



Economic viability of goat breed improvement programme (Barbari × non-descript) at farmer's flock in Uttar Pradesh

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ABSTRACT

A goat breed improvement programme was launched during 2007–08 in 20 districts of Uttar Pradesh. Potential Barbari bucks (75) were distributed to 68 goat keepers to improve their non-descript flocks. After 2–3 years, the entire flock achieved 50–87.50% Barbari genome. Thereafter, an impact study was conducted. The mean body weight of improved breed at birth, 6, 12 and 18 months were 1.90 ± 0.08 and 1.80 ± 0.07 , 8.20 ± 0.12 and 7.90 ± 0.17 , 15.50 ± 0.32 and 13.50 ± 0.18 and 32.50 ± 1.70 and 24.40 ± 2.20 kg in male and female, respectively, which were higher than the existing local goats except birth weight. The improved flock showed lower age at puberty, first conception and first kidding as 240 ± 4.50 , 425 ± 4.50 and 605 ± 5.10 days as against local goats i.e. 258 ± 5.50 , 450 ± 5.52 and 680 ± 6.10 days, respectively. The multiple births were higher in improved breed (57.30% twins and 8.50% triplets) than local flocks (50.00 and 4.50%). There was significant improvement in prolificacy of improved breed (1.85%) than non-descript (1.50%). The milk yield per day and lactation was significantly higher in Barbari than non-descript. Although, the higher mortalities were observed in Barbari than non-descript. The net return per goat/annum worked out to be ₹ 1207 in Barbari and ₹ 916 in non-descript which was 31.80% higher over local breed. The selling of goat was the major source of income (56.50%) followed by milk (34.40%) and manures (9.10%). The study suggested that Barbary goat breed improvement programme is economically more viable and can be successfully taken up to improve the productivity and profitability of most populous existing local goats at farmer's field in Uttar Pradesh.

Key words: Barbari, Improved breed, Non-descript, Prolificacy, Economic viability

India is the largest goat (16.60%) owning country in the world. It possesses 124.50 million goats and ranked first in world (Singh 2004). The demand of goat meat is progressively increasing as Indians prefer *chevon* than other meats (Sen *et al.* 2004). The annual slaughter rate of goat is about 39.70% even though; its population is increasing @ 3.55% annually. Uttar Pradesh has ranked third (12.94 million goats) in country and shares valuable genetic resources of goat known as Barbari (15.45%), Jamunapari (3.33%) and Jaunpuri (1.89%) as per Livestock Census, 2003. Barbari breed is extensively used in goat improvement programme in India and abroad due to its economic traits. Unfortunately, the breed is seriously declining in its home tract and reached to endangered category (Singh and Rai 2006) due to several reasons. Realizing the role of this breed in economy and wellbeing of rural people in Uttar Pradesh, a breed improvement programme was initiated by Krishi Vigyan Kendras (KVKs) during 2007–08 to improve the most

populous, poor productive, non-descript goat.

MATERIALS AND METHODS

Zonal Project Directorate, Zone-IV, Kanpur (Uttar Pradesh) selected 20 KVKs (Districts) and initiated a cross breeding programme (Barbari × non-descript) to improve the local goats during 2007–08. Pure and high potential Barbari bucks (75) were provided to 68 goat keepers @ 1 buck/ 20 does approximately in adopted villages. Local male/ bucks were either sold or castrated to avoid inbreeding. Goat keepers were motivated to adopt the keeping of Barbari breed. After 2–3 years, of cross breeding/grading up the entire flock achieved 50–87.50% Barbari genome. Under identical condition of feeding and management, 100 goat keepers having local goats were also selected for comparative study. Information on flock composition, feeding, housing management, disease status etc. were recorded using semi-structured interview schedule. Performance data on body weight, reproduction, milk production, economic performance etc. were recorded by Subject Matter Specialists (Animal/Veterinary Science) of KVKs in respective districts through weekly visits in adopted villages.

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RESULTS AND DISCUSSION

Flock management: Goat keepers raised their goats solely on browsing tree/shrub leaves and grazing stubble of cultivated field crops, natural pasture under free range grazing/extensive system. Feeding of concentrate was almost negligible except during sickness or kidding. They were mostly landless, resource poor and have nothing to feed their flock except grazing. Thus, decreasing of grazing resources was felt major constraint for goat keepers. Similar views were held by Gujar and Pathodiya (2008) in Mewar region of southern Rajasthan and Braj Mohan, *et al.* (2009) in Mathura district of Uttar Pradesh. Majority of flocks (85%) were kept in open/shade of trees and remaining under thatched shed. Old men, women or children of family took care, time to time of their flock. Hence, family labour was included in feeding expenditure. The flock size and range are given in Table 1.

Body weight and growth rate: The body weight gained and growth performance of Barbari improved and *desi* goats are given in Table 2.

Birth weight: Mean birth weight of male and female kids in Barbari was 1.90 ± 0.18 and 1.80 ± 0.17 kg respectively. The birth weight of non-descript (male and female) was higher (1.95 ± 0.13 and 1.82 ± 0.19 kg) than Barbari but the difference was statistically insignificant. It was due to higher percentage of multiple births in Barbari than non-descript. Similar birth weight was reported by Bharathidhasan *et al.* (2009) as 1.92 ± 0.07 and 1.84 ± 0.14 kg and Prakash *et al.* (2009) as 1.90 and 1.63 kg, respectively, for male and female. In Barbari breed male kid weighed 5.50% higher birth weight than female kid. Bharathidhasan *et al.* (2009) also observed 4.72% higher birth weight of male than female kid in Barbari.

Table 1. Flock size and range of goat

Breed	Improved breed	Non-descript
Number of goat keepers	68	100
Flock ranges	15–35	5–110
Average flock size	21.00	28.10

Table 2. Body weight and growth rate of goats

Body weight (kg)		Barbari	Non-descript	Significance
At birth	Male	1.90 ± 0.08	1.95 ± 0.13	NS
	Female	1.80 ± 0.17	1.82 ± 0.19	NS
At 6 months	Male	8.20 ± 0.12	7.90 ± 0.25	NS
	Female	7.90 ± 0.17	7.50 ± 0.27	NS
At 12 months	Male	15.50 ± 0.32	14.00 ± 0.52	$P < 0.05$
	Female	13.50 ± 0.18	12.80 ± 0.21	$P < 0.05$
Weight gain g/day	Male	37.30 ± 3.05	32.60 ± 2.75	NS
	Female	32.05 ± 2.25	30.40 ± 1.75	NS
18 month	Male	32.50 ± 1.70	28.00 ± 2.10	$P < 0.01$
	Female	24.40 ± 2.20	20.50 ± 2.50	$P < 0.01$

Male kid born as single had higher birth weight than twins or triplets in each breed. Similarly single born females had higher weight than twins or triplets. Males born with females had higher weight than female. The finding is well correlated with the observation of Mishra *et al.* (1978).

Body weight at 6 months: On an average both the male and female kids attained higher weight in Barbari (8.20 ± 0.12 and 7.90 ± 0.17 kg) than non-descript (7.90 ± 0.25 and 7.50 ± 0.27 kg) at 6 months. Likewise, male kids in both Barbari and non-descript were heavier than respective female kids (Table 2). The variations due to effect of breed or sex were statistically not significant. However, Singh *et al.* (2010) reported higher weight (8.03 ± 0.15 to 8.73 ± 0.92 kg) in Barbari at 6 month age at farmer's flock in Mathura districts.

Body weight at 12 months: The overall body weights of goat belonging to Barbari or its types was 15.50 ± 0.32 and 13.50 ± 0.18 kg for buck and goat lings at 12 months, respectively. The corresponding figures for non-descript was 14.00 ± 0.52 and 12.80 ± 0.21 kg, respectively. The body weight of both male and female in Barbari was significantly higher ($P < 0.05$) than non-descript. Likewise the body weight of males was significantly higher ($P < 0.05$) than females in both the flocks. Srivastava *et al.* (1968) reported similar body weight (14.52 ± 0.76 kg) in Barbari at this age.

Growth rate: The average growth rate (g/day) was 37.30 in male and 32.05 in female of Barbari and 32.60 in male and 30.40 in female of non-descript from birth to 12 month age, respectively. However, the variation between the body weight gain of Barbari and non-descript in buck and goat ling were insignificant. Male kid showed higher growth rate than female since birth to the age of 12 month. Barbari grew at faster rate than non-descript.

Body weight at 18 months: The average body weight of Barbari buck and doe was 32.50 ± 1.70 and 24.40 ± 2.20 kg while the corresponding figures for non-descript was 28.00 ± 2.10 and 20.50 ± 2.50 kg, respectively. The variations in body weights within breed and sex were highly significant ($P < 0.01$). However, higher body weight in Barbari buck (37.85 ± 1.96 kg) was reported by Srivastava *et al.* (1968) but the corresponding figure for does (22.56 ± 0.32 kg) was almost identical to present findings. Similar body weight (24.12 ± 0.31 to 30.11 ± 0.91 kg) of goats was also reported by Singh *et al.* (2010) for Barbari breed at this age.

Reproductive performance of goats

Age at puberty: The overall mean age at puberty was 240 ± 4.50 and 258 ± 5.50 days in Barbary and non-descript, respectively (Table 3). The difference was statistically significant ($P < 0.01$). Similar age at puberty (236 ± 3.48 days) was observed by Prakash *et al.* (2009) in Barbari.

Age at first conception: Barbari conceived at lower age (425 ± 4.50 days) than non-descript (450 ± 5.52 days). However, Prakash *et al.* (2009) found the lower range of age at first conception between 313 to 419 days in Barbari.

Age at first kidding: Improved and non-descript breed started reproduction, at an average age of 605 ± 5.10 and 680 ± 6.10 days, respectively. Barbari had approximately 75 days lower age at first kidding than non-descript. Srivastava *et al.* (1968) reported 43 day higher mean age of first kidding (648 ± 36 days) in Barbari than present findings.

Gestation period: The gestation length of Barbari and non-descript was same (150 ± 1.10 days) in both the genetic group of goat under extensive system of management. Lower range of gestation period as 148.80 to 149.80 days was observed by Prakash *et al.* (2009) for Barbari breed. Sequence of kidding e.g. single, twin and triplets, did not show any trend for gestation period in both the breed.

Kidding interval: The kidding interval was recorded to be the same i.e. 330 days in both of the breed. The duration did not differ significantly under identical condition of feeding and management. Higher kidding interval (348 ± 9 days) was reported by Srivastava *et al.* (1968) and lower intervals (303 ± 4.71 days) by Prakash *et al.* (2009) in Barbari breed as compared to present findings.

Prolificacy and litter size: Among the total kidding 34.20, 57.30 and 8.50% goat gave birth to singles, twins and triplets in Barbari, respectively. The corresponding figures were 45.50, 50.00 and 4.50% for non-descript, respectively. Reproduction of highest percentage of twins and triplets became the most liking factor of Barbari by the farmers. Srivastava *et al.* (1968) find out the litter size as 49.64% singles, 49.32% twins and 1.04% triplets for same breed. Single birth was more common in first kidding, while twins and triplets increased gradually with the advancement of age. Overall average prolificacy per kidding was 1.85 in Barbari and 1.55 in non-descript. The sex ratio for male and female was almost 55:45 in each flock.

Milk production performance

Milk production: Milk production of Barbari and non-descript under identical condition of feeding and management were studied. Average milking was 0.60 ± 0.022 and 0.50 ± 0.024 kg/day, respectively (Table 4). Similar finding of 0.76 and 0.57 kg/day was reported by Srivastava *et al.*

Table 4. Milk production performance of goats

Productive traits	Barbari	Non-descript	Significance
Milk production (kg/day)	0.60 ± 0.022	0.50 ± 0.024	$P < 0.05$
Lactation yield (kg)	105.00 ± 1.42	82 ± 1.32	$P < 0.05$
Lactation length (days)	150 ± 1.28	145 ± 2.29	NS
Dry period (days)	190 ± 3.29	210 ± 3.25	$P < 0.05$

(1968) and Prakash *et al.* (2009), respectively under free range grazing system of Barbary breed.

Lactation yield: Annual average lactation yield per doe was 105.00 ± 1.42 and 82 ± 1.32 kg for Barbary and non-descript, respectively. Similar average lactation yield (107 ± 3.27 kg per doe) was reported by Srivastava *et al.* (1968) for Barbari breed at farmer's flock.

Lactation length: The lactation length was 150 ± 1.28 and 145 ± 2.29 days in Barbari and non-descript, respectively. The variation in lactation length was statistically insignificant. Similar finding of 150 ± 2.28 and 145 ± 3.29 days were observed by Srivastava *et al.* (1968) and Prakash *et al.* (2009), respectively for the breed.

Dry period: The dry period was significantly ($P < 0.05$) higher in non-descript than Barbari. The duration of dry period was 210 ± 3.25 and 190 ± 3.29 days, respectively. Comparatively lower dry period (155.3 ± 10.60) was reported by Srivastava *et al.* (1968) for the breed. The higher dry period in present study was due to extensive system of management and not following the weaning practice.

Mortality and morbidity: Overall average mortality in kid and adult was 7.00 ± 0.02 and $5.80 \pm 0.04\%$ in Barbari and 5.50 ± 0.09 and $4.20 \pm 0.05\%$ in non-descript, respectively (Table 5). Singh *et al.* (2008) reported 3.64 to 10.17% kid mortality in Jamunapari and Nandini *et al.* (2011) 9.63% in Black Bengal. Occurrence of death in young was more than adults. The mortality was significantly ($P < 0.05$) higher in Barbari than non-descript. The mortality and morbidity showed decreasing trend with advancement in age of goat. The incidence of mortality due to major diseases in selected 20 districts was highest due to PPR (Pesti des petits ruminant, 30.10%) followed by enterotoxaemia (23.30%), pneumonia (23.30%), goat pox (14.60%) and FMD (8.70%). Other minor incidences were also noticed as HS (Hemorrhagic septicemia), brucellosis, mastitis, faciolosis, coccidiosis, haemonchosis, etc. in many districts.

Table 5. Mortality and morbidity (%) in goats

Mortality	Barbari	Non-descript	Significance
Kid	7.00 ± 0.02	5.50 ± 0.09	$P < 0.05$
Adult	5.80 ± 0.04	4.20 ± 0.05	$P < 0.05$

Table 3. Reproductive performance of goats

Reproductive traits	Barbari	Non-descript	Significance
Age of puberty (days)	240 ± 4.50	258 ± 5.50	$P < 0.01$
Age at first conception (days)	425 ± 4.50	450 ± 5.52	$P < 0.01$
Age at first kidding (days)	605 ± 5.10	680 ± 6.10	$P < 0.01$
Gestation period (days)	150 ± 1.10	150 ± 1.10	NS
Kidding interval (days)	330 ± 4.10	330 ± 3.10	-
Birth type (%) Single	34.20	45.50	-
Twin	57.30	50.00	-
Triplets	8.50	4.50	-
Average litter size	1.85	1.50	-

Economic viability of goat farming

Flock status: The initial flock size of Barbari and non-descript were 21.00 and 27.10 individuals, respectively (Table 6). After 1 year, the respective breeds were maintained constantly at 22.50 and 28.40 individuals. The sell percentage was higher in Barbari (73.30) than non-descript (62.70).

Investment pattern: The average annual investment per house hold in Barbari and non-descript were Rs 36,066 and 47,171, respectively with an overall average of Rs 41,619 (Table 7). The capital investment was 80.30% on initial stock. This was supported by Singh *et al.* (1995). The annual maintenance cost per goat worked out to be higher in Barbari (Rs 401) as compared to non-descript (Rs 294) with an overall average of Rs 348. The average expenditure on feeding/ grazing per goat was only Rs 231 and 201 respectively. The annual expenditure on veterinary aids per goat was higher in Barbari (Rs 38) than non-descript (Rs 30).

Economic return: The gross return per house hold was Rs 61,408 and 72,005 from Barbari and non-descript, respectively. The net return per unit over variable cost worked out to be Rs 25,342 from Barbari and Rs 24,834 from non-descript with an overall average of Rs. 24,998 (Table 7). The major income was from sell of goats (56.50%), followed by milk (34.40%) and manure (9.10%). Almost similar findings

were consisted by Gupta *et al.* (1992) and Singh *et al.* (2009). The net return per goat/annum was higher in Barbari (Rs 1,207) than non-descript (Rs 916) with an average of Rs 1,066. The B:C ratio was also higher in Barbari (1.70) than *desi* goats (1.52). Higher B:C ratio (2.0 in Barbari) was reported by Singh *et al.* (2009). Over all Barbari or improved breed gave 31.80% higher net return due to its higher litter size over local breed.

The overall, productive and economic traits indicate the superiority of improved breed over non-descript. The body weights at different ages were higher in Barbari than non-descript in both male and female, respectively except birth weight. There was lower age at puberty, first conception and first kidding in Barbari than non-descript. Barbari has birth of 57.3% twins and 8.50% triplets as against 50.00 and 4.50% in non-descript, respectively. The overall average prolificacy of Barbari (1.85) was superior to existing local goats (1.50). However, the mortality in both kid and adult were higher in improved breed than non-descript needs proper health care. The net earnings of Rs 1,207 per goat/annum were obtained from Barbari as compared to Rs 916 in *desi* goats. Based on study, it is concluded that superior/potential Barbari bucks can be successfully used for crossbreeding/grading up to improve the inferior and non-descript goats in rural areas on mass scale to make the goat farming economically more viable.

Table 6. Breed wise flock status

Breed wise	Initial flock size	Sold numbers	Sold percentage	Current flock size
Barbari	21.00	15.40	73.30	22.50
Non-descript	27.10	17.00	62.70	28.40
Average	24.05	16.20	68.00	24.65

Table 7. Economics of Barbari vs local goat breed (Rs)

Breeds/ annual expenditure	Barbari	Non-descript	Average
Average flock sizes	21.00	27.10	24.05
Value of initial stock	27,639	39,204	33,422
i) Feeding/grazing cost	4,860	5,440	5,150
ii) Depreciation on shed	2,769	1,714	2,242
iii) Veterinary aids	798	813	806
Total (i to iii)	8,427	7,967	8,197
Total investment	36,066	47,171	41,619
Annual income			
Value of existing stock	33,711	41,605	37,568
i) Sell of goats	15,280	17,520	16,400
ii) Sale of milk	9,624	10,398	10,011
iii) Sale of manure	2,793	2,482	2,638
Total (i to iii)	27,697	30,400	29,049
Gross income	61,408	72,005	66,617
Net income	25,342	24,834	24,998
Net profit/ goat	1,207	916	1,040
B:C Ratio	1.70	1.53	1.60

*Sale of goats includes all e.g. kid, buck, doe and spent.

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