

Small Ruminant's Role in Sustaining Rural Livelihoods in Arid and Semiarid Regions and their Potential for Commercialization

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Small ruminants play an important role in the food and nutritional security of millions of rural people especially the landless, marginal and small farmers in arid and semiarid rainfed regions. The socio-economic value of small ruminant rearing as compared to other livestock species, for poor farmers is immense. Goat and sheep are also among the main meat-producing animals in India, whose meat (chevon/ mutton) is readily preferred irrespective of caste, creed and religion. They produce a variety of products, mainly meat, milk, skin, wool and manure and are especially useful in the semi-arid and arid regions, where they can sustain on sparse vegetation and extreme climatic conditions. Further, wherever irrigation facilities are poor, one can generally find large areas of waste and other common property land; on which the small ruminants of rural resource-poor households survive. A major part of their fodder requirement is met through such waste and other common property lands. It has been argued that these rural households have often developed highly efficient agricultural and livelihood systems that make the most rational and conservative use of the scarce resources available to them. The rural poor who can not afford to maintain a cow or a buffalo find goat/ sheep as the best alternative source of supplementary income and milk. This is one reason why poor rural households maintain a few number of goats. Unlike a cow or buffalo, a few goats can be maintained easily and can be easily sold in the years of drought. They provide a stable source of income and nutrition for large number of rural people in the arid and semiarid regions which suffers from low agricultural productivity on account of frequent droughts, moisture deficit, poor resource base and low adoption of technologies. Therefore this sector assumes critical importance in arid and semiarid rainfed areas, high altitudes as well as in wasteland and fragile zones.

Hence this paper attempts to assess the status and role of small ruminants in terms of their contribution towards sustainability of rural livelihood and their potential for commercialization. An analysis is based on the secondary data sourced from FAO website, National livestock census and other published sources. The study also uses primary data collected from southwestern semi-arid zone of Uttar Pradesh and eastern semi-arid zone of Rajasthan and also from commercial goat farmers from Maharashtra, Madhya Pradesh, Rajasthan and Uttar Pradesh.

Growth and Distribution

The small ruminants during the last few decades have become steadily important in the rural economy, particularly in the arid and semi-arid regions. In 1951, the total number of livestock in the country was 292.80 million. The sheep and goats constituted 29.47 per cent of the

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total livestock population. By 2007, the total livestock population had increased to 530 million. The number of sheep and goats, interestingly, had increased to 212.1 million, forming 41.06 per cent of the total livestock population (Table 1).

Table 1: Population growth rate of major livestock species in India

Species	Population (million)			Annual compound growth rate (%)				
	1951	2003	2007	1972-82	1982-92	1992-2003	2003-2007	1951-2007
Cattle	155.3 (53.04)	185.18 (38.18)	199.08 (38.54)	0.76	0.61	-0.99	1.83	0.44
Buffalo	43.40 (14.82)	96.62 (19.92)	105.34 (20.39)	1.96	1.89	1.38	2.18	1.60
Sheep	39.10 (13.35)	61.47 (12.67)	71.56 (13.85)	2.01	0.40	1.93	3.87	1.09
Goat	47.20 (16.12)	124.36 (25.66)	140.54 (27.21)	3.50	1.93	0.78	3.11	1.97
Livestock	292.80	485.00	529.7	1.73	1.44	0.31	2.23	1.06

Note: The figures in parentheses indicate percent to total livestock population
Source: Livestock Census, Govt. of India (Various issues)

The goat population over the past few decades has increased steadily. The increase in goat population from 47.2 million in 1951-52 to 140.54 million in 2007 gave a mean rate of increment of 1.67 million per annum and annual compound growth rate of 1.97 percent. Its annual growth was 2.04 percent during 1971-2003 and 3.11 percent during 2003-2007. Combining the annual growth rate with mean slaughter rate of around 41 percent and mortality rate of about 15 percent, goat have shown the potential of population growth of above 58 percent per year. This is the single most important factor that makes goat as most desired species of animal for meat production in the country.

Table 2 Linear estimates of determinants of goat density.

Explanatory Variables	Regression Coefficient	t value
• Percentage of people below poverty line in the state	-2.01	0.403
• Average size of holding(ha.)	-64.84	1.275
• Percentage of Pasture and cultivable waste and fallow land to the total	26.38*	3.446
• Percent Net irrigated area	-11.35*	3.696
• Bovine density per 100 ha.	0.92*	5.534
Constant term	-251.05	
Coefficient of determination (R ²)	0.82	

* Significant at one percent level (< 0.01).

Source: Kumar and Pant (2003)

The goat and sheep although are well adapted to a variety of agro-ecological regions, there is marked variation in their density among different states. Among the small ruminants,

goats are more widely distributed (Rath, 1992). Among the major small ruminant keeping states, the density of goats per square km was highest in West Bengal (212) followed by Bihar, Tamilnadu and Rajasthan. The density of sheep was highest in Andhra Pradesh with 78 sheep per square km, followed by Tamilnadu, Karnataka and Rajasthan. A study on understanding the factors affecting the density of goats in different states conducted by Kumar and Pant, 2003 demonstrates that average size of holding and percent net irrigated area were negatively associated with density of goats (Table-2), validating the general perception that goats are associated with marginal and small farmers and provide livelihood to the people in rainfed regions. The association between goat density and area under pasture/wasteland was positive and highly significant, which highlights the role of common property resources in small ruminant production system.

The annual compound growth rate of sheep and goat during 1992-2003 as depicted in Table 3 for top 25 districts in the country shows that the population of sheep and goats has been increasing at a very fast rate in some of the districts. It may be mentioned that most of these fast growing top 25 districts, fall under semiarid rainfed regions. In case of sheep 15 and in case of goat 14 out of 25 top districts are the rainfed districts. In spite of general feed and fodder scarcity in the rainfed regions, these two species have performed well. It clearly indicates the higher utility and significance of small ruminants as means of livelihood security in the rainfed regions. The analysis of growth of small ruminant population further indicates that the districts with least or negative growth of goat and sheep population fall under irrigated regions.

Table 3: Districts with higher population growth of sheep and goats during 1992-2003 (compound annual growth rate (CAGR))

Sheep			Goat		
State	District	CAGR, %	State	District	CAGR, %
Uttar Pradesh	1. Kanpur Nagar	46.1	Tamil Nadu	1. The Nilgiris	39.3
Tamil Nadu	2. The Nilgiris	38.2	Uttar Pradesh	2. Kanpur Nagar	24.4
Assam	3. Goalpara	24.7	Gujarat	3. Gandhinagar	11.2
Kerala	4. Palakkad	21.2	Assam	4. Bongaigaon	9.7
Andhra Pradesh	5. Hyderabad	18.7	Andhra Pradesh	5. Cuddapah	6.7
Assam	6. Lakhimpur	17.4	Maharashtra	6. Yeotmal	6.4
Karnataka	7. Uttara Kannada	16.5	Karnataka	7. Bangalore	6.3
Andhra Pradesh	8. Nizamabad	15.0	Assam	8. Jorhat	6.3
Andhra Pradesh	9. Adilabad	14.9	Andhra Pradesh	9. Ananthapur	6.1
Andhra Pradesh	10. Medak	14.6	Andhra Pradesh	10. Kurnool	6.0
Assam	11. Hailakandi	14.2	Tamil Nadu	11. Ramanathapura m	5.7
Maharashtra	12. Sindhudurg	13.9	Andhra Pradesh	12. Guntur	5.6
Andhra Pradesh	13. West Godavari	13.3	Uttar Pradesh	13. Sonbhadra	5.6
Assam	14. Bongaigaon	13.1	Madhya Pradesh	14. Panna	5.5
Madhya Pradesh	15. Shajapur	12.9	West Bengal	15. Darjeeling	5.3
Assam	16. Nalbari	12.7	West Bengal	16. Jalpaiguri	5.1
Gujarat	17. Gandhinagar	12.5	Assam	17. Lakhimpur	4.8

Andhra Pradesh	18.	Nalgonda	12.5	Assam	18.	North Cachar Hills	4.8
Tamil Nadu	19.	Thanjavur	12.4	Andhra Pradesh	19.	Karimnagar	4.7
Andhra Pradesh	20.	Krishna	11.8	Uttar Pradesh	20.	Sant kabir nagar	4.6
Andhra Pradesh	21.	Karimnagar	11.6	Andhra Pradesh	21.	Krishna	4.6
Andhra Pradesh	22.	Guntur	11.4	Assam	22.	Dhubri	4.5
Andhra Pradesh	23.	Ranga Reddy	10.9	Andhra Pradesh	23.	Medak	4.5
Madhya Pradesh	24.	Raisen	10.7	Madhya Pradesh	24.	Jhabua	4.5
Assam	25.	Barapeta	10.6	Orissa	25.	Boudh	4.4

Contribution at National Level

The small ruminants contribute significantly to the Indian economy by providing sustenance to rural resource poor especially in the arid and semi-arid regions. The contribution of goat and sheep to the national economy has been estimated and presented in Table 4.

Table 4: Contribution of small ruminants to the Indian Economy-2010 (at current price)

Items	Goats		Sheep	
	Quantity (000' tones)	Value (Crore Rs.)	Quantity (000' tones)	Value (Crore Rs.)
Meat ¹	586.5	11730.00	289.2	5784.00
Milk ²	4594.0	6891.00	-	-
Pashmina ³	0.043	12.90	-	-
Wool ⁴	-	-	43.0	279.50
Offals ⁵	624.4	2052.00	492.1	843.50
Manure ⁶	19320.0	1545.00	8236.0	658.88
Blood ⁷	58.65	29.30	24.1	12.00
Skin ⁸	160.0	800.10	66.6	333.00
Increment in stock ⁹ , 000 Nos.	1784.0	267.60	1406	210.90
Total		23327.90		8121.78

Note: The estimates are based on FAO (2010)

1 Estimated @ Rs. 200 / kg.

2 Estimated @ Rs. 15 / kg.

3 Estimated @ Rs. 3000 / kg.

4 Estimated @ Rs. 65/ kg

5 Since figures are not available, it is estimated as 35 % of live weight and valued @ Rs. 350 /animal slaughtered.

6 Since the information on manure produced is not available, the average yield of manure has been estimated @ 500 g/adult and 200 g/young/day and valued @ Rs.800/tonne. Ratio for adult and kids is 60:40.

7 Estimated @ 5 % of live weight and valued @ Rs. 5/animal slaughtered.

8 Estimated @ Rs. 50/kg.

9 The incremental stock has been valued considering the period of last one decade. It is assumed that 50 % kids are born in February-March-April and 50 % in September – October. In the incremental stock the 50% kids has been valued at 7-8 months age @ Rs.2000/ animal and another 50% kids of 3-4 months age @ Rs. 1000/ animal.

The goats and their products contribute Rs 23327.9 crores annually to the national economy, whereas the annual contribution of sheep was estimated to be Rs. 8121.78 crores. Thus the annual contribution per animal works out to Rs. 1660 for goat and Rs. 1135 per sheep. The goat and sheep together contribute Rs. 31449.68 crores annually. Among different products, meat accounts for the largest share contributing about 50 percent of the total value of goat products and 71 percent of the total value of sheep products.

Small ruminant rearing as means of livelihood

Goats and sheep rearing is an important means of income and employment generation for the millions of resource poor rural households and significantly contribute in ensuring food and nutritional security for their families. Thus help alleviate poverty and smoothen income distribution. The goat and sheep are mainly dependent on common property resources (CPRs) for meeting their feed and fodder requirements. The CPRs comprise barren and uncultivable lands, cultivable wastes, permanent pastures and other grazing land and land under miscellaneous trees, crops and other fallow land. In spite of their critical role in livelihood security of rural poor, the CPRs are declining continuously (Jodha, 1986; Murthy and Patra, 2011). The erroneous stigmatization of goats and sheep as the major culprits for environmental degradation is unfortunate, because available evidence shows that when managed properly, especially in mixed species grazing, goats contribute to sustainable natural resource management (Rege, J.E.O., Agyemang, K., 1992 and Schwartz, H.J., 1983). The reality is that poverty and demographic pressures on the land drive environmental degradation through deforestation, overgrazing, overstocking and indiscriminate exploitation of fragile marginal ecosystems.

In a study of small ruminant based farming system it was found that the cow and buffalo rearing, crop farming; agricultural wages, trade and services were the other components of small ruminant based farming system. Household's cash needs were met by selling goats, milk, manure, crop produce, wages and other sources. Family labour and common grazing resources were observed to be the critical and major inputs used in goat production system. The other major input was supplementary feed (Kumar 2002). The landless people in the villages possess own labour as the only abundant factor which is free to them and they try to use it to its maximum for their survival and thus concentrate on animal husbandry (Pasha, 1991). In arid and semi-arid regions with poor irrigation, opportunity of agricultural employment for landless rural people is not available through out the year. Moreover the large ruminant rearing is a less preferred option for the land less people as it demands relatively large investment and higher maintenance cost. Hence, these landless households are particularly dependent on small ruminant rearing as source of income and nutrition.

The initial investment requirements for small units of goat/sheep are modest and there is quick pay-off due to fast multiplication. Studies in the past have shown that goat and sheep are

economical in arid and semi-arid regions. It was reported that a goat in Andhra Pradesh provided an income of Rs 140 per annum (Sriramamurthy, 1977). Similarly at Jodhpur, Rajasthan, net income per goat was reported at Rs.250 per year (Ghosh and Khan,1980). Pasha (1991) reported a net income of Rs.114 per small ruminant per annum. Swain *et al* (1982) found indigenous goats 2.5 times more economical than sheep on free range grazing under semi-arid region of Rajasthan. In a study of comparative economics of mutton production, it was found that the cost of rearing a lamb up to 6 months age was about Rs 114 and the total returns were Rs. 165 from sale of a indigenous lamb and Rs. 195 from cross bred lamb (Singh, 1981). The cost of chevon production was estimated at Rs. 5.80 to Rs.7.40 per kg under different dietary treatments (Sehgal and Singh, 1984). Shinde *et al* (2003) have shown goat rearing was also profitable on organized farms. The income generated from goat rearing was estimated at Rs. 1.29 in first year and Rs. 1.36 in the second year per rupee of investment. Acharya and Singh (1992) also highlighted the crucial role of goats in livelihood security of resource poor rural households. Deoghare and Rekib (1996) found that the farmers could earn a net income of Rs.331.00 per goat per annum and Rs. 74.00 per sheep per annum. In another study in Mathura district (Kumar and Deoghare, 2002), the actual cost of rearing a goat was Rs.395 per annum and the net returns were Rs.1126 per goat per year. All these studies indicate that it is quite remunerative to rear small ruminants with higher profitability in goats compared to sheep.

Cost and Return from Goat and Sheep Rearing in Semi-arid Regions

An analysis was done on the survey of 140 goat keeping households of southwestern semi-arid zone of Uttar Pradesh and another 140 goat keeping households of eastern semi-arid zone of Rajasthan. The selected households were classified into four categories based on the flock size of goat viz; very small(1-5 goats), small (6-15 goats) medium (16-30 goats) and large (>30 goats). Small ruminant were the important source of livelihood security for these rural resource poor. In Uttar Pradesh only landless agricultural wage earners and marginal and small farmers were involved in goat/sheep rearing. However, in Rajasthan, where drought is frequent and crops are rain-fed, the farmers of the all categories adopted goat/sheep rearing. All the selected households had goats but sheep was not owned by every one of them. At the same time, the flock size of goat varied from 2 to 70 goats in different categories. In both the states, the total cost per animal per annum was negatively associated with the flock size. This was mainly attributed to higher expenditure on supplementary feed in small flock size categories and better utilization of labour in large categories. Imputed value of family labour was found to be major components of total expenditure, which accounted for 51 to 79 percent of the total cost of goat rearing in different categories. This shows that actual expenditure incurred by the family on rearing a goat or sheep was very low. It ranged from Rs. 189 to Rs. 532 per goat and Rs. 163 to Rs. 204 per sheep per annum in Uttar Pradesh, and Rs. 191 to Rs. 319 per goat and Rs. 162 to Rs. 183 per sheep per annum in Rajasthan (Table-5).

The direct benefits from both the goat and sheep rearing were live animal sale, change in flock inventory and manure. Additionally goat provides milk, which was crucial for the family nutrition, and sheep provide wool for sale. Goat and sheep rearing turned out to be a very good

source of income for the landless as well as the landowners. The family of the small ruminant keeper earned a net annual income of Rs.1383 to Rs.1788 per goat and Rs 364 to Rs 663 per sheep in different flock size categories in Uttar Pradesh. Similarly in Rajasthan, the net annual income accrued from a goat ranged from Rs.1303 to Rs 1873 and that of a sheep was from Rs.371 to Rs.602 in different flock categories. The families owning large flock generated an average annual net income up to Rs. 59,344 from goats and Rs.8,978 from sheep respectively in semi-arid areas (Table 6).

Table 5: Costs of goat and sheep rearing (Rs./ annum)

Particulars	Category of small ruminant farmers							
	Uttar Pradesh				Rajasthan			
	Very small	Small	Medium	Large	Very small	Small	Medium	Large
Land holding size, ha.	0.30	0.19	0.25	0.0	1.12	2.39	3.38	0.51
GOAT								
Av. flock size (Doe)	2.43	11.09	20.68	36.00	3.47	10.72	22.56	45.59
Fixed cost	416	2032	3448	5629	630	2178	3974	6819
Total variable cost	5801	6934	10737	8344	4402	7966	13600	11447
Total cost (A+B)	6217	8966	14185	13973	5032	10144	17574	18266
Total cost excluding family labour	1293	3046	4730	6801	1077	3424	6328	8707
Cost/ goat excluding family labour	532	275	229	189	310	319	280	191
SHEEP								
Av. flock size (Ewe)	-	6.35	1.68	21.00	5.32	8.45	2.50	6.73
Fixed cost	-	997	239	2984	676	805	357	995
Total variable cost	-	3683	828	4625	6361	5864	1364	1578
Total cost (A+B)	-	4680	1067	7609	7037	6669	1721	2573
Total cost excluding family labour	-	1295	301	3433	974	1369	475	1162
Cost/ sheep excluding family labour	-	204	179	163	183	162	190	173

Table 6: Family's income from goat and sheep rearing (Rs./ annum)

Particular	Category of goat farmers							
	Uttar Pradesh				Rajasthan			
	Very small	Small	Medium	Large	Very small	Small	Medium	Large
A. GOAT								
Gross returns	5638	20746	33337	57240	6183	23501	44148	68051
Family labour income	4345	17700	28607	50439	5106	20077	37820	59344
Family Labor Income / goat	1788	1596	1383	1401	1471	1873	1676	1302
Income from goat/ man-day	35	120	121	281	52	120	135	248

A. SHEEP							
Gross returns	3607	1414	124111	3030	6456	1402	4675
Family labour income	2312	1113	8978	4007	213	319	2102
Family Labor Income / sheep	364	663	428	387	602	371	522
Income from sheep/ man-day	27	58	86	14	38	30	100

Case of sheep rearing in Rajasthan

A recent study on socio-economics of sheep rearing in Rajasthan (Suresh et al., 2005) shows that contrary to the ownership pattern of goats, the sheep are reared in larger flocks. The flock size on an average was 24 sheep in small category and 43 in medium and 91 sheep in large flock. Agriculture was the main occupation (51 per cent), followed by animal husbandry (48 per cent) for these sheep rearers. The average size of operational holding was 5 ha, varying from 2.58 ha in the small to 6.97 ha in the large category of sheep breeders. The popular belief that sheep-rearing is the occupation of very poor households seems to be gradually changing in the rural areas. Nearly 64 per cent of the sheep rearers were from semi-medium, medium and large land holding categories and accounted for 70 per cent of the sheep. At the same time 36 per cent sheep farmers belonging to landless, marginal and small land size categories possessed only 30 per cent of the total sheep population.

The sheep flocks are generally raised on the common grazing lands. Though feeding of concentrate mixture and mineral supplements are known to have significant positive effect on various production traits of sheep, its adoption was very low due to various economic and institutional constraints. Some fodder trees and harvested crop lands were reported to be leased for sheep rearing for a fixed period.

Table 7: Feature and Cost and Returns from Sheep in semi-arid region of Rajasthan

Particulars		Small (upto 30)	Medium (31-60)	Large (>60)	Overall
No. of sheep rearers		29	42	36	107
Size of operational holding (ha)		2.58	4.98	6.97	5.00
Livestock No.:	Sheep	24	43.4	91.4	54.3
	Goat	6.7	4.8	8.9	6.7
	Cattle	1.4	2.3	3.8	2.6
	Buffalo	1.6	2.8	5.5	3.4
Cost and returns in sheep rearing					
Expenditure					
Fodder and feed (%)		62.50	58.57	52.69	56.08
Medicine (%)		26.30	32.03	27.18	28.52
Hired labour (%)		5.48	3.73	14.48	9.74

Interest (%)	5.63	5.67	5.66	5.65
Total variable cost (Rs)	2115	2735	5567	3520
Returns				
Animal sale (%)	77.35	82.31	81.69	81.36
Milk (%)	4.87	2.63	3.26	3.26
Wool (%)	11.00	8.10	8.46	8.65
Manure (%)	6.87	6.96	6.59	6.72
Total returns (Rs)	12395	21822	48528	28252
Return over variable cost (ROVC) (Rs)	10280	19087	42961	24732
ROVC per animal (Rs)	428	440	470	456

Cost and Returns in Sheep Farming

The economics of sheep farming accounting only paid up cost demonstrate that the cost in sheep-rearing was maximum on feed and fodder, followed by veterinary care, hired labour and interest on capital. The overall annual average variable cost was Rs 3520 per flock @ Rs. 65 per sheep (Table 7). The returns from the sale of live-animals, milk, wool and manure together give a return of Rs 28252 for a flock of 54. The return over variable cost (net return or profit) worked out to Rs 24732, giving the per animal return of Rs 456 per annum. The animals (male lambs) of 6-8 month are sold, particularly during the peak demand season of the year. They are sold mainly to the village agents/middlemen. The average mortality was 14 per cent and was largely due to foot and mouth disease, enterotoxaemia and pneumonia. The farmers were found to depend mostly on the government veterinary clinics for treatment of animals.

Over the past one and half decades the number of large flocks (with more than 20 goats) in the selected villages has declined by 35 per cent in Uttar Pradesh and by 20 per cent in Rajasthan. Due to feed scarcity it was becoming difficult to maintain non-migratory large goat flocks on CPRs in Rajasthan in summers and in Uttar Pradesh in winters. Hence these farmers have reduced the size of their goat flock and some of the large flock-owners in Uttar Pradesh have replaced goats with sheep, which can be managed easily while grazing on limited piece of land. However, proportionately more numbers of households in the village have started rearing small unit of goats with provision of supplementary feeding. Due to feed scarcity in Rajasthan the farmers sell majority of the male kids at an uneconomic age of 2-4 months. Now a market for these young kids has emerged (Kumar, 2007), wherein 2-3 months age kids of 'sirohi' goat from Rajasthan are sold to resource poor rural families in Uttar Pradesh, Bihar and West Bengal and they raise them under semi-intensive or/and intensive system for festive sale. There is need to encourage and institutionalize such linkages between fodder scare and surplus regions for sustainable development of goat production.

Very low adoption of improved technologies was another major constraint resulting in low productivity of goats. Though goat-research has generated a number of useful technologies (Kumar and Pant, 2003), but there were constraints in their dissemination and adoption. Due to lack of awareness and innovativeness, the majority of goat keepers did not seek improved package of practices and had aimed at low input and low output system. On the one hand,

institutions imparting practical training on goat-rearing are very few and on the other the traditional goat keepers were not keen to attend training programmes. Inadequacy of veterinary facilities was a major constraint in adoption of health related technologies. The limited available veterinarians were largely involved in curative care of large animals.

Moreover, many of the technologies were suitable for large commercial farms but are not for small traditional units. The small and large/commercial farmers should be provided with separate technological options suiting their respective needs and resources. Non-availability of recommended inputs like vaccines, fodder seeds, area specific mineral mixture and cost effective complete feeds was one of the most critical constraints in adoption of improved technologies. Poor access to credit from institutional sources was a constraint in promotion of goat farming. The bankers need to be educated about the economic potential of goat farming. The poor goat farmers hardly have any asset for collateral security except their goats.

Economics of Commercial Goat Farming

An economic analysis of commercial goat farming under intensive and semi-intensive system of management based on a study covering Maharashtra, Madhya Pradesh, Rajasthan and Uttar Pradesh (Kumar, 2007) it is revealed that unlike the traditional flocks, where fixed cost was 10-15 per cent of the total cost, the fixed cost and variable cost in commercial goat farming constituted 35 per cent and 65 per cent of the total cost, respectively. The value of died adult goats alone accounted for 11.38 percent of the total fixed cost. This cost can be minimized through proper management. The feed was the major component (59%) of cost on goat rearing. The total cost per doe per annum in small (< 100 goats), medium (100-500 goats) and large (>500 goats) categories was worked out to be Rs 2354, Rs 2137 and Rs 2527, respectively (Table 10). However, analysis of the cost on goat rearing on the individual farms, depicted in Figure 2, showed large variations. On one-third of the commercial goat farms, the total annual cost of rearing a goat was between Rs 1124 and Rs 1753 and on another one-third goat farms, it ranged from Rs 2628 to Rs 4311. The latter goat farms must reduce their cost of goat rearing to remain in business by methods like (i) reducing fixed cost through expansion and minimizing mortality of goats; and (ii) reducing feed cost through identifying cheaper sources of feeds and their efficient purchases.

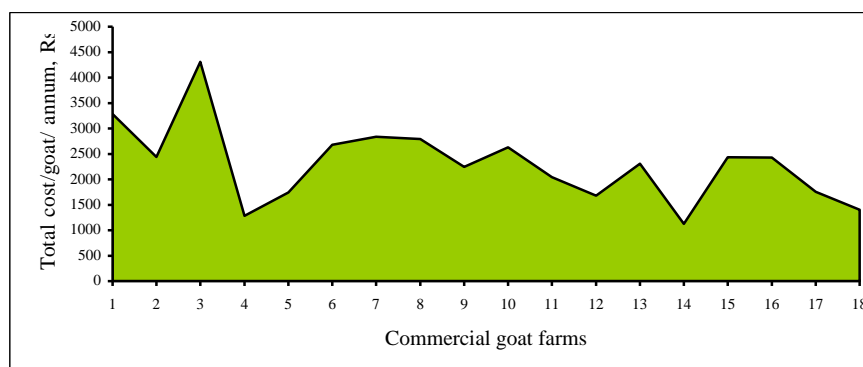


Figure 1. Annual cost of rearing a goat on commercial farms

Table 8. Costs and returns from goat farming on different categories of commercial farms (Rs/ annum)

Category	Fixed cost	Variable cost	Total cost	Cost per goat	Returns from kids	Value of manures	Value of milk	Gross returns	Net returns/farm	Net return/goat
Small	35181	50568	85749	2354	115460	7475	12969	135904	50155	371
Medium	91417	211552	302969	2137	383942	31400	17167	432508	129540	652
Large	650593	1124332	177492	2527	1888400	117000	30000	2035400	260475	494

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The gross returns from goat farming were maximum from the sale of animals (90 per cent), followed by manure and milk. The sale of milk, which constituted about 25 per cent of the gross returns on the traditional goat flocks, was only a minuscule part of the returns on commercial farms because (i) manual milking of a large number of goats involved huge labour cost and affected other farm operations; and (ii) strategy to make available more milk to the kids up to 3 months to attain proper growth.

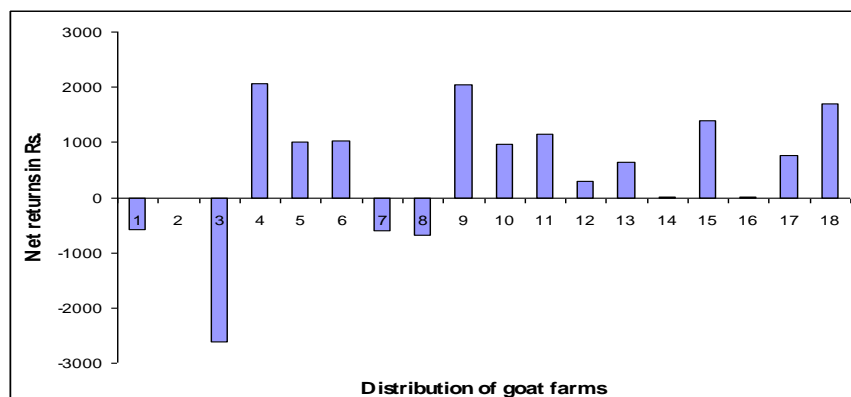


Figure 2. Annual net returns per goat on commercial farms

The individual farm-wise analysis revealed that on 39 per cent of goat farms the annual net returns per goat were quite satisfactory (Rs 968 to Rs 2069), while on 28 per cent of the goat farms, these were negative. The reasons for negative net returns were higher cost of rearing per doe and realization of low prices for their market surplus. The remaining 33 per cent of the goat farms also had a positive net return but needed to increase them to make their business economically viable and sustainable. Since a majority of the commercial farms have come up only during the past few years, they were learning from their experiences and some of them will have to increase the flock sizes for proper capacity utilization. Most of the farms with below average performance were likely to improve in the next 1-2 years.

The analysis shows that the net returns per goat did not appear to have any relationship with the flock size. However, fixed cost and disease losses per doe affected the net returns negatively. A regression analysis was carried out to explain the relationship between the annual net returns per doe and the factors affecting them.

The annual losses due to diseases per doe and average price of goats realized (Rs/kg live body weight) were the most important factors, which influenced the annual net returns per doe on the commercial farms. The relationship between losses due to diseases and the net returns from goats was negative and highly significant, indicating the importance of disease prevention for the sustainability of commercial goat production. This has implications for improvement in the productivity and profitability of commercial goat production, particularly in the short-run, through effective adoption of disease prevention technologies. The average price of live goats realized by the farmers influenced the net returns positively and significantly. The reason for higher price realization by some farmers may be the effective marketing strategy and better quality of their animals (pure breed and good health). The flock size was negatively associated with the net returns per doe, indicating higher net returns on small farms. However, its regression coefficient was not highly significant. The coefficient of dummy for system of management was negative, but not significant. It demonstrated that the system of management had no effect on net returns and the goats may be profitably raised under both intensive as well as semi-intensive systems of management. The regression coefficient of the dummy variable for training acquired by the farmers, which reflected the level of technical knowledge of the farmer, was positive. It indicated that those farmers who acquired training on commercial goat farming could earn higher net returns per doe.

The analysis revealed that a majority of commercial goat farms were operating with positive net returns with 39 per cent of them earning good profit. Goat rearing as an enterprise was found equally rewarding under both intensive and semi-intensive systems of management. Among the farms under intensive system, 22 per cent were in loss, whereas among the farms under semi-intensive system, 33 per cent were in loss. The commercial goat farming under intensive and semi-intensive systems of management may therefore be declared as profitable and promising enterprise. However, the technological intervention, particularly prophylaxis, superior germ plasm, low cost feeds and fodders and innovative marketing of the produce would be the pre-conditions for successful commercial goat production.

Implications and Suggestions

Traditional System of Small Ruminant Rearing

It may be concluded that goat and sheep rearing enterprise play a very important role in providing income, nutrition and gainful employment to the resource poor rural households especially in arid and semi-arid rainfed regions. The potential for goats and sheep to contribute to the attainment of food security, economic development and environmental sustainability is tremendous. The broad genetic variability of Indian goat and sheep breeds enables them to survive under stressful environmental conditions, including high disease incidence, poor nutrition and harsh temperatures. Environmental pressure also maintains a wide range of genotypes, each adapted to a specific set of circumstances. Under on-station management, indigenous sheep and

goat breeds have shown good growth and reproductive performances, indicating their potential and ability to respond to improvements in management, particularly nutrition and disease control.

The contribution of small ruminant sector in national GDP has also been found to be significant. Therefore goat and sheep enterprise should invariably be encouraged as a potential source of income and employment for the rural landless, and small and marginal farmers especially in the arid and semi-arid and other marginal areas having low agricultural productivity. The attractive return from goat rearing also makes a strong case for its promotion on commercial scale. However there is a need to put a system in place for better disease prevention and proper marketing of small ruminants and their products. The development of fodder resources (CPRs) and economic feeding systems and imparting practical skill on scientific small ruminant keeping is also equally important.

Implementing the following specific recommendations would contribute towards sustainable development of small ruminant production as a means of livelihood security of resource poor rural people.

- Scarcity of feed and fodder being the major constraint in the existing small ruminant production system, better management of common feed resources is crucially important for improved fodder supplies in rainfed areas. In fact, each watershed should essentially have a component to develop common and private fodder resources as part of it and its compliance by the project implementation agencies (PIAs) should be monitored. As most of the PIAs are not allocating resources for development of livestock and fodder component in spite of such guidelines under the watershed programme.
- Efficient utilization of available fodder resources: Chopping of coarse cereal stover (sorghum / ragi, etc), which is not common in southern India, needs to be promoted to reduce wastage (by at least 50%) and improve digestibility.
- The Panchayats may be given incentives to develop common grazing resources in the village commons through convergence of NREGS (National Rural Employment Guarantee Scheme).
- With the involvement of animal husbandry experts and other major stakeholders (farmers, local veterinary doctor, dairy cooperatives, etc.), the potential indigenous breeds of different species need to be identified at micro level (development block) considering the yield potential, resource situation and socio-economic factors and should be used for grading up programmes.
- For weeding out poor quality breeding males of small ruminants, Panchayat will have to play an effective role. Once the breeds of animals to be promoted at block and village level are decided, the Panchayat may ask its members not to keep breeding males of non-descript poor breeds. The poor breeding males may be replaced as part of breed improvement programme.

- For improving fodder availability for the small ruminants, besides development of CPRs by involving panchayats and user groups, there is need to institutionalize linkages between goat farmers in fodder scarce regions and areas with better fodder availability.
- Production and mortality losses in small ruminants due to diseases and parasites are huge, hence there is need to run an awareness campaign through mass media (TV, Newspaper, etc.) focusing on importance of prevention programme for diseases and parasites in small ruminants.
- Deworming against parasites and vaccination against major diseases should be taken up as campaign at national level continuously for at least for five years. The major diseases in large ruminants are; food and mouth disease (FMD, Hemorrhagic Septicemia (HS), Black Quarter (BQ), etc. and for small ruminants; Enterotoxaemia (ET), Blue tongue, peste des petits ruminant (PPR), FMD, etc.
- Poor bargaining power, low awareness, high transaction cost, smaller surplus for sale, low income (distress sale) coupled with lack of infrastructure are the main reasons for lower price realization of the livestock produce of the smallholders.
- There is need to link the smallholder producers directly with the market (processors, marketers/retailers and consumers).
- Farmers should be encouraged and supported for collective action in livestock production and marketing.
- The insurance of livestock is the best safeguard for minimizing the risk especially for smallholder producers. Its importance is paramount in case of small ruminants because of higher risk of loss of production and animals due to diseases and feed scarcity. Though the insurance companies have provision for insurance of animals throughout the country, only a very small share of small ruminants has been insured. The major reasons of poor coverage of animals under insurance are: high cost of premium (4.5 – 8.25% of the value of animal) besides low awareness among the farmers. Further the insurance companies many times do not entertain request for insurance by the farmers because of the small scale of business and higher transaction cost. Hence, there is need to increase the farmers' awareness and make mandatory provision for the companies to undertake livestock insurance of interested farmers. There should also be redressal mechanism for sorting grievances.
- Because of the constraints inherent to the situation, the level of technology adoption in small ruminants is very low. Besides specific package of practices suggested above, there is need to provide a basket of technological options so that livestock holders may choose as per their needs and resources conditions.
- Farmers must be trained and retrained to develop their management skills for proper feeding including fodder development and conservation, proper breeding skills, disease control and prevention, basic on-farm processing methods to add value to their goat farming, simple record-keeping and the exploitation of synergies between livestock and crops.

- The focus should be on development of integrated farming system with livestock and other most remunerative activities as its components.

Commercial Goat Farming

- Goat farming under semi intensive as well as intensive system of management could be taken up profitably. The entry of resource-rich people, including poultry farmers, who have better access to technical knowledge, resources and markets, into the goat rearing under intensive and semi-intensive system would help in realizing the potential of this enterprise. It would also encourage the aspirant commercial goat farmers who do not have access to grazing resources.
- The lack of good quality breeding stock being a major constraint in commercialization of goat production, the farms managed on scientific lines should be encouraged to become the centres of production of superior quality breeding animals.
- Considering good economic potential in commercial goat production, some large industrial houses such as Hind Agro Industries (a major meat exporter of the country) are entering into goat farming business, especially for the export market. The big poultry farmers from Haryana, Punjab, Delhi, Madhya Pradesh and Maharashtra have also successfully started diversifying their business towards commercial goat farming. However, for availing the benefits of lucrative export market, food safety standards will have to be developed.
- The commercial goat farmers can earn best profit by producing and marketing pure breed goats and festive sale during Eid. In the long-run, vertical and horizontal integrations would have to be evolved for achieving sustainability of commercial goat production and remaining competitive in the global market. Service centres will have to be established to provide technical knowledge, recommended inputs and market information. Small size modern slaughterhouses need to be established near the production centres (possibly in each development block) to maintain commercialization of goat production. The private sector may be encouraged to create such infrastructures through appropriate policy support and incentives. This would enable the farmers to enhance their productivity and reduce cost of their production

The small ruminant rearing has a great promise as source of income and employment and livelihood security of resource poor rural people throughout the country in general and the arid and semi-arid regions in particular. However, there is a need for appropriate policy and institutions for transfer of need based technologies, linking smallholders with the market, value addition and safeguards mechanism in face of increased competition due to globalization and climate change.

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