

Review Article

NUTRITION AND FEEDING MANAGEMENT OF GOATS FOR CHEVON PRODUCTION

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The goat is thought to have been the earliest domesticated ruminant and of all the species of domesticated animals except dog, has the widest ecological range. Originating in Asia, goats have spread over all the continents and inhabit almost all-climatic zones from arctic- circle to the equator. Goats have served the mankind earlier and longer than cattle and sheep. They are often termed as the poor man's cow. They are also linked with desert like paddy with poverty in India. They have distinct social, economical, managerial and biological advantages over other livestock species. They significantly contribute to the agrarian economy and play a very vital role in the livelihood security of the small and marginal farmers and landless labourers especially in arid, semi-arid and mountainous regions of the country. Goats have advantages over other animals. They are widely adapted. They thrive well and reproduce in tropical, cold, humid as well as dry regions.

Their small size compared to cattle and buffaloes permit them to be maintained on a limited area. The breeding animals are inexpensive. Goats consume a wide variety of grasses, weeds, leaves and small branches of bushes and trees and crop residues that would otherwise would go waste and cause pollution. They are gentle and easy to control. Their small size makes them suitable for home slaughter and the meat can be consumed by the family before it spoils in warm climate where no refrigeration facilities are available. The goats can be milked any time of the day and are therefore named as the moving refrigerators. Goat milk is prescribed for children, old and sick as it is easily digestible and has medicinal value. Goat meat (chevon) is preferred over other meats because it is leaner and there are no religious taboos against its consumption.

GOAT POPULATION AND PRODUCTION

The global goat population has been rising dramatically since the 1960s, due to changing incomes and food preferences in human populations, and climate change limiting areas for raising cattle. In 2013, the global goat herd was over one billion head, a rise of over 34% from 2000 (FAO 2019). During that same period, the sheep population rose only 10%, and the global cattle population has remained fairly constant at about one billion head (USDA 2019). Nearly 60% of the world's goats are found in Asia, with China, India, Pakistan and Bangladesh having the highest populations. Although most income from global goat production comes from meat sales, there has been a simultaneous increase in goat milk production and consumption.

GOAT PRODUCTION

The global dairy goat population was estimated to be 218 million in 2017 (FAO 2019). There has been a continuous increase in dairy goat numbers globally, with dramatic increases in the 1990s. In 2017, Asia had the largest proportion of the world population (52%), followed by Africa (39%), Europe (5%), Americas (4%), and Oceania (<1%). During the past decade (2007 to 2017), the world dairy goat population increased by almost 22%. Africa experienced the most rapid increase (32%), followed by Asia (19%), and Oceania (3%), with a minor net decrease observed in Europe (−0.9%) and Americas (−0.7%). Europe contributes 15% of the total goat milk with only 5% of the population, because of greater specialization and commercialization.

GOAT AND ECOLOGY

Man, Animal and Nature are in symbiotic relationship for their survival and sustenance. The balance maintained among the three for several millennia has been disturbed by over exploitation of natural resources for meeting the demands of increasing population of men and animals. The gravity of the situation can be gauged from the fact that India, with about 2.30% of land area of the world, is maintaining nearly 16.65 of the world's human population and about 20.00% of the livestock. The livestock in general and the goats in particular have been held responsible by the foresters and environmentalists for causing ecological degradation and desertification in Asian continent. There has been a lot of controversy over the role of goats in ecological degradation and in desertification especially in India. Of the domesticated animals, no animal has suffered from so much abuse as the goat due to this rather wrong conception. Two conflicting views prevail on the goat's role in land use (i) The goat is the major cause of deforestation, rangeland destruction and soil erosion, and as such, its propagation should be checked, and (2) Goat acts as regenerator of vegetation through dispersal of seeds in its droppings and vegetative propagation through browsing. It is undoubtedly true that an uncontrolled population of goats roaming in open can be extremely harmful to the growth and development of vegetation especially where new reseedling/plantation has been done. But it is just as true that any over grazing by any other ruminant will have similar consequence. The high pressure on and shrinking of the grazing lands, especially in view of their low carrying capacity results in over use of the land and depletion of natural vegetation. The cattle with their large size hooves and heavier body weights cause more loosening of the soil rendering it susceptible to water and wind erosion. When the sheep move towards the water points or night shelters, they follow each other in a

row because of the flocking instinct and generate tracks, which become free of vegetation and subject to erosion. These habits of sheep and not of the goats are distinctly destructive to the rangelands (Acharya and Singh, 1992). Agriculture operations in general and on the arid and semi arid lands in particular cause more soil erosion than by the livestock grazing (Shankarnarayan *et al.* 1985). Contrary to cattle and sheep, goats are mainly browsers and would seldom go for grown up trees (Lu, 1988). They dislike the leaves of timber trees. They also do not prevent the establishment and spread of grasses that are so essential for soil conservation. Acharya *et al.* (1980) found that goats spend more than 90% time on browsing and hardly graze for 10% time on surface vegetation. Goats have been found to defoliate smallest branches of trees without damaging the twigs in several behavioural studies conducted at CAZRI, Jodhpur. Their browsing habit tends to reclaim saline soils by consuming salt-laden leaves of the range plants and contribute fertility to soil by even distribution of essential manure on the lands they graze. Cattle exploit 5-6 times more of biomass than goats. Prajapati *et al.* (1988) reported that intensity of grazing of 2-4 goats/ha had no effect on run off and soil loss in hot arid regions of Rajasthan in normal rainfall years. Stocking rate of 3 sheep or goats per hectare produced satisfactory performance especially of goats and no deterioration in the physical and chemical properties of the soil was observed for 3 years.

Goats also help in dispersal of grass, bush and tree seeds. They consume grass and bush seeds and fodder tree pods while grazing/browsing and defecate hard coat undigested seeds especially of pod-bearing and xerophytic trees after providing acid treatment while passing through digestive system and fortifying with nutrients in the form of the faecal pellets and spread more uniformly all over the grazing land. These seeds germinate in large number as soon as soil moisture conditions are favourable. The goat saliva left on the bitten foliage adds nitrogen directly to the plant cells inducing quick regrowth. Saliva is also said to detoxify the high tannin available in many of the tree leaves found in the desert areas. The biting of tender leaves and twigs by goats also induces tillering and faster luxuriant regrowth of both branches and foliage. Sharma and Ogra (1987) reported that vegetative regeneration was found to be 27% more in goat paddocks comprising *C. ciliaris*, *D. nutans* and *L. leucocephala* as compared to sheep paddocks. Harsh and Shankarnarayan (1982) recorded better performance of goats than sheep in all the ecosystems in arid and semi-arid regions of Rajasthan for three successive years. A task force to evaluate the impact of sheep and goat rearing in ecologically fragile zones was constituted by the Govt. of India in 1987 under the Chairmanship of

Professor K. Hanumantha Rao one of the leading economists and then a Member of Planning Commission with a large number of foresters and environmentalists as members.

The habits and behaviour of goats are generally studied in relation to sheep to justify that there is no or very little competition in the two species for available feed resources. Goats work as leaders and the sheep act as followers while moving in a mixed flock. Goats move with their heads up and the sheep keep their heads down most of the time. Goat walks longer distances than sheep during a given time in search of their choice feed. Flocking instinct is much high in sheep as compared to goats. Sheep prefer to graze together but goats scatter all over the available grazing land. Goats prefer browsing on bushes, shrubs and lower branches of trees and sheep like grazing on surface vegetation close to the ground. Goats are much more selective than sheep. Browse and tree leaves are highly relished by goats and not so much by sheep. Goats, unlike sheep, prefer variety of feeds. Taste sensation is more discerning in goats as compared to sheep. Goats can distinguish between bitter, sweet, salty and sour tastes and show a higher tolerance for bitter substances.

SOCIO-ECONOMIC GAINS OF GOATS

The socio-economic importance of goats in India is evident by the sharp increase in their numbers and contributions during the last about 30 years. Goats contribute milk, meat, fibre, skins and manure to the subsistence of small holders and landless rural poor. They play an important role in income generation, capital storage, employment generation and house hold nutrition. Importance of goats lies in the fact that human population is increasing very rapidly creating increasing demands for animal protein foods on the one hand and the feed resources for increasing large ruminants are decreasing due to shrinkage of grazing lands on the other. This demand can, therefore, be met with by increasing population of goats. It is easier to increase the population of goats than cattle and buffaloes because the capital investment is relatively low, land requirements per animal are small, reproductive rates are higher both due to shorter breeding interval and high prolificacy and they can be managed by spare family labour and do not require any serious housing facilities and management skills. There is much less risk in goat farming in drought prone areas where large mortality occurs due to frequent droughts. The goats act as an insurance against disaster under pastoral and agriculture subsistence system. Goats have religious and ritualistic importance in India. They are offered as sacrificial animals both by Muslims on Id and by Hindus especially the worshippers of Goddess Kali. They are worshipped for their creative and generative powers and sexual virility. There are no religious taboos against consumption of goat meat. Goat

meat is preferred over sheep meat as it is more leaner. Goat milk is easily digestible because of small sized fat globules. It has much less allergic problems than the milk of other livestock species. It also has medicinal value and can ward off many diseases as the goats browse on variety of plants including medicinal ones. Goats can be milked as often as required unlike cows and buffaloes and are, therefore, called moving refrigerator. The goatskins are highly valued and have large export potential both in the processed form and as products. The value addition in goatskin processing is much larger than other products. The bones of slaughtered and dead goats are also utilized for bone meal manufacture. A goat produces about 150 kg of dry manure per year for use in crop production and gardening. Goat browsing accelerates growth of trees, shrubs and surface vegetation. They also act as seeding machines. They are much less prone to the adverse effects of toxic plants. They have higher dry matter and fibre digestibility and can subsist on poor woody vegetation. Goats are able to obtain more nutrients from the given environment in all seasons than other livestock species and are often the last species to leave the ecology during severe and continuous drought conditions. Goats make important economic contributions in India. They are so vital to a large human population that their contribution to national economy can not be over looked. Goats require relatively much lower investments and facilities in terms of housing, feed, labour and health care. There is quick pay off due to fast multiplication and early maturity. Further, the risk involved in goat farming is much lower when compared to other livestock and crop production. Goats are reported to be more economical than cattle and sheep under natural grazing/browsing on arid zone range (Abidi, 1970; Acharya and Patnayak, 1974; Wahid, 1975). The indigenous goats were found 2.5 times more economical than indigenous sheep when maintained on a free range grazing on highly degraded land in semi arid ecology of Rajas than at CSWRI, Avikanagar (Swain *et al.* 1982). Sharma (1987) recorded significantly more meat and milk production per unit live weight per year from goat than buffalo, camel and sheep have been recorded. The cost of production of goat milk worked out to be less than half than for cows milk while milk from buffaloes was intermediate. The results of a socio-economic survey in Rajasthan conducted by Ahuja and Rathore 1987) have revealed that the number of goats increased 3 times between 1951- 1983 and goats accounted for 28-31% of the value of the livestock assets and for 16-19% of the gross receipts from crops and livestock. Some studies have revealed that the goats contributed up to 50-55% to the total cash income of a farm family in the hot arid region of the country. There are growing scientific evidences to suggest that goat keeping is more economical in drier regions

which are not suitable for water spreading and dry land grain or fodder cropping (Govt. of India, 1987).

NUTRITIONAL REQUIREMENTS OF GOATS

There being no specific nutrient requirements prescribed for goats, the NRC of the USA set up a Sub- Committee on Goat Nutrition in 1975 and published and released Bulletin No.15 on “Nutrient Requirements of Goats” during the III International Conference on Goat Production and Disease held at Arizona in 1981. The research on nutrition of goats in India has been conducted only at a few Centres. A lot more needs to be done to determine the nutrient requirements of goats. The work done on nutrient requirements of goats in India at IVRI, Izatnagar (Majumdar, 1960),, NDRI, Karnal (Jai Kishan *et al.*(1983) and RBS College, Bichpuri Agra (Singh and Sengar, 1970, Sengar, 1992) has been reviewed and included by Ranjhan (1998) in the ICAR Bulletin on Nutrient Requirements of Livestock and Poultry.

FEEDING MANAGEMENT OF GOATS

Although a large number of goat feeding management systems are in practice and vary from region to region within a country these can essentially be described under three systems viz. extensive, semi-intensive and intensive. The ultimate aim of adopting a particular feeding system should be to bring improvement in reproduction and survival rates of the goat flock and birth, weaning and slaughter weights and dressing percentage in the male kids. Extensive studies on evaluation of common grazing lands, developed pastures, supplementary feeding with fodders and concentrates under semi-intensive and intensive feeding under feed lot vis-a-vis performance and production levels in goats have been conducted. The results have been reviewed by Singh and Patnayak (1987) and Patnayak *et al.* (1995) and Singh (1998).

Extensive System: Goats are generally reared under extensive system and play only a secondary role to crop as well as other livestock production. This system includes migratory, transhumance, free range, pasture and range grazing management of goats. It is most common system throughout the Asian region because the small size of goats has distinct advantages over other livestock species to contribute significantly to the sustainability of small farm situations that predominate in this region. The goats usually owned by small farmers and landless labourers are grazed together and tend to be herded over long distances in search of feed and water. The flock sizes are larger and goats belonging to several owners are run together. A low level of unpaid family labour represents the main input. The system is

principally one of low resource use and a low level of productivity emerges from poor nutritional availability. There is marked fluctuation in feed availability and its nutritive value among different regions and among years and seasons. Goats require feed all the year round. They produce all the time if it is always plentiful and of the right kind. If, on the other hand, it is short or of the wrong kind only for a month or two there is less milk, less kids and less meat. The greatest limitation in our rangelands and natural pastures is on the availability of adequate energy throughout the year and adequate amounts of protein for more than half the year. During the period from January to June the problem of energy is very acute and the intake is much less than even the maintenance requirements. Although the grazing on the rangelands is considered to be the cheapest method for goat production, the migration of the animals and over grazing of available lands is causing serious problems of soil erosion and degradation leading to desertification. Due to long and dry summers, erratic rains and light textured soils deficient in organic content having tendency to salination, the natural potential of these lands falls short of the nutritional requirements of goats. The adult body weights, reproduction rates and milk production are lower and morbidity and mortality rates are higher. The birth, weaning and slaughter weights and dressing percentage are poor and bone: meat ratio is narrow in kids maintained solely on grazing on the degraded lands. The common grazing/ rangelands can hardly carry one goat per hectare per year when unprotected and two when protected from biotic factors. There is great prospect of improving these natural rangelands. Reseeding with *Cenchrus ciliaris* and *Lasiurus indicus* perennial grasses increased the grass yield from 0.5 ton to 1.5- 2.0 ton per hectare per year. Intercropping of cowpea in *Cenchrus ciliaris* pasture increased the dry matter yield by three times. Introduction of *Dolichos lablab* legume improved the nutritive value and increased the dry matter yield from 1-1.5 ton to 2.5-3.0 ton per hectare. Such a grass-legume pasture could carry five goats per hectare for five years. Plantation of 50 fodder trees of *Prosopis cineraria*, *Ailanthus excelsa* and *Leucaena leucocephala* had no adverse effect on the pasture growth and provided an additional yield of 1 Ton dry matter when fully grown and lopped twice a year.

Semi-intensive System: A kind of compromise between extensive and intensive systems is referred to as semi-intensive system of goat management. It is a combination of limited free range grazing and feeding in stalls. Integration of goat rearing with arable cropping and tree cropping is also included where either the goats are tethered or cut and carry system of available fodder is employed. The children and women often tend the goats in this system.

Animals belonging to several owners may be combined for grazing which is mostly done morning and evening for 4 to 6 hours. The animals are supplemented with kitchen wastes, concentrate mixtures, crop residues, green and dry fodders and tree leaves etc. as per the availability. Thus goats utilize all available feed resources including natural grasses, shrubs, bushes, tree leaves, crop residues, stubbles, weeds, cultivated fodders and concentrates etc. under this system. The level of nutrition is just optimum or low but surely better than that under extensive system. Production performance depends on the quantity and quality of grazing/browsing availability and supplementary feeding provided.

Studies have shown that the natural range/grazing lands available in Rajasthan can't support growth of kids for commercial meat production and additional supplementation with concentrate mixture and/or leguminous fodders and tree leaves is recommended. Supplementation of additional energy and protein through concentrates has been advantageous in increasing the growth rate and attaining the desired slaughter weights at relatively younger age. It has been found that the kids fed on 50 concentrate: 50 roughage ration @ 4% of body weight attained 25 kg live weight at about 6 months of age. If the roughage portion of the diet can be made available from grazing, the remaining 50% of the diet has to be supplemented through concentrate mixture.

The Sirohi does grazing/browsing for 8 hours and supplemented with 150, 300 and 450g/h/digestibility concentrate mixture during last 45 days of pregnancy and first 150 days of lactation lost body weight when only grazed, maintained when supplemented with 150 g concentrate and gained in their live weights when supplemented with 300 and 450 g concentrate during pregnancy. The same does lost when only grazed or supplemented with 150 g concentrate and gained in their live weights when supplemented with 300 and 450 g concentrate during lactation. The milk production was improved by about 29, 31 and 67% and pre-weaning growth of the kids by 17, 20 and 35% with the three supplementary levels (Singh, 1996). Sirohi, Marwari and Kutchi does produced 84.4, 89.1 and 94.3 kg milk with no supplementation, 98.6, 96.1 and 93.2 kg with 150 g concentrate, 100.9, 115.7 and 110.0 kg with 300 g concentrate and 109.0, 106.4 and 101.1 kg with 450 g concentrate supplementation in addition to 8 hrs grazing during 150 days lactation (Singh, 1992). Ad-libitum supplementation of concentrate, hay and green between 91 to 180 days of age to the Sirohi kids browsing on available range land resulted in an increase of 44.8% in pre-slaughter weights, 65.1% in carcass weights and 14.3% in dressing over the browsing alone. A growth rate of 19.4, 41.7, 111.0 and 108.2 g/h/d was obtained in Beetal weaner kids

from 91 to 180 days of age on ad-libitum browsing, browsing + green, browsing + concentrate mixture and browsing + concentrate mixture + green respectively.

Intensive System: The intensive system of goat management includes grazing on developed pastures and/or complete feeding in stalls on cultivated fresh or conserved fodders, crop residues and concentrates. Although goats prefer to browse as compared to grazing, they are quite capable of making efficient use of cultivated pastures for meat and milk production similar to sheep. Stocking rates of 16 to 60 goats per hectare are feasible depending on the type of grass, level of fertilization and the presence and absence of legumes and fodder trees. This system requires high labour and capital investment and is suitable for only intensive meat production from goats. In addition to providing better milk, growth and carcass quality it removes pressure from the grazing lands. Several studies have been conducted on fattening of indigenous and crossbred kids under ad libitum feeding on concentrates including barley grain, maize grain, oil cakes, wheat and rice brans, molasses etc. and roughages including tree leaves, cultivated grasses and legumes in the ratio of 40:60, 50:50 and 60:40. The male kids weaned at 2-3 months age and fed under feedlot system achieved slaughter weights of 25 kg at 5 to 6 months age with a dressing % of 48 to 51. The kids maintained under semi-intensive system reached the target live weight of 25 kg earlier than those under intensive system. The kids under semi-intensive required less feed for a kg of gain than those under intensive feeding. The dressing % was superior under intensive. The bone and lean % was higher under semi-intensive and fat % under intensive system (Singh and Sahu, 1997). Average daily gains were higher in lambs than kids under intensive system where as the daily gains were similar under semi-intensive (Shinde *et al.* 1995). The daily gains, milk intake, meat quantity and quality and feed efficiency were found superior in the Sirohi, Marwari and Kutchi kids maintained under semi-intensive as compared to those maintained under intensive or extensive system. The milk yield during 150 days of lactation was higher under intensive system than that under semi-intensive and extensive systems and in Sirohi does than that in Kutchi and Marwari does (Singh, 1993). The total confinement and complete feeding of goats in stalls has, however, proved to be detrimental some times. Integration of goats with tree cropping especially with reseeded area among rows of trees with shade loving nutritious perennial grasses and legumes has considerable potential. This system has the advantage of increased fertility of the soil via the return of dung and urine, control of weeds and thus reducing use of weedicides and fertilizers in addition to easier management of the crop (Devendra, 1987).

COMMERCIAL CHEVON PRODUCTION

The goat meat available in the Indian markets comes either from old and culled adults or from male kids slaughtered any time between 6 months to 1 year of age. The quantity and quality of this meat is poor due to poor market weights, lower dressing percentage and narrow bone: meat ratio as these kids are maintained on scrub vegetation like their dams and hence hardly attain a body weight of 15-16 kg when they are normally marketed. The dressing percentage varies from 35 to 40 and bone: meat ratio from 1 : 3 to 1 : 4. The studies conducted in the country have revealed that a marked improvement can be achieved both in the finishing weights and carcass quality through intensive feeding of the male kids. Based on these findings two packages of improved practices have been developed and recommended for adoption by the goat farmers and the entrepreneurs for commercial goat meat production. A brief account of these packages is given below-

Package for Progressive Farmers

Sheep and goat Farmer Cooperative Societies may be formed in the goat rearing areas. These Societies in association with the village Panchyats should develop improved silvipastures on the available community grazing lands with financial assistance from the financial Institutions and subsidies being provided by the Central and State Governments. The registered goat flocks may be allowed to graze on these pastures judiciously for 6 to 8 hrs daily. In addition to grazing, the pregnant does during last 30 days of pregnancy and the lactating does during first 60 days of lactation be supplemented with 300g/h/d concentrate mixture containing 12 % DCP and 65 % TDN to ensure 2.5 to 3 kg birth weights and 14 to 15 kg weaning weights in male kids. To ensure a weaning weight of 14 to 15 kg, these male kids be provided *ad lib* suckling, creep ration and green/dry leguminous fodders during pre weaning period and completely weaned at 60 days of age. These weaners may then be fed *ad lib* on complete feeds comprised of 50 % concentrate and 50 % roughage under stalls till they attain 25 to 30 kg finishing weight at around 6 to 7 months of age. Alternatively the kids be allowed to graze on available pastures and supplemented with concentrate mixture @ 1.5 to 2% of the body weight till they reach the desired finishing weights. These finisher kids should then be sold by the farmers or their Cooperative Societies for slaughter to the consumers or the traders directly avoiding involvement of middlemen.

Package for Entrepreneurs

The male kids produced and reared by the farmers in general and the progressive goat breeders following the recommended package of practices in particular may be purchased by

the entrepreneurs at around 60 days of age and transferred from the villages to the Meat Production Complexes established near the cities. This will help in reducing the grazing pressure on shrinking pasturelands, early rebreeding and easy management of the flocks. These Complexes may be equipped with a Feed Compounding Plant capable of incorporating higher proportion of cheaper low grade roughages and agro industrial by-products to manufacture economic complete feeds, Feedlot Animal Houses for intensive feeding of the kids, Modern Slaughter House, Meat Processing, Product Manufacturing and By- Products Handling Machineries. The kids procured from the villages may be intensively fed on complete 50:50 or 60:40 concentrate: roughage feeds under feedlot from 2 months to 6 - 7 months age when they attain finishing weight of 25-30 kg. These intensively fed kids may then be sold as live animals in the National or International markets or slaughtered for selling fresh meat or their meat may be processed and converted into different meat products for export. Similarly the slaughterhouse by- products may be converted into commercial products for sale.

SUMMARY AND RECOMMENDATIONS

Current world population of goats is about 743.4 million. Asian region has the highest and over 63.20 % goats of the World. India possessing more than 16.60 % of the world and more than 26.40 % of the Asian population ranks first. Goats in India provide 2550 TMT of milk, 470 TMT of Meat and 129 TMT of fresh skins annually. The goats are reared by small and marginal farmers and landless labourers and greatly contribute to their livelihood and economy. Small size of goats has distinct economical, managerial and biological advantages over other livestock species. Most of the goats in India are maintained under extensive system. The density of livestock per unit grazing area is increasing resulting in ecological degradation and desertification. Goats are not the destroyers of vegetation more than the large ruminants. They in fact act as regenerators of vegetation through dispersal of seeds in their droppings and vegetative propagation through browsing. But the controversy over goat's role does not appear to have settled so far. It is, not possible to obtain optimum production from goats managed under free range grazing management. The extensive management system should be gradually replaced by semi-intensive or intensive system and new technological innovations should be adopted to improve the productivity of indigenous goats. Appropriate systems of management for different purposes may be identified. Production performance and economics of goat vis-a- vis other livestock species may be studied. The biomass production of the common grazing lands may improved from 2.5-3.5 quintal to 25-30 quintal

per hectare through protection, reseeding with perennial grasses and legumes and plantation of fodder trees. The areas in arid and semi-arid regions that can not support cattle and buffaloes may be identified, developed through reseeding with perennial grasses and legumes and plantation of fodder trees and utilized for goat production with low investment. Both the quantity and quality of the goat meat available in the market are poor. The finishing weights can be improved from 14-15 kg to 30-35 kg and the dressing yields from 35 to 50 % through improved nutrition and feeding management. There is very good scope for commercial meat production from goats through semi-intensive and intensive feeding management. Efforts to identify and utilize the locally available crop residues and agro-industrial by-products for compounding complete rations and supplementary concentrate mixtures in the form of pellets and feed blocks should be intensified. Feed compounding plants capable of incorporating crop residues, tree leaves and natural vegetation in the complete feed mixtures, pellets and blocks should be set up in the rural areas. Packages of practices developed for commercial chevon production may be disseminated under field conditions duly supported by the Government, financial institutions and the non governmental organizations engaged in development of livestock industry in the country.

Table 1. Production Performance of Goats under Different Systems of Feeding Management.

Particulars	Natural rangeland (Extensive)	Developed Pasture (Semi-extensive)	Developed Pasture + Conc. Suppl. (Semi-intensive)	Feedlot (Intensive)
Kidding Rate (%)	68.0	87.0	113.0	108.0
Birth Weight (kg)	2.7	2.9	3.4	3.2
3 m Weight (kg)	9.0	11.0	16.0	14.2
6 m Weight (kg)	14.0	17.5	27.5	25.5
9 m weight (kg)	18.4	22.5	32.8	29.7
Dressing (%)	40.5	44.3	50.5	52.0
Milk Yield (kg) (150 days)	65.0	86.0	110.0	94.0
Adult Mortality (%)	10.0	7.5	2.5	5.0
Kid Mortality (%)	20.0	15.0	5.0	10.0

RECOMMENDATIONS

1. India ranks first with 16.68 % of the world goat population.
2. Goats are important livestock in arid and semi-arid regions of India.
3. Goats play very vital role in livelihood security of small and marginal farmers and landless labourers.
4. Goats are not destroyers of vegetation more than the large ruminants.
5. Goats act as regenerators of vegetation through dispersal of seeds in their droppings and vegetative propagation through browsing.
6. Biomass production of the common grazing lands may be improved from 2.5 -3.5 to 25-30 q DM/ha through silvi-pasture development.
7. Extensive system of goat rearing should be replaced with semi-intensive and intensive system for commercial meat production.
8. Kid finishing weights may be improved from 15-16 kg to 30-35 kg through improved nutrition and feeding management.
9. Locally available crop residues and agro-industrial by-products may be utilized for compounding cheaper complete feedlot rations as Feed Pallets and Feed Blocks.
10. The two suggested Packages of Practices may be adopted by the progressive farmers and the Entrepreneurs for commercial chevon production.

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