Production of Crossbred Lambs through Artificial Insemination of Non-prolific Medium Size Malpura and Avikalin Ewes Using Fresh Diluted Semen of Prolific Micro Size Garole Rams

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ABSTRACT : Six adult Garole rams maintained under a semi-intensive system were used as semen donors for this study. Semen was collectied daily during the monsoon season with the help of an artificial vagina and examined for its quality characteristics. Ejaculates of thick consistency, rapid wave motion, ≥80% motility and intense movement of motile spermatozoa were diluted at the rate of 1:1 with egg yolk McIllvaine glucose diluent at 30°C in water bath. Estrus in ewes was detected by parading aproned rams of proven vigour at 12 h intervals. The ewes (54 Malpura and 23 Avikalin) in estrus were artificially inseminated with fresh diluted ram semen. The overall conception rate was 94.8%, (range 91.7 to 100%). The overall lambing percent was 80.5 with a range of 75.0 to 84.6%. There was no significant (p>0.05) difference in lambing and conception rate because of individual rams. Fertility was significantly lower (p<0.05) in ewes of less than two years and more than six years of age. Breed (Malpura and Avikalin) effect was not observed in conception and lambing rate (p>0.05). No significant difference (p>0.05) in birth weight and 12 month weight was observed between Garole×Avikalin and Garole×Malpura crossbred lambs but there was significant (p<0.05) difference at three month and six months body weight of both the crossbred lambs. *(Asian-Aust. J. Anim. Sci. 2002. Vol 15, No. 5 : 633-636)*

INTRODUCTION

Garole sheep found in Sunderban area of West Bengal (87°-89°E longitude and 21°-23°N latitude) are India's most valuable germplasm among existing sheep breeds due to high prolificacy, non-seasonal nature of reproductive rhythm, and adaptive merit of thriving well under most harsh and adverse climatic conditions. It can not only graze on muddy and marshy land but can also graze in standing water. Garole sheep, also referred as 'microsheep', are of very light weight weighing 10-14 kg at maturity and produce multiple births with an average of 2.27 lambs (Ghalsasi and Nimbkar, 1993). Age at first puberty is 7-9 months with age at first lambing being 12-14 months (Sharma et al., 1999). It is speculated that Australian scientists evolved the Booroola Merino sheep by crossing Garole with Spanish Merino (Beetson, 1979; Turner, 1982). This is a prolific breed and is reported to produce 7.3% single, 65.45% twins, 21.8% triplet and 5.45% quadruplets (Ghalsasi and Nimbkar, 1993). The ejaculate volume of Garole rams is small, varying from 0.1 to 0.9 ml (Joshi et al., 1999) averaging 0.58 ml (Joshi et al., 2000). Infusion of prolificacy traits of Garole breed into monotocus sheep breeds of our country might be the best scope for enhancing carpet wool and mutton production. The proper assessment of reproductive potential of Garole rams under semi-arid

region where sheep husbandry plays a dominant role in agro-economy is essential. The aim of the present study was to 1) introduce small size prolific Garole germplasm into medium sized Malpura and Avikalin sheep by breeding them artificially for producing crossbreds, and 2) determine the effect of individual ram, age and breed of ewes on success rate (conception and lambing) following artificial insemination (AI) with fresh diluted Garole ram semen.

MATERIALS AND METHODS

Location of study site

The study was conducted at the farm of Central Sheep and Wool Research Institute, Avikanagar. This area is located in a semi-arid region of sub-tropical India at longitude 75°-28°E, latitude 26°-26°N, and at altitude of 320 meter above mean sea level. The maximum and minimum ambient temperature ranges from 25.0 to 46.0°C, 17.0 to 37.0°C, respectively and mean relative humidity ranges from 15 to 90%. Adult Garole rams were transported with a flock of ewes from their natural habitat in West Bengal to the Institute farm in Rajasthan.

Experimental animals

Six healthy adult Garole rams were used as semen donors. The AI with Garole ram semen was done in Malpura and Avikalin ewes. Malpura is a triple purpose hardy sheep, which has originated from the arid and semi-arid tracts of western tropical India. It is a coarse wool

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breed with fairly well built body, long legs, light brown face having short and tubular ear with a small cartilaginous appendage on the upper side. The average body weight of Malpura ewes is 29.1 kg and ram is 41.6 kg. Avikalin animals have been evolved by stabilizing the crossbred population of Rambouillet×Malpura at 50% inheritance. The adult body weight of Avikalin ewes is 30.9 kg and ram is 44.0 kg. This breed is suitable as a dual purpose sheep for carpet wool and mutton production. Garole is a small size animal with the average adult body weight of male and female being 14.43 kg and 14.14 kg respectively. Garole sheep have a light brownish coat colour having coarse wool but the wool quantity is small in comparison to other sheep breeds.

Management of animals

The experimental animals were maintained under a semi-intensive management system adopted by the Institute. Rams and ewes were kept in separate flocks maintained at a distance and no mixing with each other was allowed. All the animals were allowed to graze for 8-10 h on natural pasture dominated by *Cenchrus ciliaris*. In addition to grazing, animals received 150 gm concentrate/head/day to fulfil their nutritional requirement. Water was offered to all the animals once daily. During night, animals were herded in a side open animal shed.

Collection of semen

Semen from Garole rams was collected once daily for 35 days by using an artificial vagina and examined for its quality characteristics. Ejaculates of thick consistency, rapid wave motion, having ≥80% motility and intense movement of motile spermatozoa were diluted at the rate of 1:1 with egg yolk McIllvaine glucose (EYMG) diluent at 30°C in a water bath (Mathur et al., 1993). The composition of the EYMG diluent was: 100 ml McIllvaine buffer (prepared by titrating 1.78% solution of di-sodium hydrogen orthophosphate dihydrate with 1.68% solution of citric acid monohydrate to pH 7.0); 0.8 g glucose; 0.3 g streptopenicillin and 20 ml egg yolk. Diluted semen samples were carefully filled into round bottom screw cap glass vials (5 ml, 15×75 ml) placed in a beaker of water at the same temperature and packed in a semen shipper containing ice. Care was taken to avoid direct contact of vials with the ice during storage and transport of semen for AI.

Estrus detection and insemination

Estrus in ewes of Malpura and Avikalin breeds was detected by parading aproned rams of proven vigour twice a day. Ewes exhibiting estrus in the morning along with ewes in heat on the previous evening were inseminated. Semen was deposited into the first fold of the os-cervix viewed with the help of a glass speculum in presence of sunlight. Artificial insemination was performed daily using 0.1 ml freshly diluted semen of Garole rams for two consecutive estrus cycles. A total of 77 ewes (54 Malpura and 23 Avikalin) were inseminated during the study. Ewes which did not return to estrus after mating for two consecutive cycle periods were marked as conceived. The data were analyzed using chi-square test (Snedecor and Cocharan, 1967).

RESULTS

The average mean conception and lambing rates are given in table 1. The overall conception rate in Malpura and Avikalin ewes was 94.8% ranging from 91.3 to 96.3%. Similarly the overall percent lambing for both the breeds was 80.5% and ranged from 73.9 to 83.3%. Although the conception and lambing rates were higher in Malpura in comparison to Avikalin ewes, they did not approach significance (p>0.05) except for conception rate in first cycle (p<0.05). The effect of age on conception and lambing rates in the ewes inseminated with Garole semen is presented in table 2. Age-wise conception rate ranged from 88.8% to 100%. The highest conception rate was observed in ewes of ≤2 years of age but it was lowest in ewes of more than 6 years of age. The lambing rate ranged from 53.8 to 89.7% in different age groups. A significantly higher (p<0.05) lambing percent was observed in ewes of 4 to 6 years of age in comparison to young and old animals.

The proportions of ewes which were pregnant following AI using semen from individual donor rams are shown in table 3. The conception and lambing rates for semen donated by different rams ranged from 91.7 to 100% and 75.0 to 84.6%, respectively. However, no significant (p>0.05) differences in pregnancy and lambing rates were attributed to individual rams.

The mean values of body weight at birth, 3, 6 and 12 month of age of Garole×Malpura and Garole×Avikalin lambs are presented in table 4. Body weight at birth was similar in the two crossbreds but Garole×Avikalin lambs

Table 1. Conception and lambing rate of ewes inseminated by fresh diluted Garole ram semen

Breed	Ewes inseminated	Ewes conceived in first cycle no. (%)	Ewes conceived in second cycle no. (%)	Overall conception rate of ewes no. (%)	Overall lambing rate of ewes no. (%)
Malpura	54	43 (79.6%)[b]	9 (81.8%)[a]	52 (96.3%)[a]	45 (83.3%)[a]
Avikalin	23	13 (56.5%)[a]	8 (80.0%)[a]	21 (91.3%)[a]	17 (73.9%)[a]
Total	77	56 (72.7%)	17 (80.9%)	73 (94.8%)	62 (80.5%)

[a,b] Means with different superscript in same column differ significantly (p<0.05).

Table 2. Effect of age on conception and lambing rates in ewes inseminated with Garole ram semen

Age in years	Ewes inseminated	Conception rate no. (%)	Lambing rate no. (%)
≤2	13	13 (100%)^{Aa}	7 (53.8%)^{Bc}
<4	39	37 (94.9%)^{Aa}	35 (89.7%)^{Aa}
<6	16	15 (93.6%)^{Aa}	14 (87.5%)^{Aa}
>6	09	08 (88.9%)^{Aa}	06 (66.7%)^{Bb}
Total	77	73 (94.8%)	62 (80.5%)

^{a,b} Means with different superscript in same column differ significantly (p<0.05).
^{A,B} Means with different superscript in same row differ significantly (p<0.05).

grew relatively faster and gained more weight (p<0.05). Six monthly greasy fleece yield (GFY) of Garole×Malpura lambs was also significantly lower (p<0.05) than that of Garole×Avikalin.

DISCUSSION

Although the age of ewes did not affect significantly the conception rate which varied from 89-100%, subsequent lambing rate was relatively less (p>0.05) in young (≤2 years) and older (>6 years) ewes. Since no abortion was observed, the reason was obviously embryonic mortality. Poor fertility following AI was also reported in older ewes (Sahni et al., 1976) mainly due to higher rate in embryonic losses. Ray et al. (1962) reported 12.5% embryonic mortality following AI in sheep flocks maintained in the semi-arid region of India. Although there is conflicting evidence in literature regarding the effect of age of ewes on prenatal mortality (Edey, 1969; Nancarrow, 1994), it appears that the incidence of prenatal reproductive losses is higher in younger ewes as compared to that in adults. The poor lambing rate (54%) obtained in younger ewes even after having better conception rate (100%) may have been due to embryo loss rather than ovulation or fertilization

failure. This difference in lambing rate and fertility in young ewes may be attributed to its complex interrelationship between body growth and development on one hand and sexual maturation on the other. The findings of others (Dyrmundsson, 1973; Quirke, 1981 and Naqvi et al., 2000) also showed lower lambing rate in young ewes and are in agreement with the results obtained in this study.

The overall conception and lambing rates in Malpura ewes were relatively higher than that in Avikalin ewes. The reason for low conception rate in Avikalin sheep following AI in the first cycle is not clear from the results of this study. Breeds differences in fertility have also been reported by Sahni et al. (1976). The fertility rate reported by them following AI in exotic, native and crossbred ewes varied between 33.5-74.5% during autumn season. Avikalin being crossbred, experienced more environmental stresses compared to their native counterpart (Hooda and Naqvi, 1990) and therefore their reproduction (fertilization and embryo survival) seems to be more affected than native Malpura animals. However, following AI of repeaters ewes in their second cycle, the overall conception and lambing rates of the two breeds were similar. Efficiency of AI was calculated as the number of inseminations required per lambing. Avikalin required 1.9 compared to 1.4 inseminations per lambing in Malpura. This also indicated relatively more prenatal reproductive losses following AI in Avikalin compared to native breed Malpura which is ecologically more adapted to a semi-arid hot environment.

The effect of individual Garole rams on fertility in Malpura and Avikalin ewes is not evident from the results of this study. Other studies demonstrated differences in fertilization rates between rams (Kilgour, 1993) in which some males had higher fertility while others had low fertility. The males in this study were of same age and maintained under the same management practices. Moreover, individual rams sired only 12-13 ewes which may be too small a number for exhibition of the individual effect. The semen quality of individual rams assessed prior

Table 3. Effect of individual rams on conception and lambing rates in ewes inseminated with Garole ram semen

Attribute	Ram-1	Ram-2	Ram-3	Ram-4	Ram-5	Ram-6	Overall
Conception rate	12/13	11/12	13/13	12/13	12/13	13/13	73/77
	(92.3%)	(91.7%)	(100%)	(92.3%)	(92.3%)	(100%)	(94.8%)
Lambing rate	10/13	9/12	10/13	12/13	11/13	10/13	62/77
	(76.9%)	(75.0%)	(76.9%)	(77.8%)	(84.6%)	(76.9%)	(80.5%)

Table 4. Growth and wool production of Garole×Malpura and Garole×Avikalin crossbred lambs produced following artificial insemination with Garole ram semen

Breed	Age in months			GFY (kg)
	0	3	6	
Garole×Malpura	2.38±0.05^a (46)	9.35±0.33^b (44)	14.04±0.47^b (43)	0.309±0.023^b (41)
Garole×Avikalin	2.33±0.12^a (18)	11.71±0.38^a (16)	16.17±0.48^a (16)	0.579±0.007^a (16)

^{a,b} Means with different superscript in same column differ significantly (p<0.05).

to dilution was almost similar which may be the reason for no individual ram effect on fertility. In this context Maurya et al. (1999) have reported that the reproductive potential of Garole rams is good in semi-arid tropics of India.

The body weights of Garole×Avikalin and Garole× Malpura were significantly (p<0.05) higher at birth, 3, 6 and 12 months of age than those of pure Garole sheep (Sharma et al., 1999) but lower than the pure Malpura and Avikalin sheep (Arora et al., 1999). The higher weight gain in Garole×Avikalin lambs as compared to that in Garole×Malpura lambs may be attributed to their genetic characters. The idea of infusion of Garole sheep germplasm in the relatively heavy monotocus breeds of sheep in semi-arid region of India was to introduce prolificacy trait. For this, natural or hand mating was not possible due to extreme variation between the body weight of ram and ewes. From the results of this study it is evident that AI can be successfully utilized to produce crossbred lambs from small sized Garole sires and ewes of 2-3 times in size compared to the sire.

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