



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

## **Goat Rearing: A Pathway for Sustainable Livelihood Security in Bundelkhand Region**

**M.K. Singh<sup>\*a</sup>, A.K. Dixit<sup>a</sup>, A.K. Roy<sup>b</sup> and S.K. Singh<sup>a</sup>**

<sup>a</sup>Central Institute for Research on Goats, Makhdoom, Mathura-281 122, Uttar Pradesh

<sup>b</sup>Indian Grassland and Fodder Research Institute, Jhansi-284 003, Uttar Pradesh

### **Abstract**

The study has explored goat production systems, adoption level of management practices, constraints to goat-rearing, critical gaps and impact of introduced innovations on livelihood security of resource-poor households in 16 villages belonging to two disadvantaged districts (Hamirpur and Mahoba) of Bundelkhand region. In the Bundelkhand region, goats are reared by more than 75 per cent rural households in the form of mixed farming system. Goats have been found contributing 17.5 per cent share to annual household income of goat-keepers in Hamirpur and 16.4 per cent in Mahoba district. The majority of goat-keepers have moderate level of knowledge on different aspects of goat breeding and very low level of knowledge on up-gradation of genetic potential of goat, value addition of crop residues, utilization of CPRs and preventive health measures. Five hundred goat-keepers of selected villages were provided training on different aspects of goat-rearing under the NAIP, along with establishing goat-farmers based self-help groups. The impact analysis of goat-keepers has revealed net income of ₹ 19,000 with a unit of 5 adult goats. Prophylactic supports to all livestock species and fodder interventions have provided additional income of ₹ 3204 and ₹ 4285/household/year, respectively. The integrated goat-rearing could generate employment of 224 person-days annually besides milk for household consumption. The study has suggested improvement of common property resources (pastures and water bodies), value-addition of feed and fodder, bridging knowledge gap and veterinary support are the key aspects for sustainable livestock (goat) production in the Bundelkhand region.

**Key words:** Common property resources, integrated farming, livelihood, knowledge gap, mixed farming, Bundelkhand, Uttar Pradesh

**JEL Classification:** Q10, Q12

### **Introduction**

Bundelkhand region of Uttar Pradesh is located in the Indo-Gangetic Plains on Vindhya hilly tract in central India. Livelihood security is highly vulnerable in this region. A sizable number of people (40%) belong to below poverty line category and an equal is close to poverty line due to recurring droughts, highly erratic or irregular rainfall with uneven distribution and scarcity of irrigation resources. About 35-45 percent

of the human population migrates in search of employment. Thus, livestock is an important source of livelihood contributing to household income, employment and nutritional security. In Bundelkhand, farmers have adopted mixed farming system (crop-livestock) to counter frequent crop failures. Among livestock, goat is most common and is reared by more than 75 per cent households, irrespective of landholding size or caste. Besides assured income, employment and nutrition, goat-rearing supports crop production by providing cash for the purchase of critical inputs in financial distress and risk aversion in case of crop

---

\* Author for correspondence  
Email: manojnaip@gmail.com

failure. Therefore, goat has one of the most inclusive growth rates among livestock. In the mixed species grazing system, goats browse on plants which are less preferred by other livestock species and thus add flexibility to the management of livestock. Therefore, goat-rearing is sustainable even in fragile environments of Bundelkhand region. However, actual productivity from goats is much less than their potential productivity due to under-feeding and inadequate support services. Realizing the importance of goat-rearing in sustaining the livelihood of poor people, an integrated programme was introduced in 16 villages of Mahoba and Hamirpur districts under 'Sustainable Livelihood Research Project' of National Agriculture Innovation Project. Under this background, the present study has investigated goat production systems, adoption level of management practices and impact of adopted innovations on livelihood security of resource-poor households in the Bundelkhand region of Uttar Pradesh.

### Data and Methodology

The study was carried out in two districts, viz. Hamirpur and Mahoba in the Bundelkhand region of Uttar Pradesh. For study, data were collected from 89 households of 8 villages of Rath, Gohand and Muskara blocks in the Hamirpur district and 105 households of 8 villages belonging to Jaitpur, Panwari, Charkhari blocks of the Mahoba district in 2010 using a well-defined pre-tested questionnaire through personnel interview method. The production performance of goats with respect to body weight of kids at different ages, milk yield at different lactation stages and lactation length were recorded by measuring their values for body weight and milk yield. The farmers were asked to assess the knowledge level on a continuum of 'very poor/nil', 'poor', 'good' and 'very good' and adoption level as 'never', 'sometimes', 'often' and 'always' which carried weightage of 1, 2, 3 and 4, respectively. The intensity of knowledge and adoption level were highest with the lower score. The Garrett's technique was used to rank the constraints according to their mean scores. The magnitude of critical gaps was worked out by comparing the observed average of performance with standard values in percentage terms. The impact of introduced innovations (inputs, management practices, and knowledge level) was assessed on a structured performance from 45-500 beneficiaries (depending upon

innovations) mainly through measuring goat production performance and income by improvement in productivity and survivability of goat and fodder resources. The statistical analysis was carried out as per standard procedure (Snedecor and Cochran, 1989).

## Results and Discussion

### Socio-economic Profile of Goat Keepers

The majority of goat-keepers belonged to the backward social community (54%), followed by schedule caste (37%) and general category (9%). The average literacy, family size, landholding, annual income, contribution of goat in income and size of goat flock according to landholding are shown in Table 1. The level of working knowledge of goat-keepers was low in spite of good (>75%) literacy rate. The average landholding size of goat-keepers was higher (1.5 ha) in comparison to state average (0.83 ha) (Dev, 2012). However, productivity of crops was quite low due to rain-fed crops cultivation on more than 70 per cent sown area. Even the irrigated cropped area has less than 2.0 irrigations per crop. Maximum cultivable area was sown during *rabi* season and kept barren in *kharif* and *zaid* seasons. Agriculture (crops) was the main source of income, followed by livestock and labour in Hamirpur district, whereas labour (wages from village-based and migratory) was the major source of income, followed by livestock and agriculture in Mahoba district (Table 1). Livestock (cow, buffaloes and goat) was integral part of all categories of rural household, except landless people who work as a labourer (Singh *et al.*, 2009; Misra, *et al.*, 2010 and Singh *et al.*, 2010). Goat was kept by all categories of farmers though its contribution to income was more among marginal and small farmers in both the districts. Goats contribute 14-16 per cent in average household income besides providing nutrition (milk) to family.

### Goat Production and Management System

Goat production is well integrated with other livestock species and crop production. Nearly 34 per cent people keep goat with cattle and buffaloes, followed by with cattle alone (15%) and with buffaloes (14%). Some households (37%) keep goats only. Sheep accounted for 2.8 per cent livestock population. The average flock-size ranged from 2 to 39 with average of 9.17 in Hamirpur and 7.6 in Mahoba district. The

**Table 1. Socio-economic profile of the goat-keepers in Bundelkhand region**

Particulars	Hamirpur (N=89)	Mahoba (N=105)
Family size (N)	5.76	6.18
Literacy (%)	76.00	75.00
Landholding size (h)	1.56	1.51
Income/Household/Year (₹)	56725	48149
Income from agriculture (%)	32.45	22.42
Income from the goat (%)	15.50	14.30
Income from cow & buffaloes (%)	23.20	24.59
Income from labour (%)	28.40	38.47
Backward social community (%)	57	51
Schedule caste social community (%)	36	38
General community (%)	7	11
Flock size among marginal farmers	11.4	8.8
Flock size among small farmers	7.9	7.1
Flock size among medium farmer	7.8	7.1
Flock size among large farmers	4.9	4.5
Flock- size (N)	9.17	7.60

N Number

proportion of households with flock size of 1-5, 6-10, 11-15, and >15 goats was 38 per cent, 37 per cent, 17 per cent and 8 per cent, respectively in Hamirpur and 41 per cent, 34 per cent, 17 per cent and 8 per cent, respectively in Mahoba district. The flock was predominated by adult/ yearling females (> 62%), followed by growing kids (33%). Breeding bucks were available with 1.8 per cent goat-keepers, i.e. only with large flock owners. There were 1- 3 individual bucks in 13 selected villages and no individual buck was found in other 3 villages and stray bucks called as *Mata-ka- Bakra* (a male kid reserved to serve the female goats in the name of village deity) were utilized to cover the village goats. The villages with good access to community grazing land had higher flock size. Goats

in grazing areas were looked after by girls and women (24%), male children (16%), aged people (21%) and youths (39%).

Kids were provided suckling twice a day (morning and evening) up to the age of 5 months. Kids born in a large flock, however, weaned little early (2-3 months) and were sent for grazing as a separate flock up to the age of 5-6 months and after that in adult flock. Goats were reared primarily on grazing (range + crop fields) with little external inputs (Rai and Singh, 2004; Singh *et al.*, 2009). Except *rabi* season, cultivable fields remain available to goats for grazing due to about 25 per cent and 5 per cent crop cultivation in *kharif* and *zaid* seasons. The farmers who keep large flocks graze their goats by own, whereas, those who keep small flock, rear goats on contract grazing. The rate of contract grazing varied from ₹ 75 to ₹ 100 per goat across villages and seasons. Contract grazing rate increased in *rabi* season. Grazing hours varied from 5 to 8, depending upon flock size, biomass availability and season.

The supplementation of concentrate ration was given only to lactating goats at the rate of 100-150 grams/goat/day. Breeding bucks, found with few goat keepers, were also given concentrate feed at the rate of 200-250 grams/day. The average quantity of concentrate fed to a goat was 142 g/day for a period of 109 days in Hamirpur and 130 g/day for 128 day in Mahoba district (Table 2). The concentrate was mostly fed in the winter season when grazing, by and large, was restricted due to crops cultivation. Green fodder was mostly provided in the form of lopped fodder and the average quantity was 287 g/day in Hamirpur and 357 g/day in Mahoba district for a period of 90-184 days (Table 2). Kids from 15-20 days onward were

**Table 2. Goat production system in selected villages of Hamirpur and Mahoba districts**

Particulars	Hamirpur (N:89)	Mahoba (N:105)
No. of grazing days/year	236	230
No. of (grazing + straw feeding) days/year	162	144
Quantity of concentrate (g)/goat/day	142	130
Concentrate fed (days/year)	109	128
Average quantity of green/lopped fodder/day (g)	207	285
Green fodder fed (days/year)	179	145

N= Number of households

**Table 3. Production performance of goats in selected villages of Hamirpur and Mahoba districts**

Particulars	Hamirpur	Mahoba
Age at first kidding (months)	17 (134)	18 (112)
Mortality up to 3 months (%)	13 (94)	12 (65)
Mortality among adults (%)	10 (242)	12 (220)
Abortion rate (%)	5.5 (134)	7.4 (112)
Average body weight at 6 months (kg)	10 (34)	10.6 (42)
Lactation length (days)	123 (134)	129 (112)
Total milk yield (litres)	59 (56)	63 (74)
Milk yield per day (litres)	0.47(56)	0.51 (74)

Note: Figures within the parentheses are number of goats for data collection

provided lopped fodder and also sent for grazing in nearby areas for 2-4 hours/day. Area under cultivated fodder crops was hardly 4.0 percent of the total cultivated area and fodder was provided to buffaloes and high-yielding cows on priority basis. However, leftover or waste of green fodder is provided to about 15-20 per cent goats kept in mixed livestock farming. Major items fed to goats were crop by products viz. straw of different legumes and cereals (arhar, gram, pea, pigeon pea, sesame, sorghum, bajra and wheat) and lopped fodder obtained from grazing areas such as bargad, pipal, bair, babul, pakhar, neem, mahua, siris, shrubs and grasses (lampa, kail, dub, sain, etc). About 47 per cent goat-keepers (with medium to large flocks and those who reared on contract grazing) maintained their goats for the entire year under extensive feeding system on common property resources (CPRs). However, grazing pressure was continuously increasing on pasture and grazing lands and productivity of these resources was continuously decreasing (Saran *et al.*, 2000; Dixit *et al.*, 2012).

### Incidence of Diseases and Mortality

The incidence of various diseases ranged from 20 per cent to 60 per cent in different villages, leading to 10-35 per cent goat mortality over flocks and villages (Table 3). The wide variations in incidences of disease could be attributed to variable nutrition levels, health care measures (deworming, vaccination) and housing facilities. The common goat diseases observed in the selected villages were PPR, enterotoxaemia, foot and mouth disease, pneumonia, colibacillosis, anemia, diarrhea, foot-rot and parasitic diseases. Outbreaks of PPR and FMD were common in the region. Parasitic

infestations were very high largely due to drinking of stagnated and contaminated pond-water, shared grazing and housing with other livestock species, and non-adoption of deworming schedule. Incidences of mortality were high in kids (20-50%), particularly in large flocks and could be attributed to overcrowding and unhygienic management of kids.

### Housing of Goats

The goats were kept mostly in human dwellings (50%), with other livestock species (32%) and in a separate house (18%) in the Hamirpur district. The corresponding goat housing in Mahoba district was 45 percent, 39 per cent and 16 per cent, respectively. The cleaning of goat/livestock shelter was done almost daily. Separate housing for goats was provided in case of large flock (>10) only. At night, goats were mostly kept in open verandas in summers and inside the room/house in winters. Ventilation was inadequate in most of the goat houses irrespective of flock size. Due to poor economic conditions of goat-keepers, the housing facilities for goats in this region were sub-optimal. Present results were in agreement to those reported by Singh *et al.* (2010); Ekambaram *et al.* (2011).

### Goat Production Performance

The average body weight of goats (females) at 6 and 12 months of age was 10.6 kg and 18.1 kg in Hamirpur district and 10.4 kg and 18.5 kg in Mahoba district (Table 3). The average total milk yield, daily milk yield (recorded on the basis of test day) and lactation length were better in Mahoba than Hamirpur district. It could be attributed to availability of larger

**Table 4. Economics and marketing of goat-rearing ring in Bundelkhand region**

Particulars	Hamirpur district	Mahoba district
Average expenditure on feeding (₹)	523	499
Average expenditure on health (₹)	20	19.7
Average expenditure on labour (₹)	201	198
Average expenditure on breeding (₹)	10	16
Average expenditure on others (₹)	9	15
Total cost per goat/year (₹)	754	737
Average income/goat/year (₹)	2446	2476
Goat sold by farmer (%)	27	23
Goat sold through middle-men (%)	71	68
Goat sold through market (%)	1.7	8.2
Retention of milk (%)	30	34
Sale of milk (%)	12	21
Milk consumed by kids (%)	53	50
Average sale price of milk (₹/L)	12	13
Average sale price of Meat (₹/kg)	239	231

grazing area in comparison to Hamirpur district. It was observed in village-wise analysis that performance of goat production (body weight and milk yield) was positively associated with biomass availability in the grazing areas and cultivated or lopped fodder supplementation to goats. The highest production performance was recorded in Chillee village of Hamirpur district and Ari village of Mahoba district.

#### **Economics of Goat Production and Marketing Practices**

The major expenditure in goat production was on feeding (63.45%) and labour (grazing charges (31.2%). The grazing charges of a goat ranged from ₹ 50 to ₹ 100 across villages and seasons (Table 4). The male goats were sold maximum (70%) up to the age of 6 months, whereas females (yearlings) were retained for reproduction. Male goats were mostly sold (92%) through middleman, whereas female goats were sold (82%) among goat-keepers, except the aged ones. However, the overall sale through middleman was 71.4 per cent in Hamirpur and 68.5 per cent in Mahoba districts. Dixit and Shukla (1995) and Senthilkumar *et al.* (2012) have also reported a similar pattern of goat selling. The sale of male kids of goat accounted for 64 per cent of the total income from goat-rearing. The milk of goat after household consumption is sold. Goat milk for house hold retention was 25.9 per cent in the

villages of Hamirpur and 40.0 per cent in the villages of Mahoba district. The sale of goat milk is not common and is attempted by households who have good number of adult female goats. Lower milk yield, more labour cost and low milk price were the other reasons of less sale of goat-milk. The sale of goat milk accounted for 16 percent of total income from goat farming.

#### **Constraints to Goat- farming in Bundelkhand Region**

The feeding of goats was the most significant problem due to scarcity of fodder and degradation of common grazing resources (CGRs) (Table 5). Due to growing livestock population and lack of management of common grazing resources, both yield and quality of grasses and carrying capacity of CGRs have declined. Knowledge gap and poor need realization for important inputs and practices were another important constraint at individual farmer's level. Poor veterinary services for prophylactic and curative measures were ranked as the IV<sup>th</sup> constraints by goat-keepers in both the districts. Goat shelter and housing was another important constraint ranked V<sup>th</sup> in Hamirpur and VI<sup>th</sup> in Mahoba districts. The problem of inadequate availability of high potential and known pedigree buck was ranked VII<sup>th</sup> and VI<sup>th</sup> in Hamirpur and Mahoba districts, respectively. Bucks used by farmers were either stray bucks or were of unknown

**Table 5. Constraints to goat keeping in Hamirpur and Mahoba districts**

Constraint	Hamirpur		Mahoba	
	Rank	Score	Rank	Score
Knowledge gap	2	6.6	3	6.4
Feed and fodder scarcity	1	7.6	2	6.6
Degradation of common grazing resources	3	5.6	1	7.0
Inadequate veterinary services	4	5.4	4	5.5
Scarcity of quality bucks	7	3.9	5	4.5
Inadequate housing	5	4.9	6	4.3
Credit for inputs	6	4.6	7	3.9
Poor structure for marketing of goat and goat milk	8	3.3	8	3.2
Inadequate resources of safe water	9	2.7	9	2.9

**Table 6. Impact of interventions on livestock (goat) production, survivability and CPRs: 2009-10 to 2012-13**

Attribute /Character	2009-10	2011-12	2012-13
Deworming adoption by goat-keepers in goats (%)	55(N=404)	69(N=459)	87(N=510)
Vaccination adoption by goat keepers in goats (%)	65(N=404)	82(N=459)	95(N=510)
Goat mortality (%)	29.4	11.2	4.2
PPR and FMD outbreaks in villages	7	0	0
Body weight at 6 months (kg)	8.6(82)	10.2 (106)	12.4(98)
Milk yield per lactation (litre)	42 (76)	59 (56)	82 (273)
Lactation length (days)	86(76)	106(56)	127(122)
Mixed ration & minerals adoption by goat keepers (%)	8	14	42
Breeding with elite buck by goat keepers (%)	17	42	59
Establishment of progressive farms in selected villages (No.)	nil	4	6
Deworming adoption by goat-keepers in their bovines (%)	55 (N=404)	69(N=659)	87(N=810)
Vaccination adoption in bovines (%)	65 (N=404)	82(N=724)	95(N=810)
Incidences of bovine mortality (%)	9.6	5.1	3.7
Annual fodder yield (q/ha)	300	500-700	500-800
Perennial fodder yield (q/ha)	-	600-800	800-1000
Fodder cultivating farmers (No.)	87	132	175
Milk yield of buffaloes (litre/lactation)	940 )	1218 (51)	1570 (106)
Lactation length of buffaloes (days)	245 (56)	271 (51)	286 (106)
Milk yield of cows (litre/lactation)	618 (86)	802(51)	972(81)
Backyard poultry units (No.)	43	58	66
Distress sale (market linkage development)	Traders	Local NGOs &traders	Tata Trust & local NGOs
Pot for clean drinking water for livestock	31	42	48
Community pasture improvement	-	Perennial grasses	Pasture grazing & rotational grazing

Note: Figures within the parentheses are number of observations

**Table 7. Recommended goat-based integrated livelihood models**

Model	Unit	Net income	Suitability to household category	Number of households covered
Goat+ Poultry	15 adult F+ 25 chicks	₹ 56625 (52500+4125)	Landless Marginal	64
Goat+ Cow+ Poultry+ Crops (rain-fed)	10 adult F+ 2 cows + 50 chicks + 1 ha	₹ 73250 (35000+22000+ 8250+8000)	Landless Marginal Small	142
Goat+ Buffaloes+ Cows+ Crop (semi-irrigated)	5 adult F + 2 buffaloes+ 2 cows + 2 ha	₹ 101500 (17500+32000+ 22000+30000)	Marginal Small Medium large	80
Goat+ Buffaloes+ Cows Crop (semi-irrigated)	10 adult F+2 buffaloes+ 2 cows+ 2 ha	₹ 119000 (35000+32000+ 22000+30000)	Semi-medium Medium Large	56

Note: Above models were suggested for Bundelkhand on the basis of experiments with listed inputs/commodity utilized,  
F = Female goats

pedigree. Inbreeding was also high on account of selection from own flocks over the generation. The ratio of breeding does and bucks was high, more than 100:1, which was due to non-availability of bucks, may be due to unwillingness to rear bucks on account of high management cost. Results were in agreement of those reported by Singh and Rai (2006); Gaur and Pathodiya (2008) and Singh *et al.* (2009). The poor access to credit of goat-keepers was observed another important constraint to improving the management system, especially among landless, marginal and small farmers. Low price realization by goat farmers in the absence of organized marketing structure for the sale of goat and goat milk, was also reported to be an important constraint. The scarcity of clean water round the year has emerged as a specific constraint in most villages of the region.

### Critical Gaps in Goat Management and Production

The critical gap for stocking rate was very high (> 500%) and indicates the feeding status of goats. Similarly, the gap for concentrate and green fodder supplementation, quality bucks availability and goat survivability were 400 per cent, 233 per cent, 150 per cent and 100 per cent, respectively. Due to low adoption of inputs and management practices, the gap for milk yield, lactation length and body weight at 12 months of age was 100 per cent, 49 per cent and 29 per cent, respectively. Higher (20-25%) productivity and

survivability of goats was observed in those villages which had better grazing material in the rangeland in both the districts. To minimize these gaps, concrete efforts were needed at the level of stakeholders, development agencies (livestock, forest, fodder and rural development) and policy makers (Singh *et al.*, 2005; Misra *et al.*, 2010). Improvement and sustainable utilization of CPRs along with veterinary services are vital for livelihood security of the poor people of this eco-fragile region.

### Adoption and Impact of Introduced Interventions

Initially, the goat breed Barbari was provided to the poor farmers of selected villages. Adaptability and survivability was low of “Barbari breed”; and moderate to high for Sirohi and Jakhrana breeds. Considering the lower adaptability of goats from other regions, Bundelkhandi goats were provided to farmers of this region. The high potential bucks of Jakhrana, Sirohi and Bundelkhandi breeds were also provided to the farmers and castration of scrub bucks was taken up simultaneously.

Initially, there was low level of the adoption of vaccination and deworming among goat-keepers even for free. The heavy morbidity and mortality in non-adopted flocks and in neighbouring villages (due to outbreak of PPR, enterotoxemia and FMD) and the absence of outbreak in adopted villages motivated the goat keepers to adopt health care calendar. No outbreak of infectious disease was reported in the study villages



occurred due to timely adoption of prophylactic measures, whereas in the neighboring villages, goat mortality was observed in the range of 20-55 per cent over the flocks.

Concentrate feed was provided to pregnant and lactating goats, and growing kids. Season-specific fodder crop varieties suitable for poor irrigation and rain-fed conditions, were introduced, viz. sorghum (MP Chari), cowpea + sorghum (PC-6)/ bajara (AVKB-19), berseem (bundel berseem-2 and JHB 146), oat (Bundel Jai 822) and perennial grasses (NB hybrid/guinea grass). Fields of horti-silvipasture were also established in low fertile and waste lands. Plantation and spray seeding of legume grasses in common grazing land was attempted; however, it resulted in low survival due to uncontrolled and overgrazing. A higher production (40-70%) of fodder crops was observed over traditional varieties; however, cultivated fodder was preferably given to buffaloes and high-yielding cows by the farmers (Table 7).

Low cost innovative goat shelters, feeders and water devices were provided to the selected beneficiaries for their adoption among farmers. Goat-keepers of selected villages were introduced to organize goat markets through KSS supported by Tata Trust, which provides a remunerative price on live weight basis. It helped in realizing a better price by the goat keepers. To genetically improve the potential of Bundelkhandi goat breed, a kid nursery was established. These kids after maturity will be supplied again to goat keepers to be used as breeding bucks. Milk yield, lactation length, body weight and survivability of goats had increased by 20-55 per cent over time with the adoption of strategic feeding, breeding practices and prophylactic measure. The average price of a goat at one year age increased from ₹ 2,500 (in 2010) to ₹ 4,500 (in 2012) and ranged even up to ₹ 10,000 in some cases. Some goat-keepers (10-15%) have even obtained insurance cover for their goat after realizing their economic value. The goat keepers were found to have a net income of ₹ 19,000 with a unit of 5 adult goats that ranged from ₹ 15,000 to ₹ 29000. The goat-keepers have realized the benefits of adopting the suggested low-cost interventions not only in study villages but in neighbouring villages also. However, the availability of vaccines and maintenance of cold chain at block/tehsil level, micro-credit and CPRs have to be ensured for their long-term acceptability.

## Conclusions

The study has concluded that goat-rearing has tremendous potential for improving the food, employment and livelihood security of rural people. However, a holistic livestock policy and consistent efforts are required to minimize technological knowledge gap on improved goat management practices, watershed development, fodder conservation and sustainable agro-forestry models. The use of CPRs is to be sustained by comprehensive measures through regulatory, technological and intuitional interventions.

Community mobilization for rearing breeding buck, custom hiring of livestock services and fodder bank are other important issues and need to be effectively addressed. Due to weak economic base of goat farmers, they may be provided initial support for input supply to realize the benefits through increased adoption of innovations and technologies. The goat-based integrated livelihood models have been suggested for different categories of households in rural areas. The capacity building of goat-keepers is necessary to bring a change in goat-keepers' orientation, attitude and approach. Active support services, availability of key inputs (vaccines, breeding bucks etc.) and a policy support for better access to micro-credit will have to be ensured for making goat farming a key tool to alleviate poverty, check migration, provide employment, manage malnutrition and attract youths for making agriculture and livestock farming more profitable even in less fertile areas.

## Acknowledgements

The authors are thankful to Dr A P Srivastava , National Coordinator (NAIP, Comp-3) for his technical guidance. The financial help provided by NAIP, ICAR, New Delhi is gratefully acknowledged.

## References

- Dev, Mahendra. S. (2012) *Small Farmers in India: Challenges and Opportunities*. WP-2012-014. Indira Gandhi institute of Development Research, Mumbai (<http://www.igidr.ac.in/pdf/publication>).
- Dixit, A. K., Singh, M. K., Reddy, B. S. and Manohar, N. S. (2012) Potential of wastelands for mixed farming system in India. *Range Management and Agro-forestry*, **33**(2): 118-122.

- Dixit, A. K., and Shukla, B. D. (1995) Efficiency of different marketing channels for goat in Etawah district of Uttar Pradesh. *Indian Journal of Agricultural Economics*, **50**: 331.
- Ekambaram, B., Gupta, B. R., Prakash Gnana, M., Sudhaker, K. and Reddy, V. R. (2011) Housing, breeding and management practices of Mahabubnagar goats. *Indian Journal of Animal Sciences*, **81**(8): 875-879.
- Gaur, M.L. and Pathodiya, O.P. (2008) Constraints perceived by farmers in goat rearing in Mewar region of southern Rajasthan. *Indian Journal of Animal Sciences*, **78**: 124-126.
- Gurjar, M. L., Pathodiya, O. P., Jingar, S. C. and Sharma, M. C. (2008) Health care and marketing practices of goats in Mewar region of Southern Rajasthan. *Indian Journal of Small Ruminants*, **14**: 243-247.
- Jodha, N.S. (1992) *Common Property Resources — A Missing Dimension of Development Strategies*. Discussion paper 169. The World Bank, Washington DC, USA.
- Kumar, S., Vihan, V.S. and Deoghare, P.R. (2003) Economic implication of disease in goats in India with reference to implementation of a health plan calendar. *Small Ruminant Research*, **47**: 159-164.
- Misra, A.K., Rama Rao, C. A. and Ravishankar, K. (2010) Analysis of potentials and problems of dairy production in rain-fed agro-ecosystem of India: *Indian Journal of Animal Sciences*, **80**: 68–72.
- Rai, A.K. and Rai, P. (2010) Role of silvipastoral system in increasing productivity of small ruminants. *Range Management and Agro-forestry*, **31**: 102-08.
- Rai, B. and Singh, M.K. (2004) Rearing practices of Jakhrana goats in their native tract. *Indian Journal of Small Ruminants*, **10**: 33-35.
- Rakib, A. (1998) Grazing Resources and Livestock Productivity with special references to goat production. *Indian Journal of Animal Sciences*, **68**: 846-848.
- Saran, S., Singh, R.A., Singh, Rajvir, Rani, S. Issabella and Singh, K.K. (2000) Feed resources for rearing livestock in the Bundelkhand region of Uttar Pradesh. *Indian Journal of Animal Sciences* **70**: 526-529.
- Senthilkumar, S., Ramprabhu, R. and Pandian, Serma, Saravana (2012) *Indian Journal of Small Ruminants*, **18**: 129-131.
- Singh, M.K. and Rai, B. (2006) Barbari breed of goat: Reasons of dilution in its home tract. *Indian Journal of Animal Sciences*, **76**: 716-719.
- Singh, M.K., Goel, A.K., Rai, B., Kumar, Ashok and Sharma, M. C. (2010) Impact of breed improvement programme on goat production under farmers flocks. *Indian Journal of Animal Sciences*, **80**: 379-81.
- Singh, M.K., Rai, B., Kumar, Ashok, Simaria, M.B. and Singh, N.P. (2009) Performance of Zalawadi goats under range conditions. *Indian Journal of Animal Sciences*, **79**: 68-72.
- Singh, K.P., Dixit, S.P., Singh, P.K., Tajane, K.R., Gurmej, Singh and Ahlawat, S.P.S. (2009) Economics of goat farming under traditional low input production system in north Gujarat region of India. *Indian Journal of Animal Sciences*, **79**: 948-951.
- Singh, V.K., Suresh, A., Gupta, D.C. and Jakhmola, R.C. (2005) Common property resources rural livelihood and small ruminants in India: A review: *Indian Journal of Animal Sciences*, **75**: 1027-36.
- Snedecor, G.W. and Cochran, W.G. (1989) *Statistical Methods*, 8th edn. Iowa State University Press, Ames, Iowa, USA.

