CIRG
ANNUAL REPORT
2007-08

Research Achievements

- Goat Genetics and Breeding
- Physiology, Reproduction and Shelter Management
- Nutrition, Feed Resource and Products Technology
- Goat Health
- Extension Education and Socio-Economics
- AICRP
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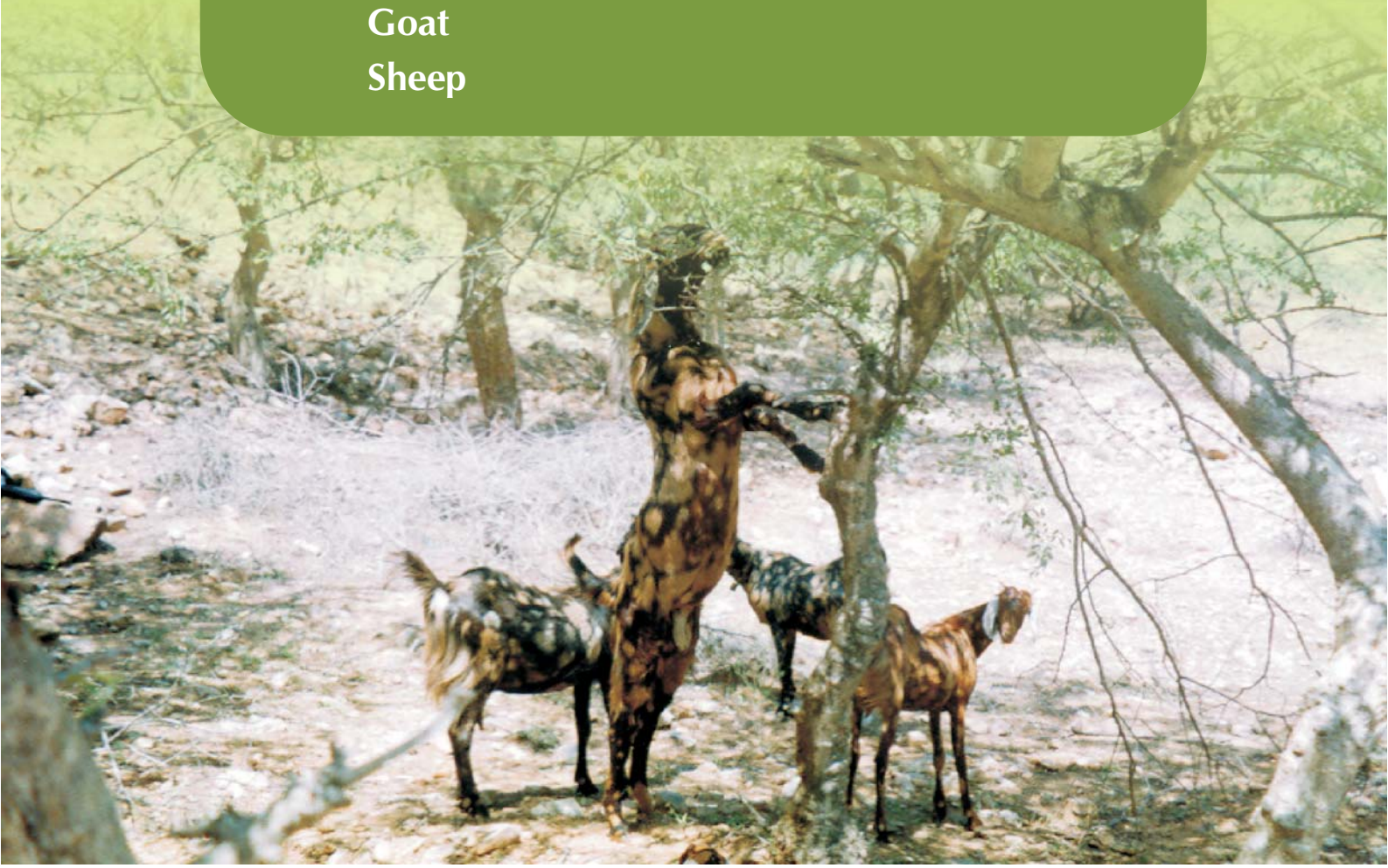


RESEARCH ACHIEVEMENTS

GOAT GENETICS AND BREEDING

GGB-1.09: Genetic Improvement and Sire Evaluation of Jamunapari Goats for Milk Production (AICRP)

M.K. Singh, H.A. Tiwari and T.K. Dutta

Jamunapari is one of the important dual-purpose goat breeds of India with greater recognition for milk yield. Nucleus flock of Jamunapari goats has been established at CIRG in 1983 and since then selective breeding is practiced to improve the performance of flock for body weight, milk and reproduction efficiency traits. Besides generating data base, good quality bucks and does were also distributed for the on going field goat improvement programmes in the country.

Body weight: Average least squares means of body weights of kids at birth, 3, 6, 9 and 12 months of age were 3.16±0.01, 11.45±0.07, 15.51±0.09, 20.87±0.13 and 26.82±0.13 kg, respectively during the period of 2005 to 2007 (Fig. 1), whereas, corresponding average least squares means of body weights of kids for 2007 were 3.28±0.03, 11.99±0.14, 16.41±0.22, 21.54±0.38 and 27.06±0.38 kg, respectively. The average least squares means of body weights of kids at birth and 3 months of age for the year 2008 were 3.21±0.04 and 13.45±0.33 kg, respectively. Year and season of kidding, type of birth, sex of kid, parity and weights of dam at kidding have significantly affected the body weights under study. Kids born as single and males were born with higher birth weight and maintained their superiority up to 12 months of age. Parity has significantly influenced body weight at 3, 6 and 12 months of age, however the magnitude of effect was low. The heritability estimates for body weight at birth, 3, 6, 9 and 12 months of age were 0.272±0.068, 0.169±0.076, 0.230±0.064, 0.213±0.003 and 0.327±0.073, respectively.

Milk Yield: Average milk yield in 90 days, 140 days and total lactation and total lactation length for the period from 2005-2007 were 92.4±0.9, 127.4±1.3, 136.2±1.7 liters and 175.1±1.4 days, respectively; whereas corresponding estimates for the year 2007 were 103.1±2.0, 143.6±2.9, 152.8±4.2 liters and 169.9±3.1days, respectively (Fig 2). Year, season of kidding and does' weight at kidding significantly influenced all the milk performance traits. Goats kidded in winter produced ($P<0.05$) higher milk yield than those, which kidded in autumn and spring. Significantly ($P<0.05$) lower lactation length was observed of does, which kidded in summer. The performance of milk production traits and lactation length's decreases significantly after 5th parity. The observed additive genetic variability for milk production traits was low ranged from 0.098 (90 d MY) to 0.124 (140 d M Y).

Reproductive Performance: The average age at first kidding, weight at first kidding and kidding interval for the year 2007-08 were 754±21 days, 32.6±0.5 kg and 323±5 days, respectively (Table 1). The Multiple birth rates and litter size were 34.2% and 134%, respectively. Kidding percentages on the basis of does available and does tupped were 78.5 and 103.17% respectively (Table 2). Selection differential on the basis of bucks superiority over flock average was 6.4 kg for body weight and 26.6 lit for milk yield. The average body weight of male kids under complete feed (feed lot) at 9 months of age, average weight gain (kg), average daily weight gains during 3-9 months (gm/d), carcass weight, dressing percentage (empty weight) were 27.65±1.51kg, 15.15±1.06, 84.17±5.92, 12.23±1.62 and 55.4±1.67%

respectively, for the group fed with Arhar pellet. Corresponding means were 24.68±2.14 kg, 11.43±1.71 kg, 63.51±9.53, 11.36±12.67 kg and 55.43±3.08, respectively for the group fed with Arhar mesh. The corresponding means for the group of kids fed with Gwar pellet were 25.85±1.31kg, 13.01±0.86, 72.31±4.78, 11.76±0.12 and 54.56±1.67% respectively, and the corresponding means for Gwar mesh were 24.76±1.67 kg, 10.21±0.85 kg, 11.97±1.09 and 55.33±1.69, respectively.

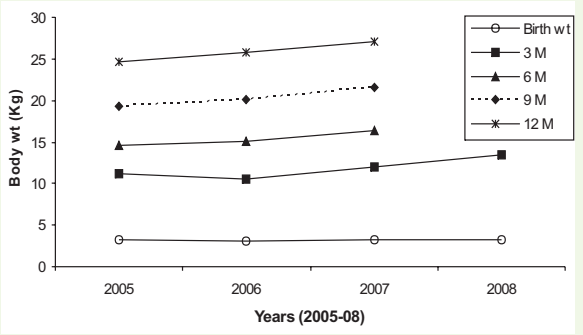


Fig. 1: Least squares means for body weight at different ages in Jamunapari

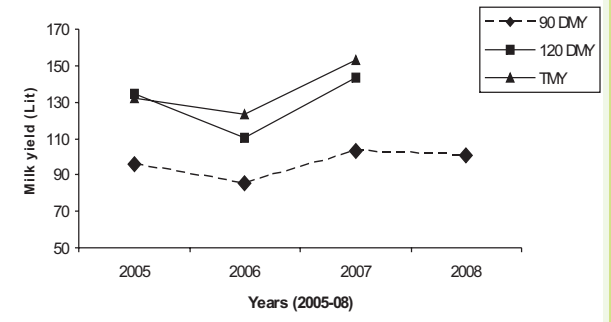


Fig. 2: Least Squares means for milk yield at different period in Jamunapari goats

The population growth rate during the year was 101%. The overall survivability of the flock was 93%. Thirty-three males and twenty-two females were supplied to farmers, SAUs, NGOs and other research institutions for improvement and conservation of Jamunapari goats under field conditions.

Table 1: Reproductive Performance of Jamunapari Goats

Sr. No.	Traits	2005	2006	2007
1.	AFK (d)	767±24 (56)	739±29 (53)	754±21 (113)
2.	KI (d)	338±11 (119)	321±13 (81)	323±5 (146)
3	Kidding rate (DT)	126	137	134
4	Litter Size (%)	138.5	142	134
5	Multiple births (%)	38.91	38.20	34.02

GGB 1.10: Genetic Improvement of Barbari Goats for Meat and Milk Production (AICRP)

S.K. Singh and P.K. Rout

The Barbari is one of the most suited dual purpose goat breeds of semi-arid climates in India. It has lactational performance similar to Indian dairy goat breeds and possesses many desirable characters of body weight growth, prolificacy, reproductive efficiency and sufficient milk to nourish high litter size. Because of these characteristics, the breed is considered to be one of the best dual-purpose among Indian goat breeds.

Population Growth

The population growth for the period of 2007-08 was 164 per cent. A total of 174 elite animals were supplied to farmers, government departments and NGOs for Breed improvement in the field.

Body Weights: The overall mean body weight at birth, 3, 6, 9, and 12 month of ages was 1.87±0.10, 6.40±0.10, 12.45±0.09, 17.66±0.11 and 22.33±0.13 kg, respectively. Kids born between July to December months attained significantly higher body weight at 9 month of age as compared to kids born during January to March. Single born kids had significantly higher body weight than that of

twins and triplets at 6 and 9 months of age. The heritability and genetic parameters for body weight growth at 3, 6, 9 and 12 months of age were 0.347 ± 0.059, 0.390 ± 0.620, 0.308 ± 0.57 and 0.374 ± 0.061 respectively. The h^2 for most body weight traits were high except for weight at birth, which was in medium range. Most genetic correlations were highly positive and precise. Likewise, the phenotypic correlations were highly significant and positive.

Genetic Trends: Genetic trends for body weight at 3, 6, 9 and 12 months of age were estimated using method described by Smith (1967). The genetic trends for all above method traits were positive precise and significant. The phenotypic trend was of low magnitude than that of genetic trends. This is because the environmental trends were negative. The results on genetic trends indicated that by improving the environment desired gain in bodyweight can be obtained.

Lactation Performance: The overall mean for 90 days milk yield, lactation yield and Average Daily Milk yield were 58.81 ± 1.52, 62.21 ± 1.84 liters and 565.4 ± 12.9 gm, respectively. The lactation length was 109.80 ± 1.32 days. Year of kidding significantly affected the 90 days milk yield but the means for last three years were of same magnitude. Year had significance influence on milk yield both in 90 and 140 days of lactation. Does kidded during 2003 and 2004 also recorded similar performance but year 2006 it is 54% only. Compared with last 7 years milk performance, year 2006 indicated one of the lowest performance.

Genetic Parameters: The h^2 estimates for MY 90, LMY and LL were 0.333 ± 0.071, 0.303 ± 0.068 and 0.107 ± 0.052 respectively. These estimates appear to be precise and reliable. The genetic correlations among these traits were of high magnitude and positive in nature.

Genetic Trends: Phenotypic, genetic and environmental trends for 90 days milk yield and lactation length have been estimated. Although phenotypic and environmental trend were positive but the genetic trend was of negative magnitude. There had been negative association between 9 M body weight and first lactation milk yield of female barbari kids.

Reproductive Efficiency: The adult does with good health were allowed to re-bred during the same year and hence they reproduced twice within a span of 12-14 months. During 2007 out of 298 does available in the beginning of the year there were 467 breeding making tupping % as 157. Out of this 341 does kidded during the calendar year 2007 producing 543 kids at the rate of 1.53 kid per kidding.

XI/GGB-1.1 Improvement of Jakhrana Breed of Goats for Milk and Meat Production under Farm and Field Conditions

Saket Bhusan, R.B. Sharma and H.A. Tiwari

The selective breeding has been followed to improve the performance of Jakhrana goats for milk, body weight and reproductive efficiency traits.

Body Weights: Weekly body weight of kids and monthly body weight of adult males and females were recorded. Least square means of body weight of Jakhrana kids are presented in Table 1. Weights of Jakhrana kids from birth to 18 months of age were higher in year 2007 as compared to 2006.

Milk Production: Least squares means of milk production are presented in Table 2. Milk yield of does was higher in 2007 as compared to 2005. It indicates that selection of does for the production of milk was in proper direction to increase milk yield of Jakhrana breed. Average lactation length of Jakhrana goats was 173.67 ± 5.42 days.

Table 1: Least squares mean of body weight (kg) in Jakhrana kids

Factor	Age of kids					
	Birth	3M	6M	9M	12M	18 M
Overall mean	2.59 ±0.09 (263)	9.23±0.38 (216)	13.49±1.04 (131)	16.52±0.66 (96)	22.63±0.87 (70)	31.00±1.29 (34)
Year of birth						
2006-07	2.61±0.10 (85)	9.95±0.41 (75)	13.95±1.21 (59)	17.86±0.74 (50)	22.39±0.81 (40)	31.99±1.78 (17)
2007-08	2.78±0.09 (151)	9.98±0.36 (110)	14.97±1.05 (48)	17.89±1.00 (19)	22.52±1.55 (6)	n.a.
Season of birth						
Winter	2.53 ±0.09 (219)	9.21±0.35 (184)	13.18±0.91 (108)	17.25±0.57 (77)	21.17±0.66 (57)	30.68±1.74 (21)
Summer	2.64 ±0.11 (44)	9.26±0.88 (32)	13.79±1.43 (23)	15.79±1.09 (19)	24.08±1.41 (13)	31.33±2.19 (13)
Sex of kid						
Male	2.70 ±0.10 (136)	9.82±0.39 (114)	13.92±1.09 (70)	17.32±0.79 (52)	24.22±1.03 (34)	32.75±1.76 (13)
Female	2.48 ±0.09 (127)	8.64±0.40 (102)	13.05±1.14 (61)	15.72±0.76 (44)	21.03±0.92 (36)	29.26±1.39 (21)
Type of birth						
Single	3.00±0.07 (86)	9.65±0.28 (74)	14.10±0.90 (46)	17.06±0.85 (41)	22.32±1.05 (30)	30.69±1.64 (16)
Multiple	2.66 ±0.06 (167)	9.03±0.24 (134)	14.72±0.79 (81)	16.00±0.73 (55)	22.93±0.93 (40)	31.32±1.52 (18)

Table 2: Least Square Means of Milk Production of Jakhrana goats

Factor	Age of kids				
	30 d	60 d	90 d	120 d	150 d
Overall mean	34.13±1.65 (167)	67.35±2.74 (167)	92.70±3.74 (167)	121.69±4.33 (151)	144.56±5.79 (135)
Year of birth					
2006-07	39.32± 1.89 (57)	70.40±3.12 (57)	92.60±4.26 (57)	117.67±4.91 (57)	140.28±6.30 (50)
2007-08	35.75± 1.77 (92)	75.79± 2.93 (92)	109.87±3.99 (92)	145.69± 4.75 (77)	176.88±6.62 (68)
Season of birth					
Season I	37.70±1.29 (139)	73.46±2.13 (139)	98.66±2.91 (139)	126.39±3.48 (123)	153.28±4.15 (115)
Season II	30.56± 2.82 (28)	61.24±4.66 (28)	86.74±6.36 (28)	117.00±7.29 (28)	135.85±10.21 (123)
Type of kid					
Male	34.51±1.84 (85)	66.36±3.05 (85)	90.26±4.16 (85)	119.75±4.93 (76)	140.76±6.55 (67)
Female	33.74 ±2.05 (82)	68.34±3.39 (82)	95.14±4.62 (82)	123.64±5.35 (75)	148.36±6.96 (68)

Reproductive Performance: Gestation period, kidding interval and dry period of Jakhrana goats were 151.48±1.56, 311.16±22.23 and 154.25±12.64 days, respectively.

RAPD markers for genetic divergence study in Jakhrana goats: High molecular-length DNA was isolated in all the samples from both the lines (Fig 1). A total of 20 random primers were screened using pooled DNA samples representing HP and LP lines. All the 20 primers generated reproducible

and distinct RAPD profiles. The total number of bands amplified ranged from 2 to 10. Out of 20 random primers capable of generating distinct and repeatable RAPD profile, only 5 primers (25 %) could detect polymorphism between the HP and LP line, while rest 15 primers generated monomorphic RAPD pattern. The five polymorphic random primers i.e. PI_{14}, PI_{18}, PII_{11}, PII_{14} and PII_{15} were used for further analysis using individual DNA samples from LP and HP lines. The RAPD profiles generated by these primers have been shown in Fig 1 to 2. Within line genetic similarity as band sharing proportion (WS) and band frequency (WF) estimated from 5 polymorphic primers. Between lines genetic distance from band sharing (DS) and from band frequency (DF), between the low and high milk producing lines were estimated. Study confirms that there is DNA polymorphism between high and low milk producer Jakhrana goats. Line specific markers for different lines (HP and LP) were not found very clear but there is still scope to find out such type result by using more animals in the study with specific traits. Genetic similarity and genetic distance between high and low milk producing lines of Jakhrana goats was distinguished by this study.

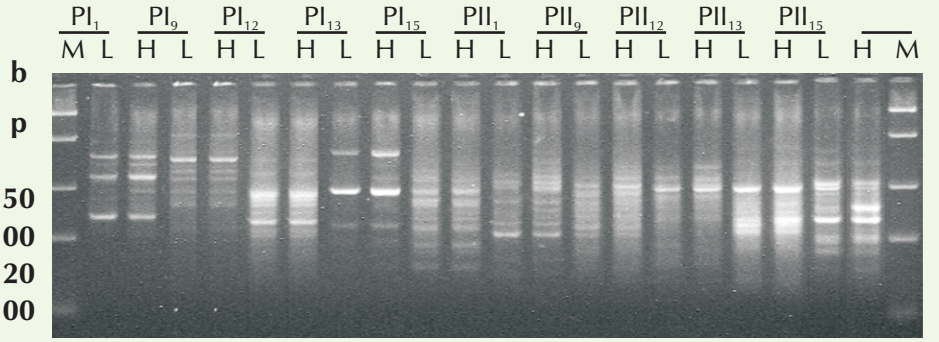


Fig 1. RAPD profile generated by different random primers in high producing (H) and Low producing pools. M: Molecular size marker (Middle range fast ruler).

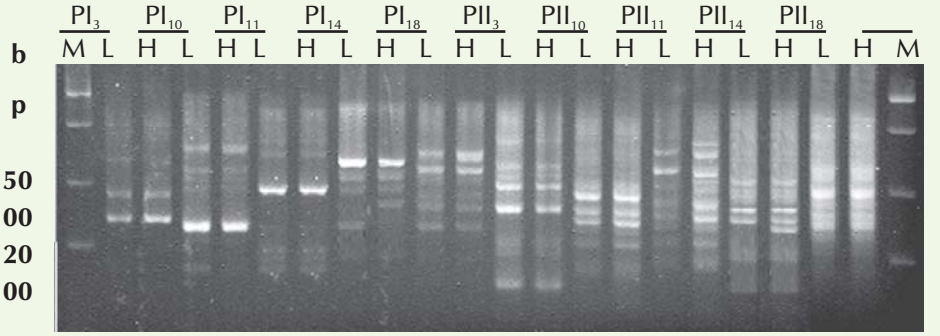


Fig. 2: RAPD profile generated by different random primers in high producing (H) and Low producing pools. M: Molecular size marker (Middle range fast ruler)

XI/GGB-2: Molecular Analysis of Major Genes and Quantitative Trait Loci Influencing Growth, Reproduction and Disease Resistance Traits in Indian Goats

P.K. Rout, A. Mandal, A.K. Das, S.K. Singh, M.K. Singh, R. Roy

It is necessary to utilize molecular markers to select high performance individuals for suitable environment for enhancing productivity and sustainability in goat production. DNA marker information, which identifies important allelic variation within the genome, could be incorporated into genetic evaluations to provide producers with selection tools that increase the rate of genetic improvement for lowly heritable traits.

Genetic diversity in Indian goats has been established using micro-satellite and mtDNA markers. The geographical structuring exists within Indian goats and the genetic distances between breeds are significant indicating that they are unique population. The association of some markers with different traits has also been studied. Therefore, it was proposed to analyze the major genes/QTL influencing production and other traits in Indian goats. The established loci in cattle, goat and human for milk production and growth will be selected and will be analyzed by PCR-RFLP, microsatellite and SNP based approach. This will be again validated in population and will give an idea to use markers for enhancing productivity in the population. As bovine genome sequence draft has been declared, therefore the information yielded from the bovine genome will have direct application to goat, sheep and other farm animal research. The bovine genome physical map and genome sequence will help to select desirable production traits, identify genes controlling economic traits and disease resistance traits and enable to produce better matching products for market specifications. As a part of objective, we have analyzed genetic variations in MyoD family genes, which are responsible for growth and meat quality.

Molecular Analysis of Myf-5 Gene Myofibrilar formation in mammals occurs only during embryonic development and is controlled by the MyoD family genes. MyoD gene family consists of four genes namely myogenin, MyoD1, myf5 and myf6. The myf5 and myoD genes are expressed in proliferating single nucleotide precursor cells called myoblasts. The Myf6 gene is mainly expressed postnatally. Myogenin has a crucial role during myogenesis and expressed in all myoblasts during early differentiation (i.e. Fusion of myoblasts into multinucleated myofiber), and its expression continues during cell fusion. The myf-5 gene has been considered to play an important role in growth and development of mammals. Myogenin expression also marks the end of the proliferation of myoblasts. Therefore different myogenin function or timing of expression could have a major influence on the number of muscle fibers that develop during myogenesis. Therefore polymorphism in Myf-5 coding sequence in different breeds will give an idea regarding body growth and meat quality in Indian goat breeds.

Myf-5 gene polymorphism was carried out in 35 samples of Barbari, 25 samples of Jamunapari and 25 samples of Black Bengal. DNA was isolated from the samples using standard protocols and was checked for its quality, purity and concentration. Subsequently DNA samples were purified by Gene Elute PCR Clean up Kit of Sigma for further use. PCR-RFLP was carried out to analysis myf5 gene using following set of primer F_1 = 5'-CCT ATC TGG TCC AGA AAG AGC AG-3' R_2 = 5'-TAT ATA AGT TAA GCA TTG CAA CAA-3' The PCR reaction was performed in a 50 µl final volume containing 0.5 unit of *Taq* DNA polymerase, 1xPCR buffer, 1.5 m*M* $MgCl_2$, 200 µ*M* each dNTP, 10 pmole of each primer and approximately 100 ng of goat genomic DNA. The PCR conditions were: 94°C for 4 min, followed by 38 cycles of 94°C (30 sec), 58°C (1 min), 72°C (1 min), and final extension at 72°C (4 min). About 30 microliters of the PCR product were digested with 5 units of

the restriction endonucleases *Taq*I (New Biolab) overnight at 37°C. The resultant fragments were separated by electrophoresis in a 4% agarose gel stained with ethidium bromide.Genotyping of Myf-5 gene was carried out by analyzing DNA samples of 3 different breeds of goats for the presence of different alleles by allele specific polymerase chain reaction (AS-PCR). PCR amplified product was observed to be 980 bp. The PCR product of 980 bp long was digested with Taq-I restriction enzyme. The PCR-RFLP pattern revealed three genotypes, BB (580 bp + 400 bp), AB (980 bp + 580 bp + 400 bp) and AA (980 bp). The BB genotype was most frequent in all the analyzed samples. The frequency of AA genotype was very low in all the analysed samples. The genotypic frequencies of BB and AB genotypes were 0.62 &0.32 in Barbari, 0.54 & 0.42 in Jamunapari goats and 0.50 & 0.45 in Black Bengal goats. The frequency of B allele was higher than an allele in all the three breeds. The myf-5 gene has been considered to play an important role in growth and development of mammals. Myf-5 knock out mouse showed no muscle growth, which indicates that the gene myf-5 had an effect on muscle development. The significant association between the myf-5 gene and these growth traits suggest that the gene may be one of the causative genes that control growth traits in beef cattle or that the gene is very close to the causative genes. Naturally occurring genetic variation in myf-5 gene could affect muscle fibre number and thus lean meat production.

GGB 1.11 Conservation and Improvement of Jamunapari Goats in their Home Tract

P.K. Rout, A. Mandal, Saket Bhusan and R.Roy

Population Dynamics:

The overall population of two villages varies over the years and the population remains minimum from May to September and thereafter increases due to kidding. After kidding, then the migration of population is observed due to selling, purchasing and providing the animal to relatives in other villages. Migration in goat population in village flocks has been usual phenomenon due to frequent sale and purchase.

Males were sold at all the age groups. The percentages of males sold were 10.97%, 46.66% and 33.33% in 3-6 months, 6-12 months and adult age groups, respectively. Similarly 42.22% and 18.83% females were sold in 6-12 months and adult age groups, respectively. The villagers also purchased 9 animals from adjacent villages.

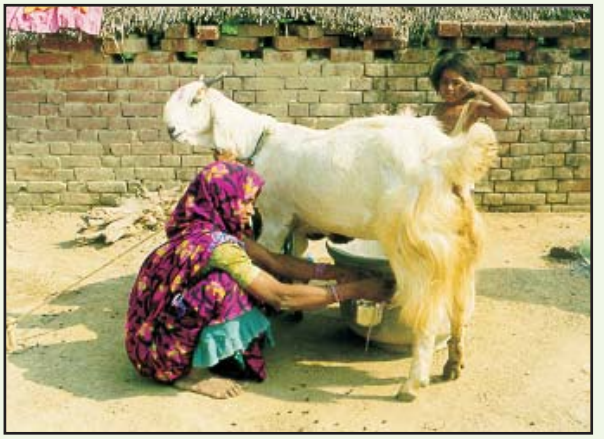
Reproductive Performance:

54 male kids and 59 female kids were born during the period from 76 does and seven abortions were observed during the year. The sex ratio was 1:1.09. The kidding rate was 1.48. The multiple birth percentage was 64.60 during the year. The average fertility percentage was 75.45% during the year.

Production Performance:

Body Weights: The overall body weight in adopted villages was 2.42 ± 0.05, 14.53 ± 0.16, and 21.14 ± 0.39 and 26.24 ± 0.49 kg at birth, 3 months, 6 months and 9 months of age, respectively. The mean body weight during the year was 2.39 ± 0.06, 14.35 ± 0.21 kg at birth and 3 months of age, respectively. The mean body weight during the year was 2.41 ± 0.06, 15.54 ± 0.23, 22.15 ± 0.48 and 27.22 ± 0.60 kg at birth, 3 month, 6 month and 9 month of age, respectively. Village had significant effect on 9 months of body weight. Sex had significant effect ($P < 0.05$) on body weight up to 9 months of age. Birth type had significant effect ($P < 0.05$) on body weight at birth and 3 months of age. The body weight at 3, 6 and 9 months of age were showing an increasing trend over the years in both the villages.

Milk Yield: The factors affecting milk yield were year, birth type and fortnight and all the factors had significant effect ($P<0.05$) on total milk yield. The average daily milk yield over the last five years was about 1.117 ± 0.013 litre. The



average daily milk yield during the year was 1.134 ± 0.015 litre. The total milk yield at 30, 60 and 90 days were 32.52, 72.12 and 110.82 litres, respectively. The fortnight milk yield showed consistent yield up to 5th fortnight and highest milk yield was observed at 4th fortnight and thereafter it started to decline (Fig. 1). Does, which produced twin and triplet, produced more milk in comparison to does having single kid. To analyse the effect of birth status on milk yield, fortnight and type of birth (TOB) interaction was carried out. The milk yield up to fourth fortnight with respect to birth status was observed as 65.640, 69.075 and 82.005 liters in single kidded, twin kidded and triplet kidded does, respectively (Fig. 2).

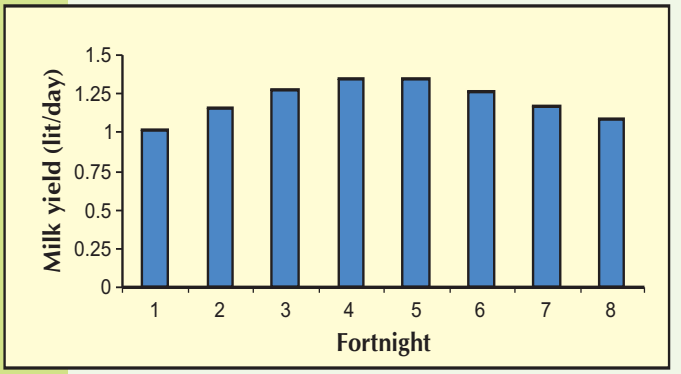


Fig.1: Fortnight milk yield in Jamunapari goat in field condition

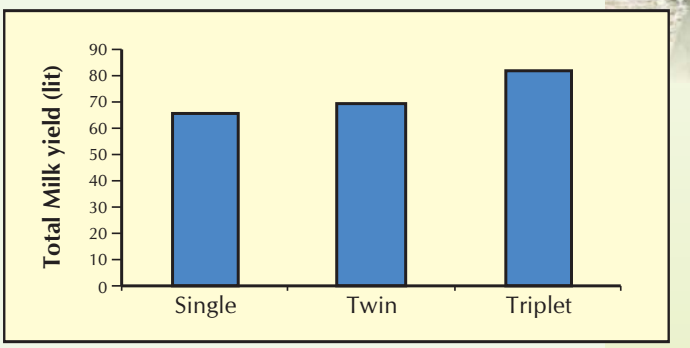


Fig 2: Total milk yield up to fourth fortnight with respect to birth status in village condition.

Biomass Characterization

The gullies and ditches are densely covered with vegetation of Bilati babool (P. juliflora) and other drought resistant trees like Babool (A. nilotica), Chhonkra (P. spicigera), Hingota(B. aegyptica). Arhar(C. cacjan), Gram (C. erietinum) and Bajra (P. typhodium) are the main cereal crops. Different varieties of mustard are also grown in this area.

Disease Incidence and Health Coverage:

The mortality observed in 0-3 months age group and was about 6.77% in male and 1.51% in female. Mortality in 3-6 months of age group was observed in males and was about 3.63%. The general symptoms/disease including mastitis, tympany, lameness, coccidiosis, colibacillosis. Parasitic characterization of field condition was made by analysing faecal sample every month. The parasitic load was not observed from May to July. Bursate load was more in animals from September to January and subsequently it was lower.

PHYSIOLOGY, REPRODUCTION AND SHELTER MANAGEMENT DIVISION

PR&SM XI/1.1: Studies on Refinement of Frozen Semen Technology and Strengthening of Goat Semen Bank

S.K. Jindal, N.K. Sinha, A.K. Goel, S.D. Kharche, N. Ramachandran and R. Ranjan

Refinement in Semen Freezing Protocol:

The modification in an already standardized semen extender and freezing protocol was

evaluated for getting optimum post thaw recovery. The neat semen samples having mass activity of +4 and above were immediately diluted in glycerol free extender (part A) at the ratio of 1:5 at room temperature. Then the samples were cooled to 5 °C in cold handling cabinet in 1.5 to 2 hrs and an equal part of glycerolized extender (part B) was added gradually to make the final dilution rate of 1:10. Then the samples were filled in French mini straws (0.25 ml) and sealed. An equilibration period of 4 hrs was allowed before samples were frozen conventionally i.e. frozen in liquid nitrogen vapor 2.5cm above LN_2 for 10 minutes and dipped in liquid nitrogen. A total of 500 (Jamunapari- 250; Sirohi- 200; Marwari-50) good quality straws having post thaw motility of minimum 40-50% were stored in large LN_2 container for further use/study. However, for supply of straws to field needs improvement in quality control aspects and further refinement in freezing protocols are under process.

Experiments on Different Cryoprotectants and its Levels:

Penetrating Cryoprotectants:

Two levels (6 and 8%) of four types of penetrating cryoprotectants viz., Glycerol, Ethylene glycol, Propylene glycol and Dimethyl Sulfoxide were tried in the above modified freezing protocol to observe the comparative cryoprotective ability of cryoprotectants. Irrespective of four types of cryoprotectants studied, 8% did not yield satisfactory results. However at 6% level, glycerol yielded 30-40%post thaw motility vis-a-vis 20-30, 0-10, 0-10% for Dimethyl Sulfoxide, Ethylene glycol, Propylene glycol, respectively.

Non-Penetrating Cryoprotectants Levels:

The ejaculates were collected at weekly intervals using artificial vagina and were extended at the rate of 1:10 with Tris- Citric acid-Fructose (TCF) diluent having 2.5%, 5%, and 7.5% and 10% egg yolk by volume as non-penetrating cryoprotectant and preserved up to 72 hours in refrigerator. Analysis of data using two way ANOVA revealed that sperm motility differed significantly ($p < 0.05$) at different levels of egg yolk up to 72 hours of preservation. The mean sperm motility recorded at 0, 24, 48, 72 hours of preservation in 7.5% egg yolk level were 85.00 ± 1.29, 63.33 ± 1.05, 50.00 ± 1.82 and 44.17 ± 1.54 %, respectively. The corresponding figures in 10% egg yolk were 85.00 ± 1.29, 69.17 ± 1.54, 61.67 ± 1.67 and 55.00 ± 2.23%, respectively. However, at lower egg yolk levels (2.5 and 5 %), the mean sperm motility drastically reduced to below 50% with in 24 hours of preservation. The live sperms did not vary significantly among different egg yolk levels and storage periods.

Standardization of in Vitro Fertility Test:

Hypo Osmotic Swelling Test (HOST)

A total of 28 samples were taken from stored frozen straw from male reproduction laboratory of this division for the standardization of hypo osmotic swelling test. A different strength of 50, 75,100, 125, 150, 175,200 and 300-mosmol solutions were prepared for this purpose. Frozen semen was thawed at 40°C temperature for 45 second and 0.1 ml were added in 1ml hypo osmotic solution of different strength for one hour at 37°C. Sperms were evaluated for strongly coiled, weakly coiled and non-coiled under oil immersion lens. The total coiled percentage in 50, 75, 100, 125, 150, 175, 200 and 300 mosmol were 34.04 ± 1.39, 54.45 ± 1.39, 31.44 ± 1.39, 21.66 ± 1.39, 19.86 ± 1.39, 12.85 ± 1.39, 8.67 ± 1.39 and 0.58 ± 1.39 respectively. The best swelling in term of strong coiling and total coiling was in 75-mosmol hypo- osmotic solution. There is significant difference in swelling in different strength of hypo osmotic solution. So for frozen sperm 75-mosmol and fresh diluted 100 - mosmol hypo-osmotic solution is the best.

Dual Staining Test for Viability and Acrosomal Integrity:

Dual staining technique was standardized for frozen and fresh semen for viability and acrosomal integrity. A thin smear was prepared on warm glass slide of fresh diluted and frozen thaw semen and stained with eosin-nigrosin stain. After drying it was fixed in formalized buffer solution for 30 minutes at 37°C and was

washed in running tap water for 10 minutes and again dried. Now slides were kept in Giemsa stain for 1 hour at 37°C and wash in running tap water for 10 minutes and dry it and observed under oil immersion lens. Based on observation it was fond that there is no significant difference in viability and acrosomal integrity in dual staining technique and individual vital staining technique and acrosomal staining technique. So dual staining technique will save time and chemicals as viability and acrosome integrity can be seen in same slide. There is no need for separate test for viability and acrosomal integrity.

Artificial Insemination Using Liquid Semen and Pregnancy Diagnosis:

Immediately after semen collection, ejaculates were diluted in TRIS buffer at the ratio of 1:5 at room temperature having 10% egg yolk level and preserved in refrigerator for 2-3 hours before use. The does, which come into estrus in the morning, were inseminated in the evening and the does, which came in estrus in the evening, were inseminated in the morning using above diluted and stored liquid semen. Twice insemination (deep cervical) was done per oestrous cycle. The inseminated goats were examined for pregnancy status by real time ultrasonography at 25 30 days post insemination. A total of sixty Sirohi goats were inseminated with the overall conception rate of41.52% on actual kidding basis.

PR&SM XI/1.2: Augmentation of Prolificacy by Using Biotechnological Tools in Goats

S.D. Kharche, A.K. Goel and S.K. Jindal

Preparation of Sponges of Different Sizes and Shapes to Study their Retention

Sponges of different sizes and shapes were prepared in the laboratory. They were inserted in to the vagina of Sirohi goats and tested for their retention in to vagina for 12 days.

Table 1: Effect of size and shapes of sponges on its retention in to vagina of goats.

S. No.	Type of sponge	Total goats	Sponge retained	Sponge lost	Sponge retained (%)
1.	Square (25mm)	7	4	3	57.14
2.	Circular (25mm)	6	4	2	66.66
3.	Circular (30mm)	6	5	1	83.33
4.	Cylindrical (25mm)	8	7	1	87.5
5.	Cylindrical (13mm)	7	4	3	57.14

Preparation and testing of hormone delivery system (sponges):

Sponges impregnated with different doses of progesterone were prepared. The sponges were inserted in to the vagina of Sirohi goats up to the external os of the cervix by using glass speculum on day 17 of the estrous cycle. The sponges were kept for 12 days in to the vagina to prolong the estrous cycle. The goats were observed for estrus daily in the morning and evening using teaser buck.

Table 2: Effect of different doses of progesterone impregnated sponges on prolongation of estrous cycle in goats.

S. No.	Progesterone (mg)	No. of animals treated (n)	Prolonged estrous cycle (%)
1.	25	5	40.00
2.	50	7	71.42
3.	75	4	75.00
4.	100	9	66.66
5.	200	9	55.44
6.	300	10	80.00
7.	350	4	100.00

Table 3: The average serum progesterone (ng/ml) concentration in goats inserted with sponges.

S.No.	P4 Sponge (ng/ml)	Day 17 before sponge insertion	Day 18 at sponge insertion	Day 20	Day 22	Day 24	Day 26	Day 29 at sponge withdrawal	Day 31
1.	350	4.15±1.11	6.0±1.28	4.32±1.53	1.8±0.41	3.32±1.45	1.77±0.26	2.35±0.24	1.87±0.20
2.	300	5.3 ±2.5	10.36±4.68	4.56±2.14	5.76±2.88	8.24±4.22	5.38±2.30	3.75±2.02	3.27±1.60

Reproductive status of Jamunapari Goats:

The reproductive status of thirty adult cyclic Jamunapari goats was observed. The estrus detection was done daily in the morning and evening by using aproned buck. Twenty four goats were bred naturally. Out of which nineteen goats (79.16%) were kidded. Eleven goats produced single kid and eight goat produced twins' kid. After kidding the goats were observed for the onset of estrus. It was observed that only 26.31% goats came into estrus within 6 months of kidding, indicating long postpartum interval in Jamunapari goats.

Standardization of technique for visualization of follicles / corpus luteum using ultra-sonograpy in treated goats.

Twenty estrous does were scanned by employing curvilinear trans-rectal (TR) scanners of variable frequency ranging between 5 to 7 MHz. The does were kept off feed 12 hour prior to scanning. The uterus was located in all animals but ovaries could be located only in 50% cases.

In vitro embryo production and transfer:

Oocyte collection

Oocytes were recovered by follicle puncture technique for in vitro maturation, fertilization and culture from goat ovaries collected from slaughter house located at Agra. A total of 1874 goat ovaries were used for recovery of oocytes using follicle puncture technique for IVMFC. The recovery of oocytes using follicle puncture was 1.82 per ovary.

In-vitro maturation of goat oocytes:

Goat ovaries obtained from an abattoir situated at Agra. The oocytes collected from goat ovaries were cultured in tissue culture medium (TCM-199) containing 20% EGS or 10% NCS with FSH, LH, 1µg/ml E2, and bovine serum albumin, (pH: 7.2-7.4) supplemented with insulin (50ng/ml) or EGF (10ng/ml) in 50 µl drops of maturation medium covered with mineral oil. The matured oocytes were evaluated under stereo zoom microscope and the maturation rate of oocytes on morphological evaluation was 85.36%.

In-Vitro Maturation of Nude Goat Oocytes:

Effect of granulosa cell co-culture and monolayer on IVM of nude oocytes: The selected nude oocytes were assigned at random in following treatment groups:

Group 1: Approximately 115 selected oocytes were matured in TCM-199 (sigma) supplemented with 10% FBS in 50µl droplets.

Group 2: Approximately 108 selected oocytes were matured in TCM 199 (sigma)) supplemented with 10% FBS and granulosa cell co-culture in 50µl droplets.

Group 3: Approximately 107 selected oocytes were matured in TCM-199 (sigma) supplemented with 10% FBS and granulosa cell monolayer in 50µl droplet.

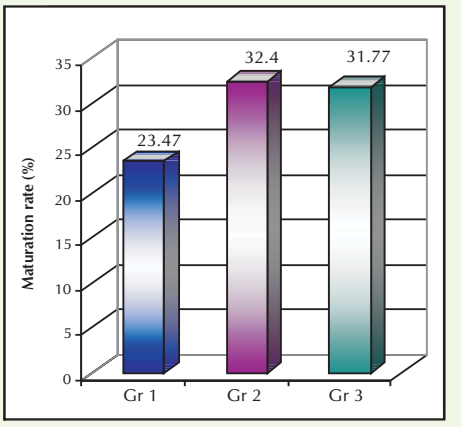


Fig. 1: Effect of granulosa cell co-culture and monolayer on IVM.

Effect of hormones on IVM of nude oocytes:

Group 1: Approximately 107 selected oocytes were matured in TCM-199 (Sigma). Supplemented with 10% FBS in

Group 2: Approximately 100 selected oocytes were matured in TCM-199 (Sigma) with 10% FBS, FSH (5µg/ml), LH (5µg/ml), estradiol-17β (1µg/ml) in 50µl droplets.

Group 3: Approximately 105 selected oocytes were matured in TCM-199 (Sigma) supplemented with 10% FBS and FSH (5 µg/ml), LH (5µg/ml), estradiol-17β (1µg/ml) and insulin (50ng/ml) in 50µl droplets.

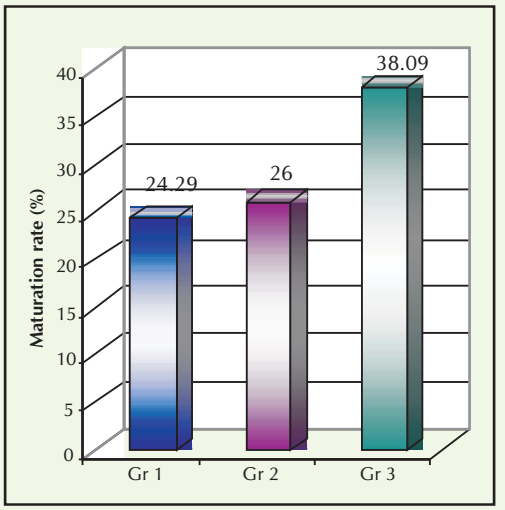


Fig. 2: Effect of hormones on *in vitro* maturation of goat oocytes.

After 27h of maturation of oocytes, the oocytes were washed by vortexing. The oocytes were then fixed for 15 minutes in 2.5% (w/v) glutaraldehyde in phosphate buffered saline, washed twice with PBS, stained with 0.1μg/ml 4, 6 diamidino 2 phenylindole (DAPI) in PBS and mounted on slides. The evaluation of nuclear status was done by epifluorescence microscopy.

In-vitro fertilization of *in vitro* matured goat oocytes:

The matured oocytes were separated from cumulus cells by treating them with PBS containing 0.1% hyaluronidase and by passing through a fine pipette and kept for fertilization in 100 µl fertilization drop. Fertilization drop (Fert TALP) containing oocytes were inseminated with 25 to 50 µl of final diluted semen (1x106 sperm/ml).

In vitro produced embryo transfer:

Twelve in vitro produced embryos of 4-16 cell stage were transferred in to two natural synchronized recipients on day 2 or 3 post oestrous surgically at tip of the uterine horn of the genital organ. The recipient was monitored for the oestrus / pregnancy. Following transfer, pregnancy was detected by using ultrasound scanner at 8 weeks.

In vivo produced embryo transfer:

The percentage of goats responded to oestrus synchronization treatment in recipient and donor groups were 75.00% and 100%, respectively. The onset and duration of oestrus in recipient and donor were 32.00 ± 10.58/ 36.0 ± 12.00 and 28.00 ± 10.58/32.0 ± 4.0 hrs, respectively. The average number of follicles and corpus luteum in donors were 7.0 ± 2.51 and 4.66 ± 2.60, respectively. Three embryos were recovered. Two embryos were transferred surgically at the tip of one uterine horn and remaining one was transfer into another horn of a synchronized recipient goat. The results indicated that:

a) Crestar ear implant can be used effectively for oestrus synchronization in donor and recipient goats during non-breeding season.
b) The recipient could not sustain pregnancy and repeated oestrus after two months.

PRSM XI/2.1: Model Goat Production Systems With Special Reference to Intensive and Semi-Intensive Systems

Dharm Singh, S.K. Jindal, N. Ramachandran, B. Rai, R.B. Sharma and H.A. Tiwari

The Layout Plan of the Model Goat Farm has been prepared and submitted to the Institute. The construction of Model Goat Farm involving about Rs. 42 Lakhs is pending subject to the approval of the PLAN. The recording of observations will be done after experimental animals are purchased and the purchase of animals is dependent on construction of Goat Farm.

PRSM XI/2.2: Adaptability of Goats and Environmental Aspects Under Different Production Systems

Puneet Kumar and R.P.Misra

Adaptability studies on Barbari and Sirohi bucks were initiated during the period under report. Changes in the climate in terms of temperature and rainfall in the last decade from that of last to last decade were found. Presently the method of collecting goat faeces within the shed is not correct and may transmit infection to the workers by inhaling contaminated air and thus is injurious to the health of the shed workers. Studies were initiated on goat waste management. A comparative adaptability study was also initiated on the goats brought to this institute from different agro-climatic regions.

Adaptability of Barbari and Sirohi bucks under semi-intensive system of goat production

Rectal temperature, respiratory rate and heart rate of 12 bucks, 6 each of Barbari and Sirohi breed were recorded in May and June (hot-moderate humid), July, August and September (hot-humid), October and November (comfortable-dry) and in December (cool-dry) months of the year. The goats were managed under semi-intensive system at this institute. The recordings of physiological responses in the morning were done before feeding and watering of the goats. In the afternoon, recording was done after giving rest of about 1 hr after the goats arrived to sheds from grazing. The recording was done at 15 days interval for 3 consecutive days. The mean body temperature in both the breeds in comfortable period was almost equal. It was 38.42 ± 0.03 in Sirohi and 38.41 ± 0.04 °C in Barbari bucks.

The mean rectal temperature in hot period was higher and in cool period was lower than the comfortable period. Rectal temperature in the afternoon was higher in both the breeds in all the four periods. In the afternoon, in the hot moderate humid period, the rectal temperature of Sirohi breed was higher than Barbari breed. But in hot-humid period, which forms the longest part of the hot period, rectal temperature in the afternoon of Barbari was higher than Sirohi bucks. The mean rectal temperature in cool period of both the breeds was equal i.e. 38.25 ± 0.06 °C in Sirohi and 38.25 ± 0.08 °C in Barbari breed. In the morning hours of cool period, Barbari bucks were able to keep themselves warmer than those of Sirohi bucks.

Respiratory rate which reflects the ability of the bucks to dissipate extra heat during hotter part of the year. The mean respiratory rate in comfortable period of Sirohi and Barbari bucks was equal in both the breeds i.e. 31.64 ± 1.01 in Sirohi and 31.58 ± 0.82 in Barbari bucks. Respiratory rate increased in hot periods and decreased in cool period. Barbari bucks remained under more heat stress than those of Sirohi buks.

Heart rate, which is an indicative of metabolic rate of the goats under comfortable and cool period and of cutaneous evaporation in heat stress. Under comfortable period, the metabolic rate of Sirohi breed is lower than that of Barbari breed. It was 86.59 ± 1.26 no./min. in Sirohi breed and 91.40 ± 0.90 in Barbari breed. Heart rate increased in Barbari breed in hot humid period of the year than that in Sirohi breed indicating more heat stress on Barbari bucks as compared to Sirohi bucks.

Blood Biochemical Studies:

Metabolic Activity: Blood metabolites like glucose, urea, uric acid, creatinine, cholesterol and triglycerides of Barbari and Sirohi bucks during summer season have been presented in Tble 1. All the parameters except creatinine were higher in Barbari bucks than in Sirohi bucks.

Table 1: Metabolite concentration in blood plasma of Barbari and Sirohi bucks during summer season under semi intensive production system

Breed	Glucose (mg/dl)	Urea (mg/dl)	Uric Acid (mg/dl)	Creatinine (mg/dl)	Cholesterol (mg/dl)	Triglycerides (mg/dl)
Barbari	86.27 ±5.51	32.81 ±3.03	3.53 ±0.23	1.79 ±0.08	159.87 ±5.24	50.65 ±3.57
Sirohi	81.62 ±5.36	26.16 ±1.38	3.50 ±0.15	1.87 ±0.09	139.34 ±4.87	44.79 ±3.25

Enzyme Activity: The activities of enzymes like acid phosphatase, alkaline phosphatase, GOT, GPT, LDH and Amylase have been given in Table 2. The activities of alkaline phosphatase and GOT were higher in Barbari bucks. Rest of the enzyme activities were higher in Sirohi bucks.

Table 2: Enzyme activity in blood plasma of Barbari and Sirohi bucks during summer season under semi intensive production system

Breed	Acid Phosphatase (KAU/dl)	Alkaline Phosphatase (KAU/dl)	GOT (Units/ml)	GPT (Units/ml)	LDH (IU/lit.)	Amylase (Street Close Units/100ml/dl)
Barbari	1.76 ±0.10	25.60 ±1.34	59.78 ±5.98	19.80 ±1.49	277.03 ±9.53	10.79 ±0.50
Sirohi	1.99 ±0.22	25.11 ±1.72	55.68 ±3.47	22.98 ±1.98	299.71 ±10.34	10.94 ±0.67

Hormones: T_3 and T_4 hormones were higher in Barbari bucks than that in Sirohi bucks.

Electrolytes: The concentration of phosphorus, chloride and calcium have been given in table 3. The concentration of all the three electrolytes were higher in Barbari than that in Sirohi bucks.

Table 3: Electrolyte concentration in blood plasma of Barbari and Sirohi bucks during summer season under semi intensive production system

Breed	Phosphorus (mg/dl)	Chloride (mg/dl)	Calcium (mg/dl)
Barbari	7.82 ±0.40	96.81 ±4.85	10.36 ±0.94
Sirohi	7.12 ±0.47	91.55 ±4.84	8.94 ±0.82

Comparative adaptability of Barbari and Sirohi bucks under intensive and semi-intensive production systems

Twenty four bucks of Barbari and Sirohi bucks were taken to study the cardinal physiological responses in December, January and February (cool period), February and March (comfortable) and April, May (hot-dry). 12 bucks, 6 each of Barbari and Sirohi were taken in intensive system of goat production and 12 in semi-intensive system of goat production. The mean rectal temperature of the bucks of both the breeds reduced in cool period from that of comfortable period in both the systems of goat production. The reduction was comparatively more in Sirohi bucks that that of Barbari buck in both the systems. The reduction in rectal temperature was more in intensive system in Sirohi bucks that that in semi-intensive system.

The mean respiratory rate of bucks of both the breeds in cool period reduced in cool period than that of comfortable period as a means of heat conservation process. The reduction in mean respiratory rate was more in semi-intensive system than that of semi-intensive system. The reduction in respiratory rate was more in Sirohi bucks than that of Barbari bucks (Table 4). The mean heart rate of the bucks of both the breeds in cool period was less affected in semi-intensive system than that of intensive system. Sirohi bucks seemed to be more affected than Barbari bucks in intensive system, whereas; Sirohi bucks were less affected by cold in semi-intensive system of goat production.

Overall, the Barbari bucks were physiologically better adapted in intensive system of goat production and Sirohi bucks in semi-intensive production system.

Table 4: Respiratory rate (no./min) of Sirohi and Barbari bucks in Intensive and semi-intensive system of goat production

Period of the Year	Breed	n	Intensive system			Semi-intensive system		
			Morning	Afternoon	Mean	Morning	Afternoon	Mean
Cool -dry	Sirohi	72	17.21 ±0.40	34.18 ±1.36	25.69 ±0.72	16.07 ±0.27	31.56 ±0.97	24.26 ±0.63
	Barbari	96	22.23 ±0.06	39.11 ±1.16	30.67 ±0.09	25.52 ±0.07	35.21 ±0.06	30.36 ±0.05
Comfortable	Sirohi	72	18.04 ±0.04	60.79 ±0.30	42.44 ±1.47	17.14 ±0.05	56.64 ±0.26	36.89 ±0.13
	Barbari	96	22.17 ±0.0.04	67.96 ±0.25	45.06 ±0.13	23.33 ±0.05	60.73 ±0.21	42.03 ±0.11

Comparative adaptability of Marwari, Sangamneri, Surti and Black Bengal goats

A comparative study on the adaptability of Marwari, Sangamneri, Surti and Black Bengal goats was done in hot-dry period. The rectal temperature and respiratory rate of the goats has been recorded. The rectal temperature indicated that it was higher in females of Marwari, Sangamneri and Surti goats than the male goats of the same breed. In Black Bengal goats, the rectal temperature of males was higher than the females. The growing kids of Black Bengal recorded the highest rectal temperature. The respiratory rate of the female goat was lower than the male goats in Marwari, Sangamneri and Surti goats. In Black Bengal goats females had higher respiratory rate than the males. Black Bengal growing kids recorded the higher respiratory rate. The heart rate of Marwari and Sangamneri goats was lower than Surti. Black Bengal goats had highest rate. Heart rate in males and females in all the breeds was of almost similar magnitude. However, kids had lower heart rate than adult black Bengal goats.

Climate Change

Date collected on various meteorological observations during the last 21 years (1987-2007) was analyzed to study the climatic changes at this institute. The overall increase of 1.90 °C in mean temperature has been observed during the last decade (1998-2007) from that of 1987-1997 periods. The increase in maximum temperature and minimum temperature during that period was 0.92 °C and 2.84 °C respectively. The lowest minimum temperature of 1.5 °C has been observed on February 02, 2008. During the last 21 years the lowest minimum temperature dropped either in the month of December or January. June 9, 2007 remained the hottest day during the last 21 years as the maximum temperature reached 50 °C. The average annual rainfall has decreased to 382.01 mm in 39 wet days during the last decade from 487.81 mm in 38.18 wet days during 1987-1997.

Development of Appliances for Faeces Collection

At present in most of the goat farms in the country brooms are used for cleaning the sheds. During cleaning dust particles create difficulties and health hazards for the workers. Simultaneously soil erosion also takes place. To take care of these problems four types of appliances were developed to clean the shed and collect faeces. Two appliances were not found suitable during preliminary testing. One appliance gave promising results during preliminary testing. One is yet to be tested. A buck drawn trolley is under design stage to transport faeces, which will help in waste management.

NUTRITION, FEED RESOURCES AND PRODUCTS TECHNOLOGY DIVISION

NFRPT XI/1: Development of Fodder Production, Conservation and Processing Technologies for Small holders and Commercial Goat Farmers

P.K. Sahoo (upto Dec. 31, 2007), Prabhat Tripathi and T.K. Dutta

Performance of Various fodder legumes under Agroforestry system

Under the agro forestry system four fodder legumes were raised as sole crops and in combination i.e. Lobia, Sunhemp, Sesbania, Guar + Lobia, Sesbania (low density), Control, Sesbania + Sunhemp, Sesbania + Lobia. The study was conducted under rain fed condition. The maximum green fodder yield among the various treatments were recorded with Guar + Lobia 25.41t/ha and lowest biomass yield was associated with control i.e. 5.89 t/ha. Maximum dry fodder yield also occurred with Guar + Lobia treatment.

Soil pH and electrical conductivity after harvesting of the crops were lower than the their initial values. The pH value of the soil at initial stage ranges from 7.53 to 8.02 while at post harvest stage it ranged from7.31 to 7.81. The lowest electrical conductivity0.06 dsm/cm was associated with Sesbania crop (low density). At post harvest stage all the treatments were observed with lower available nitrogen from its initial value but the magnitude of the reduction was not very large, However lowest values of organic carbon and available nitrogen 0.60% and 303.6 kg/ha were associated with control treatment respectively.

Leaf stem ratio of various legumes under *Morus alba* and *Azadirachta indica* indicated that Sunhemp had lowest leaf stem ratio 0.44 on dry weight basis under Sesbania + Sunhemp mixture and 0.49 in the sole stand. Maximum leaf stem ration was observed in Guar and Lobia crop as sole or mixed crop.

Maximum weed density was observed with the Sesbania under both the densities. While Sunhemp was observed with the minimum weed infestation than all other treatments at 15 days after sowing. All the treatments reduced weed infestation at 30 days after sowing except control. A three hectare land was also sown under the *Cenchrus* sp. based rainfed pasture.

Guar (*Cyamopsis tetragonoloba*) crop under Agroforestry system

Drying Studies of fodder legumes

To observe the drying rate of Lobia and Guar fodder in polyhouse and in ambient conditions, harvested fodder was used for study. The swath thickness was 2″ and 4″ and the initial moisture content were from 77% to 83% in Guar and 70 to 79% in Lobia. The drying rate was recorded higher for poly house drying as compared to ambient solar drying irrespective of swath thickness. Inside the poly-house the swath thickness has no effect. However, incase of ambient solar drying 2″ swath gives higher drying rate. Therefore, poly house may be used for making good quality hay due to higher drying rate as compared to ambient condition.

Effect of Goat manure on Cyamopsis tetragonoloba

Under this experiment various doses of goat manure were incorporated in to the soil as alone or with potassium and nitrogen doses as the basal dose at the time of land preparation and Guar crop was raised under various treatments i.e. Goat manure@20t/ha, Goat manure @ 10 t/ha, Goat manure 10t + 50 kg K/ha, 20kg N + 50 kg K, 50 kg. K/ha and Control. Maximum 27.3 t/ha Fresh fodder yield was achieved from

the Goat manure @ 20 t/ ha treatment followed by Goat manure @10t/ha + 50 Kg. K

Top feed Harvesting

Under field conditions ground cover in the grazing areas dries in the winter season and more or less remains dry up to monsoon season in semiarid/ arid areas. In these areas only top feed is the main source of green biomass production especially during the summer months. Hence under this study fodder trees were lopped at their maximum leaf bearing stage or maximum biomass producing stage when they were usually offered to the animals. Among the harvested species *Sygium cumini* produced maximum biomass i.e. 44.5 kg/tree. However maximum dry matter percentage was associated with *Zizyphus* species. During the harvesting and collection and drying of the fodder tree leaves thorny plants required more man power due to difficulty in handling.

XI NFRPT/2. Development of Feeding Strategies for Goats under Intensive and Semi-Intensive System

T.K. Dutta, P.K. Sahoo (up to Dec. 2007) and R.S. Upadhyay

Nutritional manipulation for higher productivity and reproductive performance in female goats

Thirty nine female Barbari goats were divided into three equal groups based on their body weight, age and parity of kidding (0-3 parity females taken). The non-pregnant females were put under challenge feeding with the ration schedule as under,

T1: Concentrate mixture-A @ 2% of the BW + Arhar straw *ad lib.* + Green fodder 1kg/goat
T2: Concentrate mixture-B @ 2% of the BW + Arhar straw *ad lib.* + Green fodder 1kg/goat
T3: Concentrate mixture-C @ 2% of the BW + Arhar straw *ad lib.* + Green fodder 1kg/goat

Pregnancy performance and growth of kids

Pregnant goats under T2 group gained higher (12.67 kg) than other two treatments (T1, 10.52 kg and T3, 11.35kg). Average daily gain (due to foetal growth and body weight change during pregnancy) was 83.54, 90.40 and 93.30 g in the respective three groups. Pregnant females under experimental groups kidded 92.31, 100 and 100 per cent in T1, T2 and T3 groups respectively. The percentage of female goats, which gave birth single and multiple kids were 66.67 and 33.33% in T1, 69.23 and 30.77% in T2 and 61.54 and 38.46% in T3, respectively. Total kids born in each treatment were 16, 18 and 18 in T1, T2 and T3 groups. It was observed that weight of male and female kids born under T2 and T3 tended to be higher than T1 (Table 1). Similar pattern was observed when the data calculated based on birth type. Average daily gain of kids up to three months of age was also higher in T2 (65.75g) and T3 (70.65g) than T1 (56.47). Similar pattern was observed when analyzed sex-wise. Therefore, the ration containing cotton seed cake and linseed cake in the ration 50:50 and 30:70 have better impact on kids' performance during pregnancy period and lactation period.

Table 1: Birth weight of kids born under different groups.

Parameter	*T1*	*T2*	*T3*
Birth weight (kg)			
Male	2.04±0.19	2.24±0.09	2.27±0.04
Female	1.90±0.10	1.94±0.17	1.99±0.12
Overall	1.96±0.10	2.14±0.09	2.14±0.07
Birth type (kg)			
Single	2.01±0.15	2.16±0.11	2.19±0.10
Twin	1.89±0.11	2.33±0.08	2.15±0.06
Triplet	-	1.95±0.10	-
ADG (g/d)			
0 day-1 month			
Male	54.85±8.13	68.20±7.22	80.57±12.89
Female	53.85±9.53	50.70±12.77	60.97±7.44
0 day-2 month			
Male	58.67±6.88	68.09±5.17	74.07±6.91
Female	48.75±9.61	60.54±4.98	63.65±5.34
0 day-3 month			
Male	63.47±7.11	67.17±5.80	76.43±4.35
Female	52.09±9.86	63.47±5.52	65.70±4.56
Overall	56.47±6.61	65.75±4.02	70.65±3.40

Intake and digestibility of DM

Two metabolism trials were conducted during the pregnancy (mid pregnancy) and lactation periods (mid lactation) of the experimental female goats. Six goats from each group were taken for the trial during both the periods.

1. Pregnancy period: 18 goats (6 x 3).
2. Lactation period: 18 goats (6 x 3).

It was observed that lactating goats under each group consumed higher DM than pregnant goats (Table 2). DMI/100 kg body weight ranged from 3.10 (T3) to 3.49 kg (T1) in pregnant does and 3.99 (T3) to 4.42 kg (T1) in lactating does. However, the differences were statistically similar.

Table 2: DM intake and DM digestibility in pregnant and lactating Barbari goats under different treatments

Treatments	DMI (g)	DMI (g)/100 kg BW	DMI (g)/kg W0.75
Pregnant Barbari goats			
T1	830.07	3.49	77.98
T2	857.16	3.35	75.14
T3	880.925	3.10	71.44
Pooled mean	856.05	3.31	74.85
Pooled SE	98.04	0.16	2.38
Significance	NS	NS	NS
Lactating Barbari goats			
T1	1188.36	4.42	100.46
T2	1257.99	4.30	99.84
T3	1101.55	3.99	91.42
Pooled mean	1182.63	4.24	97.24
Pooled SE	93.39	0.30	6.47
Significance	NS	NS	NS

NFRPT XI/3.1: Studies on Nutritional Value of Goat Milk

R.B. Sharma and A.K. Das

Milk Composition and Paneer Yield of Jamunapari Goats during different Months

Total 274 Jamunapari goat milk samples were collected during different months to study the milk composition and paneer yield. Specific gravity of goat milk was not affected during different months. However, a wide variation was observed in fat, SNF and T.S. content of Jamunapari goat milk during different months (Fig.1-4). Fat content was observed to be higher during February, September and October viz. 5.14±0.07, 5.07±0.07 and 5.40±0.03 %, respectively. Total solids content were also noticed higher during these months resulting better paneer yield.

Fig. 1: Monthly variation in FAT content of Jamunapari milk