

GOAT

Goat is a very important species of livestock in India and specifically to Kerala. They are highly prolific, have short generation interval and the products are easily marketable. It has become a good option for farmers who cannot keep large animals because of the shrinking fodder base. In Kerala goats are mainly reared for meat and milk. The goat population in the state as per 2012 census is 13.51 lakhs showing an increasing trend in goat population in the state.

COMMON TERMINOLOGIES

- Buck - Male of an adult goat
- Doe - Female of an adult goat
- Doeling - Young growing female
- Kid - Young one of a goat
- Kidding - Parturition of does

IMPORTANT INDIAN BREEDS OF GOATS

Important Indian breeds of goats are Jamunapari, Barbari, Beetal, Black Bengal, Ganjam, Sirrohi, Marwari, Osmanabadi, Sangamneri, Surti, Malabari, Kanniadu and Attapady black. Each breed performs well in the agro climatic conditions where they have evolved.

Breeds of Kerala

Malabari: Mainly found in north Malabar covering four districts of Kerala viz., Kasargod, Kannur, Kozhikode and Malappuram. It is maintained for milk, meat and manure. The bulk of animals of this breed are located in and around Tellichery of Kannur district and Vadagara of Kozhikode district. The animals found in other parts of Kerala ~~are believed to~~ also have Malabari blood. Goats are medium sized, mainly white, black, and brown or a combination of all these colours. Majority of animals have short hairs in the forequarters and hindquarters. They are long eared and have convex forehead. Bearded animals are common. Few animals have tassels. Almost all animals are horned.

Birth weight varies from 2-3 kg and one year old animals weigh 24-28kg. The milk production varies from 0.5 to one litre. Age at first kidding is 13-15 months and inter kidding interval is 8-10 months. The incidence of singles, twins and triplets is 40, 50 and 10 percentages respectively. The average litter size is 1.6.

In good management conditions, selected Malabari males have growth rate of 100-120 gms/day.

Attappadi black: Completely black coloured, sturdy animals with medium sized, lean slender body and long legs, mainly maintained for meat and manure. They are poor milk producers. The birth weight varies from 1.5 to 2 kg. It has an adult body weight of 23-25 kg. The overall age at first kidding is 14-16 months and interkidding interval is 8-10 months. The overall average litter size is 1.3 and incidence of different types of births is 73 % singles, 26% twins and 1% triplets.

Usually Malabari goats are suitable for plains and Attappady black goats for the hilly areas.

Breeding programme for the state

Systematic goat breeding programme started only recently in the state. Initially crossbreeding was practiced using Saanen, Alpine and Boer as exotic breeds. Though the performance of early generation crossbreds was better than the local, their adaptability was poor and kid mortality rate was quite high. Many private agencies are using exotic bucks and other Indian breeds for breeding. It is very important to note that the gains made are only temporary and equal or higher gains can be attained by crossing with selected Malabari goats. The selective breeding programme among our native Malabari breed has been accepted as the policy. Selected Malabari animals have higher growth rate than crossbreds and other exotic crosses under Kerala's conditions.

SELECTION AND BREEDING

The selection should be based on the breed of choice. Since the goat population in the state is generally a mosaic one having Malabari blood, a local selection will be most ideal. Select those animals having high growth rate and dam's yield. Milk yield per day is assessed by recording two consecutive milking (including milk suckled by kids). The

doeling must be free from physical defects. The animal should satisfy dairy confirmation such as long, deep, wedge shaped body, thrifty appearance, well sprung ribs, straight legs, soft shiny hair coat, capacious udder extending below and between thighs with teats medium sized, uniform, sloping slightly forward. After milking, the udder should collapse and become pliable. Prominent milk veins are also desirable.

A young buck may be selected based on its breed character, growth rate and the production performance of its dam. An average daily weight gain of 100 gms per day and dam's milk yield of 1.0-1.5 kg per day is ideal for Malabari goats. Though the bucks attain puberty at the age of 6-7 months it should be put to service only when it is 10 to 12 months of age. Bucks should be masculine with straight legs and long feet. It should be a male kid selected from multiple births, based on body weight at 6 – 9 months of age (18 – 22 kg respectively). It must possess good libido and good semen quality.

Doelings are selected based on the breed character, growth rate and dam's milk yield. An average daily weight gain of 80 gms and dam's yield of one litre should be preferred for Malabari goats. The best and sustainable method to improve the local goat population is by using selected Malabari bucks on the population.

Reproduction

Does

The age of attainment of puberty in goats is 7 months to one year, but mating is at the age of 9 – 10 months of age. The oestrous cycle duration is 18-21 days and duration of heat is 12 – 36 hours.

The signs of heat are wagging of tail, frequent bleating, excitement or restlessness frequent urination, reduction in feed intake, and drop in milk yield. Vulva becomes swollen and edematous. Small quantity of clear discharge from the vagina is also noticed. It remains close to the buck and allows mounting. It mounts on other goats and submits to be mounted by others.

Techniques for heat detection

A buck jar technique can be effectively used for heat detection. Pheromones from the poll glands of the buck are collected by rubbing the ventromedial aspect of the horn with cotton which is kept in an air tight jar. For heat detection does are allowed to sniff the open jar for a minimum period of one minute. Those animals in heat will exhibit typical behavioral signs as mentioned above. This technique will be more effective if bucks are not stationed along with does.

A teaser buck also can be used for effective heat detection in larger farms.

Bucks

Bucks can be used for breeding from nine months onwards and they can be used for 6-8 years on a rotational basis (Not more than one year in a herd). Natural mating is practiced in the state commonly. But now selected centers of the Dept. of Animal husbandry and Kerala ~~Agricultural~~ Veterinary and Animal Sciences University are doing artificial insemination. The ratio of males to females in natural mating is 1:25. Measures should be inbreeding, including rotation of bucks. Mating of related individuals results in progeny having poor growth rate, lowered fertility etc.

Artificial Insemination The semen collection can be started from nine months onwards. The frequency of semen collection is two ejaculates per day. An artificial vagina is used for collection. Normal volume is 0.5 to 1.5 ml (0.8 ml) and the colour is creamy or thick white with yellowish tinge. The concentration is 2 - 6 million/cmm (3000 million/ml) having an optimum mass activity of (+ + + +).

Preservation of buck semen Buck semen can be preserved either in chilled conditions at 4-5° C for 48-72 hours or frozen at -196° C for years.

The common extenders used for chilled semen are Tris diluent and goat milk extender. Dilution rate is 1:10 and the required number in one dose for insemination is 50–150 million.

Higher dilution rates ensure longer preservation.

Tris diluent is commonly used for dilution of frozen semen. Good quality buck semen after evaluation is extended with Tris diluent containing glycerol, packed in 0.25 ml straws, frozen in liquid nitrogen vapour and preserved in liquid nitrogen container.

Techniques

There are four methods of A.I. in goats: vaginal, cervical, transcervical and laproscopic or intrauterine.

Chilled semen:

Hind quarter of the animal should be raised to about 50 cm. (this can be done by an attender or A.I. crate can be used). Properly lubricated metal speculum (20 cm long and 2.5 cm wide) is inserted into the vagina and cervix is located. Micro-pipette (30 cm long), attached to a 2 ml plastic syringe with an adapter loaded with semen is introduced into the cervix up to a depth of 0.5 to 1 cm and semen is deposited there. After deposition, it is advisable to retain the animal with hind quarters in raised position for 5 minutes, for better conception rate.

Frozen semen:

Handling of frozen semen and loading of A. I. gun are done as in the case of bull semen. The site of frozen semen deposition within the reproductive tract of the doe has a marked effect on pregnancy rates. Semen should be deposited in the body of the uterus although cranial cervical deposition has yielded satisfactory results. The A. I. gun should penetrate the cervix at least 13 mm for getting optimum conception rate. In no instance should penetration be greater than 38 mm to avoid perforation of the uterine wall or entry in to one of the uterine horns.

Pregnancy Diagnosis

Physical methods like external palpation, abdominal ballotment, recto - abdominal palpation and bi-manual palpation, biological methods like estrone sulphate test, pregnancy specific proteins, and progesterone test, ultrasonography and radiography are the various techniques used for pregnancy diagnosis in goats.

Bi- manual palpation

Out of the physical methods, only bi - manual palpation gives a reliable diagnosis before 3 months of gestation. The technique of bi-manual palpation includes digital palpation of reproductive organs per- rectum combined with abdominal manipulation.

The animals should be examined before feeding and watering. Obese animals should be fasted over night. Faecal pellets should be cleared out of rectum and the urinary bladder should be emptied

The doe is restrained in a standing position by an attendant holding the head. Sitting at the level of pelvic region on the right side of the animal, lubricated gloved index finger of the left hand is introduced into the rectum. Rectal pellets are removed and a distended urinary bladder is evacuated by gentle recto - abdominal pressure. The right hand is held vertically with the finger tips touching the ventral floor of the posterior abdomen. It is then lifted upwards to move abdominal organs forward. Using regulated forward, upward and backward movements the reproductive tract within the pelvis can be held in palm of right hand. The size, shape, consistency and surface characteristics of the vagina, cervix and uterine horns are then assessed. An experienced person can diagnose pregnancy as early as one month by applying this technique.

Ultrasonography for pregnancy diagnosis

B- Mode real time ultrasonography is the most reliable method and transabdominal approach is generally employed for examinations made more than 35 days after breeding. Transabdominal scanning is done on the right side, slightly cranial to the mammary gland and about 3 to 4 inches from the midline, because the reproductive tract is pushed towards right side by the rumen. For transabdominal scanning 3 to 5 MHz curvilinear or sector transducers are superior to linear array transducers; 5 to 7.5 MHz linear transducers have been used transrectally. Pregnancy can be diagnosed with 100% accuracy by transabdominal approach by 45-50 days after breeding by locating the fetus and placentomes. Transrectal scanning is usually reserved for diagnosis at less than 30-35 days after breeding.

Radiography

Abdominal radiography is useful for detection of pregnancy and determination of fetal numbers from the latter part of second trimester until term.

Pseudo pregnancy/Hydrometra/Cloud burst

It is the accumulation of sterile secretions in the uterine lumen and occurs following oestrus both in mated or unmated does with persistence of corpus luteum in the ovary. The presence of pseudopregnancy rather than pregnancy may be detected earlier by ultrasound scanning. Pseudopregnancy can be treated effectively by using prostaglandins.

Care of pregnant goat

Keep pregnant animals separated from others and provide adequate nutrition, easily digestible and laxative diet. Do not allow them to fight with each other. Do not allow them to mix with recently aborted animals. Shortly before the doe is due to freshen, clip hair around the udder, hind quarters and tail for greater cleanliness.

Problems during pregnancy

Most common is a stress induced abortion that occurs in poorly grown and immature goats. Most abortions occur between 90 and 120 days of gestation, at the time of rapid fetal growth. Habitual abortion is probably a genetically determined hyperactivity of the maternal adrenal cortex, prematurely initiating the process of parturition. Vitamin A, certain minerals (manganese and iron) and energy deficiencies may be associated with abortion when the deficiency is chronic. Infectious agents causing abortion in goats include Brucellosis, Campylobacteriosis, Chlamydial abortion, Leptospirosis, Listeriosis, Salmonellosis, Toxoplasmosis, Q- fever and Mycoplasmosis.

Signs of approaching kidding

The signs of approaching kidding are raising base of tail, sharp hollows at the flank region on either sides, rapid cud chewing, restlessness and pawing at bedding, low plaintive bleating, rapidly filling udder, udder turning pink and shiny just before kidding and a mucous discharge from highly enlarged and oedematous vulva. When these signs are exhibited transfer the animal immediately to a kidding pen and observe closely.

Kidding

The gestation period is 145 – 156 days. The age at first kidding ranges from 13 –15 months. Ideal kidding rate is 3 in 2 consecutive years. Average kids per kidding is 1.6, usually for Malabari. (It varies with different breeds of goats). The ideal service period is 45 days and minimum dry period is 30 days. Kidding pen should be clean and roomy. The floor must be dry with sufficient bedding. Kidding pen should be quiet and free from disturbances. The doe should be under close observation.

Stages of parturition

Parturition is in three stages.

Stage (1): This stage starts with the initiation of myometrial contractions

Duration: 6 – 12 hours

The doe becomes anxious and restless, breaths heavily, frequently gets up and lies down, looks inquisitively at the flank and paws at bedding. There will be slight but thick vaginal discharge. This stage ends with the complete dilatation of the cervix

Stage (2): Expulsion of foetus

Duration: ½ to 1½ hours

The first water bag breaks and fluid comes out. Animal shows forceful abdominal contractions. Foetal parts appear at the vulva and kidding takes place. The process repeats when there are more kids. Care should be taken to prevent wedging of rear quarters against wall or corners. If the kids are not born within two hours after the onset of second stage help from a qualified veterinarian may be sought.

Stage (3): Expulsion of fetal membranes

Duration: 2-6 hours, after expulsion of last kid.

Fetal membranes get expelled during this stage. Do not allow the hanging fetal membranes to twist around body or legs of the doe. Prevent eating of fetal membranes by dam. If fetal membranes are not expelled within 12 hours, aid from a qualified veterinarian should be sought.

Problems during parturition

Dystocia

The most common cause of dystocia arises when more than one fetus tries to exit the vaginal canal at the same time. The other causes of dystocia include fetomaternal disproportion, cervical dilatation failure, uterine torsion and uterine inertia. Dystocia due to flexion of the hind limbs is common in cases of posterior presentation of fetus in single births

Retention of fetal membranes

Retention of the fetal membranes is quite rare in goats. The etiology and predisposing factors are broadly the same as in the cow. Manual removal may be attempted if the membranes are still present 72 hours after birth. It is often impossible to pass the hand through the cervix but the membranes, if trapped by the closing cervix, can often be retrieved by gentle traction. If access of the cotyledons is possible they are generally separated by squeezing from the uterine caruncles. Antibiotic cover should be provided.

Care of newborn kids

The care of newborn kids should start from birth itself or rather from the foetal stage itself. It has been scientifically proved that there is positive correlation between dam's weight and birth weight of kids and hence proper nutrition of dams during pregnancy should be ensured (400 – 500 gms concentrate + 3 - 4 kg fodder per day), especially during last stage of pregnancy.

Soon after birth, if the newborn shows signs of respiratory distress, lift the kid by its hind limbs and sway to and fro so that the nostrils are cleared from mucus. Kids should also be examined for anatomical abnormalities.

Umbilical cord, which is the main route through which microorganisms enter the body should be disinfected and tied to prevent infection. First of all wash the umbilical cord with dilute potassium permanganate solution. Then dip the cord in a cup/bowl containing Tincture Iodine solution. Leaving one inch from the umbilicus, tie with a clean thread (dipped in Tincture Iodine solution) and cut the umbilical cord one inch below the knot using a new blade or clean scissors.

As soon as the kid is born the dam will start licking the kid and will direct the kid towards the udder, coaxing it to drink milk. Ingestion of colostrum within half an hour of birth is very important, as it provides vital nutrients and also immunoglobulin. If the dam is reluctant to nurse the kid, try applying placental fluid on the kid, as the bonding gets established mainly through smell. The period immediately after birth is very important as far as bonding between dam and kid is concerned and hence they should be left alone with minimum human interference. If artificial feeding is to be practiced weaning can be done after the colostrum stage (third day) and milk fed in bottles at the rate of 1/6th its body weight (300 to 400 ml) for the first 30 days, the total quantity being distributed in 4 equal feedings. The quantity of milk given may be reduced to one eighth of the body weight during the next four weeks and to one tenth of the body weight during the third month.

In case the dam of the kid happens to be sick or happens to die, another doe which has kidded more or less at the same time may be used as a foster mother to ensure colostrum. If that is also not available goat milk or cow milk fortified with vitamin A (10,000 I.U. per litre) may be given.

For the first week after birth, it is better that the kids move with the dams – suckling 4 to 5 times a day. But if completely confined in a pen, kids might overfeed leading to milk indigestion and Floppy Kid Syndrome (FKS) – A condition characterized by weakness and depression in young kids associated with metabolic acidosis. To prevent this condition, kids may be allowed to suckle three to four times a day for first three weeks (especially if the dams are high yielders) and then twice a day till they are three months old. By around two weeks of age they will start consuming a little bit of kid starter and nibble the fodder given to dam.

Goats consume more dry matter (upto 5-7% of their body weight) when compared to sheep and cattle (2-3% of body weight). Almost the whole of **the** dry matter requirement of **an** adult non producing goat can be met by the consumption of the forage (grass/tree leaves). Adult goat can be maintained on good quality forage like jack leaves alone if they can be fed adequate quantities of the same (3-4 kg). When roughage supply is

limited, some concentrates (around 0.25 – 0.50 kg) have to be given for maintaining adult stock.

Adult goats may be fed a mixture of oil cakes, brans, grams and grains as concentrate part of the ration supplemented with salt and mineral mixture. Unconventional feeds such as dried tapioca leaf, rubber seed cake, tapioca starch waste etc. can be incorporated in the concentrate mixtures of goats. Concentrate mixtures which can be fed to cattle can also be used for feeding of goats, examples of which are given in the chapter on cattle (feeding and management). **If concentrate goat feed is not available locally, good quality ready-to-feed compounded cattle feeds can be used for feeding of adult goats.** Pelleted concentrate feeds have the advantage over dry mash in reducing respiratory troubles caused by the dust/powdered feed.

Succulent fodders like tree leaves (e.g. Jack tree, Poovam, Kaini, Venga, Murikku etc.), cultivated fodder grasses like Guinea, Napier, Para, Congo Signal etc. and leguminous fodders such as cowpea, lucern and subabul are palatable and are fed to goats. Apart from tree leaves and grasses, agricultural by-products such as plantain leaves, dry fodders such as hay and ensiled fodders are also eaten by goats. **Complete feeds for goats containing various concentrate ingredients like grains, brans and oil cakes with various roughage ingredients like dried and powdered hay, leucern meal etc. are now available in the market in pellet form or can be formulated using locally available ingredients and fed as total mixed ration (TMR).**

When dry fodder such as hay is fed, the quantity required will be about 25-30 per cent of the green fodder indicated above. Depending upon the quantity and quality of fodder available for feeding, the concentrate allowance to the different classes of goats can be reduced. For pregnant goats, during the 4th and 5th month of pregnancy, 200-300g of concentrate mixture has to be fed in addition to the maintenance allowance to meet the nutrient requirements for the growth of the foetus. For the milch goat, over and above the maintenance allowance, 400 g of concentrate mixture may be fed extra for every litre of milk produced.

Mouldy and spoiled concentrates should not be fed to goats as it might lead to diseases due to fungal toxins.

Feeding schedule for different categories of goats

Category of goat	Approximate body weight (kg)	Quantity to be fed per day	
		Concentrate (g)	Green fodder (kg)
Growing (6-12 months)	15-20	300-400	1-2
Adult goats	25-30	200-300	2-3
Breeding bucks	30-40	400-500	3-5

Age of kid Days	Approximate body weight(kg)	Quantity of milk to be given(g)	Quantity of kid starter to be given(g)	Quantity of green fodder to be given(g)
Birth to 4 days	1.5-2.0	Colostrum	-	-
5-30 days	2.0-3.0	300-500	Small quantity	Small quantity
31-60 days	3.0-5.0	400-600	50-100	Small quantity
61-90	5.0-7.5	500-750	100-200	250-500
90-120	7.5-10.0	-	200-250	500-750
5 th and 6 th month	10.0-15.0	-	250-300	750-1000

Water requirement

Goats should be provided unlimited access to fresh, clean water. Goats are among the most efficient of domestic animals in their use of water, approaching camel in their low rate of water turnover per unit of body weight. Goats appear to be less susceptible to high temperature stress than other species of domestic livestock. In addition to a lesser need for body water evaporation for maintaining comfort in hot climates, they can conserve body losses of water by decreasing losses in urine and feces. Factors affecting water intake in goats include lactation, environmental temperature, water content of forage consumed, amount of exercise, and salt and mineral content of the diet.

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MANAGEMENT

There are mainly five systems of rearing goats.

1. Tethering

In this system goats are usually tied with a rope to a tree or on a peg and they will be able to browse from the surroundings. It is a convenient method from the stand point of minimum labour input and utilisation of feeds. This system is suitable for farmers with one or two goats.

2. Extensive production

This system can be adopted if grazing land is available where goats are allowed to browse on free range and provided with shelter during night time.

3. Intensive production

This method is suitable in urban areas where there is scarcity of land. In this method goats are confined exclusively in sheds and fed on leaves/grass and concentrates.

4. Semi-intensive

This method represents varying degrees of compromise between extensive and intensive production. In this system the goats are allowed to go out of the shed for a few hours daily.

5. Integration with cropping system

In this case goats can be allowed to browse under plantation crops. It ensures increased fertility of land by return of dung and urine and controls the weeds.

The manure output from an adult goat per day varies from 0.5 to 1 kg.

Care and management of growing stock

The males and females should be separated at the age of 3-5 months.

Ageing

At one year all temporary incisors (kid teeth) are well worn and the first permanent pair are just cutting. The ages of full eruption of 1st, 2nd, 3rd and 4th pairs of permanent incisors are 15 to 18, 21 to 24, 25 to 28 and 29 to 36 months respectively.

Dental formula –

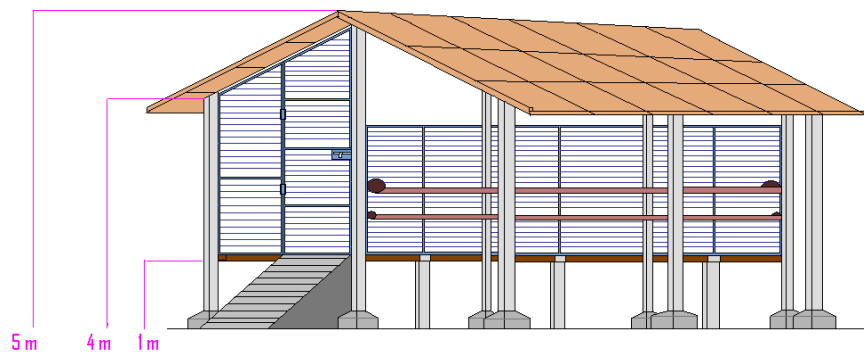
Temporary	0/4	0/0	3/3	0/0
Permanent	0/4	0/0	3/3	3/3

HOUSING

For goats, an elaborate house or barn is not necessary. The cheapest form of building will be the lean-to-type of shed placed at the side of an existing building. A model plan for two goats and their kids is provided. Such a shed should have a plinth area of about

6m². The floor should be made of raised wooden/bamboo/plastic slatted platform. The arrangements for storing fodder can be made overhead below the roof. Cheap roofing materials will reduce the cost of construction. Large scale goat rearing sheds can be constructed for accommodating 50 to 60 goats with provision for 1 m² per goat. Like the does, kids should be provided with loose stalls. Bucks may be housed individually in stalls measuring 2.5 m² per buck.

Construction details of model mini goat shed for 12 adult unit



- Orientation: Long Axis-----East-West
- Length ----- 20'
- Breadth -----12' Slat ----- 6'
- Central height-----13'
- Side Height -----10'
- Height of the slatted floor from the ground ---2.5'
- Height from the slat to roof ---5'
- Space between the slats -16 mm

- Size of the wooden planks-2.5x2 cm
- Total floor area -----240 Sq.ft
- Total slatted area---120 sq.ft
- Holding capacity of the slatted unit=12 adult goat units

Specification of Backyard Goat shed for 2 adult goats and their kids



Height from ground to floor – 1m

Total height - 2.5m

Length - 2.5m

Width - 1m

Care at milking

Keep the lactating doe away from the buck. Bruising of the teats and udder of goats should be avoided. Generally goats are milked twice a day. Prepare the goat for milking by washing the udder with lukewarm water and dry it with clothing. To prevent injury to the udder, first close the thumb and first finger, then close the second finger, followed by third finger. Use a steady pressure. Finally close the little finger and squeeze with the entire hand until the milk is drawn. Now release the pressure on the teat and open the finger so that the teat can refill. Repeat the process until very little milk comes out. Both the hands can be simultaneously used for milking.

Immediately after milking, remove milk from the shed, sieve it through a strainer and cool.

RECORD KEEPING

As for other livestock, proper records must be maintained for profitable goat farming. The various records to be kept by a goat farmer are given below:

1. Livestock record

Details of all the animals should be recorded in a livestock record. It should give the data about number or name of the animal, its parentage, date of birth, breed, mode of disposal of the animal and remarks. .

2. Birth record

Each kid born should be recorded. It should preferably be identified by a number or any other suitable methods. The birth record of the kids should have information on details of its sire and dam, date of birth, breed, birth weight and a remarks column.

3. Breeding record

Details of each mating and inseminations done should be recorded in the breeding record. The record should give information about the name or number of the buck, details of the doe, date of mating or insemination, expected date of kidding, litter size at birth and litter weight at birth.

4. Breeding register of does

The breeding efficiency of each doe should be recorded in a breeding register. The information about all matings of the doe, individual kiddings of the animal, details of the buck used and other information should be provided in the record.

5. Breeding register of bucks

The breeding efficiency of the buck should be recorded in breeding record of buck, where all the matings conducted by the buck and its results will be recorded.

6. Feed record

The quantity of feed given to the animals should be recorded every day. A feed record is hence essential for the animals.

7. Treatment record

The diseases and treatments should be recorded in a treatment record.

8. Vaccination Register with details of vaccinations conducted

9. Deworming Register with complete details of deworming done in the herd

10. Receipt and expense book

Each and every expenditure incurred in the farm and details about the receipts should be recorded in a receipt and expense book.

DISEASES

Metabolic diseases of goats

Condition	Cause	Clinical signs	Treatment:
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Lactic acidosis	ingestion of excess carbohydrates	Anorexia, bloat, diarrhoea, regurgitation of rumen contents through mouth, weak and fast pulse, death.	5% Sodium bicarbonate, 5 ml / kg body weight I/V. OR a combination of 5% Sodium bicarbonate and 5% sodium carbonate (Carbicarb)- 5 ml/ kg body weight I/V. Oral Magnesium hydroxide 1 g / kg body weight + 500 mg Tetracycline bolus through a stomach tube.
Polioencephalomalacia	Thiamin (B ₁) deficiency.	Sudden convulsions, recumbency & nystagmus	Thiamin Hydrochloride – 10 mg / kg body weight I/V at an interval of 3 hours. Dexamethasone I/V, Mannitol 20% - 2g / kg body weight I/V Oral Thiamin HCl (available in chemical shops) – 1g / animal / day
Hypocalcaemia in milking goats	reduced blood calcium occurring before or after kidding	Ataxia, recumbency, bloat, dilated pupil, normal to reduced body temperature.	Calcium borogluconate (25 %) 1.5 ml / kg body weight I/V
Pregnancy toxemia	Low plane of nutrition during late pregnancy. Common in does carrying twins, triplets.	Muscle tremors, convulsions, blindness, stargazing posture, recumbency and death.	Caesarean section during early stages. Oral propylene glycol or Glycerine – 110 g daily. Sodium bicarbonate I/V. Parenteral glucose is not recommended due to relapses.
Plant poisoning			
Hydrocyanic acid (HCN)	Leaves of plants like tapioca, rubber, Acacia, Eucalyptus, sorghum etc.	Restlessness, dyspnoea, muscular spasms, salivation, mucous membranes- cherry red initially, cyanosis terminally.	1 g Sodium nitrate & 3g Sodium thiosulphate in 50 ml water I/V, OR Sodium thiosulphate 660 mg /Kg body weight I/V with fluid

Lantana	Ingestion of the plant <i>Lantana camara</i> (Red flowered variety is more toxic).	Photosensitization due to hepatotoxicity. Erythema and oedema of light colored skin. Edema of head and ears. Icteric mucous membrane.	Symptomatic. Fluids, corticosteroids
Strychnine	Ingestion of plant <i>Strychnos nuxvomica</i> .	Muscular twitching, stiffness of neck and limbs. convulsions, hyperesthesia, dyspnoea and death.	Gastric lavage using Potassium permanganate solution. Barbiturate I/V .Muscle relaxants (Eg. Methocarbamol).
Mimosine	Ingestion of plant <i>Mimosa invisa</i>	Anorexia, oedema of perineum. Renal failure. Increased serum creatinine .	Oral Potassium permanganate, fluids

Disease control measures

Diseases in goats adversely affect the economics of production and in turn profit. Diseases can be controlled by prevention, vaccination, treatment and eradication *i.e* regional extinction of the infectious agent.

Vaccination

Regular vaccination is recommended for foot and mouth disease, enterotoxaemia and Peste des petits ruminants (PPR). In endemic areas vaccination against hemorrhagic septicemia, anthrax and tetanus is advised.

Points to be noted in vaccination programmes

Transportation of vaccine should be made as fast as possible and cold chain should be maintained throughout, until it is used. Multi-dose vials of vaccines should be used within the specified time after opening. Prolonged storage of such bottles/vials after opening is not desirable. Make sure that 80% population is covered. Left out animals e.g. young animals below 3 months of age, animals suffering from diseases, parasitism, malnutrition and animals in advanced pregnancy should be vaccinated as soon as they are fit for it. Vaccination should be carried out in the cool hours of the day. Live viral vaccines are generally contraindicated in pregnant animals. Milking animals may have a temporary reduction in milk yield for a day or two. A nodular thickening develops at the site of vaccination within a week and persists for a variable period. Generalized allergic

reactions can be treated with antihistaminic drugs.

Other strategies for disease control

Quarantine should be done before introducing new animals into the herd. Length of quarantine period depends on the incubation period of the agent. Test and slaughter is considered to be economically and technically beneficial in case of chronically infected animals, Disease control through improved managemental and husbandry practices such as removal of flock from high risk areas is recommended. To reduce pasture contamination with internal parasites, grazing management by mixing 2 species together or alternate grazing of pasture with different species or sequential grazing at different times by resistant and susceptible animals of the same species are advised. Other measures are reducing the stress by avoiding overcrowding and practicing vector control.

Control of parasites in goats

Goat is a free ranging animal and it performs better when it is let loose for grazing. Parasitism in goats is widespread and leads to morbidity, mortality and thereby heavy economic losses. Since anthelmintic resistance is an emerging threat, the control of parasitism in goats has become a complicated problem. One of the most common reasons for anthelmintic resistance is improper medication.

In goats it is not suggested to follow a specific deworming schedule. In field condition it is preferred to give a broadspectrum anthelmintic to kids at 2-3 weeks of age. Further deworming is needed only in clinical cases. In conditions where faecal sample examination is not possible deworming can be done at six months interval with a broad spectrum anthelmintic active against cestodes also.

It is to be remembered that goats need twice the anthelmintic dose of sheep. Underdosing must be strictly avoided. Piperazine shall not be administered to goats.

Anticoccidials should also be administered during the first month of age, preferably after faecal sample examination.

Ectoparasites like ticks and lice are common in goats. *Haemaphysalis* is the predominant tick species while *Damalinia caprae* and *Linognathus steopsis* are the common louse species in goats. Increase in lice or lousiness indicates poor management. *Damalinia caprae* is parthenogenetic and its control becomes all the more difficult.

Control of ectoparasites mainly depends on improving the nutritional status, isolating the affected animals and treating with ectoparasiticides. Ectoparasitic dusting powders can be used. Dips have to be avoided since it may lead to pneumonia. Now pour-on preparations are also available for controlling ectoparasites.

Heat stress in goats

As in the case of any livestock species, causes of heat stress in goats can be either due to environmental or managerial conditions. Environmental conditions include high temperature, high humidity and low air movement where as managerial conditions include limited access to water, poor quality of water, lack of shade and handling of goats in hot weather. Goats appear to be less subject to high temperature stress than other species of domestic livestock because of their lesser need for body water evaporation for maintaining comfort in hot climates as well as due to their ability to conserve body losses of water by decreasing losses in urine and feces. Goats get more relief from the heat by panting than by sweating, so rapid breathing is their primary form of cooling themselves. Panting and collapse are the most obvious signs of heat stress. In order to manage heat stress, provide animals with plenty of clean, fresh and cool drinking water, access to salt and minerals and avoid handling of animals during hot hours of the day. Supplemental cooling can also be provided.

GOAT MILK

It is a general belief that goat milk is nutritionally superior to cow and buffalo milk. Scientific evidences are now available on the nutritional superiority of goat milk over other milk.

Taurine, a conditionally essential amino acid is higher in goat milk than in cow milk. Goat milk does not contain the protein complexes that are the main stimulants of allergic reaction. In goat milk, fat globules are half the size as that of cow milk; so more surface area for lipase action is available. The globule membranes are thinner and more fragile so that curd tension is almost half that of cow milk. It has been proved that goat milk has more acid buffering capacity than cow milk and soy infant formula. Goat milk is a rare dairy food that has an 'alkaline ash'. Goat milk is rich in L.glutamine, an alkalinizing amino acid often recommended by nutritionists.

Selenium is a necessary trace mineral for its immune modulation and antioxidant properties. Medium chain fatty acids like capric and caprylic acid that are present in high concentrations in goat milk are antibacterial in nature. Lacto ferrin content of goat milk also play a protective role. Goat milk exceeds cow milk in mono unsaturated fatty acid (MUFA), polyunsaturated fatty acid (PUFA) and medium chain triglycerides(MCT), which are known to be beneficial for health especially in cardiovascular diseases. Lower orotic acid content in goat milk can be important in the prevention of fatty liver syndrome. As goats feed on even bitter and pungent herbs its milk is found to be very beneficial for patients with chronic abdominal diseases.

Reference guide for physiological and hematological parameters.

Parameter	Unit	Normal values
Rectal temperature	°C	39.1
	°F	102.3
Heart rate	Bpm	70-80
Resting respiratory rate		25-35
Urine volume	mL/kg body wt/day	10-40
Specific gravity of urine		1.015-1.045
Hematologic Reference Ranges		
PCV (hematocrit)	%	22-38
Hemoglobin (Hgb)	g/dL	8-12
Red blood cells	10 ⁶ /μL	8-18
Reticulocytes	%	0
Mean corpuscular volume	fL	16-25
Mean corpuscular Hgb	pg	5.2-8
Mean corpuscular Hgb concentration	g/dL	30-36
Platelets	10 ⁵ /μL	3-6
White blood cells	10 ³ /μL	4-13
Neutrophils	%	30-48
	10 ³ /μL	1.2-7.2
Lymphocytes	%	50-70
	10 ³ /μL	2-9
Monocytes	%	0-4
	10 ³ /μL	0-0.55
Eosinophils	%	1-8
	10 ³ /μL	0.05-0.65
Basophils	%	0-1
	10 ³ /μL	0-0.12
Myeloid/erythroid ratio		0.7-1:1
Plasma proteins	g/dL	6-7.75
Plasma fibrinogen	g/dL	0.1-0.4

SOURCES OF BIOLOGICALS AND VACCINES

Indian Veterinary Research Institute, Izatnagar

Institute of Animal Health & Veterinary Biologicals, Bangalore

Institute of Animal Health & Veterinary Biologicals, Palode

IVPM, Ranipet

SOURCES FOR GOAT

Kerala Veterinary and Animal Sciences University Goat and Sheep farm, Mannuthy, Thrissur.

Kerala Veterinary and Animal Sciences University Instructional Livestock Farm Complex, Pookode, Wayanad

Regional Agricultural Research Station, Pilicode, Kasargod

Kerala Livestock Development Board Farm, Dhoni, Palakkad.

Government Goat Farm, Komeri, Kannur.

Government Goat farm, Attapady, Palakkad

Government Goat farm, Parassala, Thiruvananthapuram

Government Goat farm, Vithura, Thiruvananthapuram.
