Fig. 2: Monthly variation in SNF of Jamunapari milk

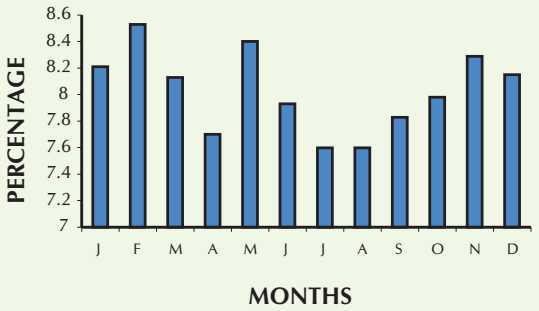


Fig. 3: Monthly variation in TS content of Jamunapari milk

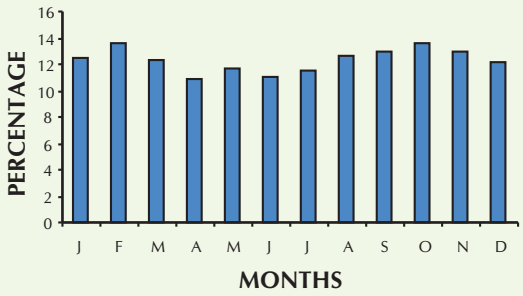
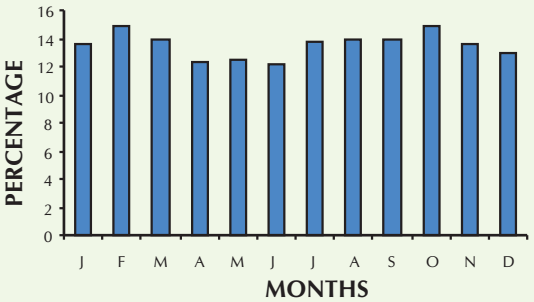


Fig. 4: Monthly variation in paneer yield of Jamunapari milk

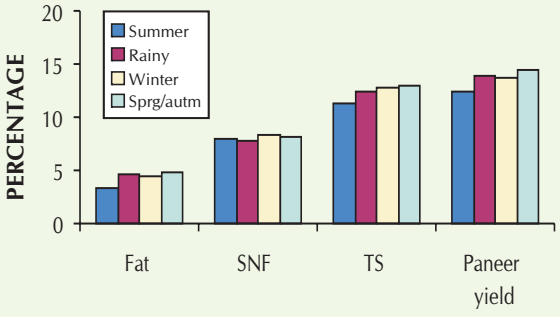


Effect of different seasons on major milk constituents and paneer yield of Jamunapari goats

Jamunapari goat milk samples were collected and analyzed during summer (65), rainy (69), winter (90) and spring/autumn (50) season. Fat content was observed higher (4.80 ± 0.11) during spring/autumn and lowest (3.27 ± 0.03) during summer season ($P < 0.05$) (Fig. 5). Intermediate values were obtained during rainy and winter season and no significant difference was noticed between these two seasons. Almost similar trend was noticed between seasons in respect of total solids in goat milk. A significant difference was also observed in SNF content during different seasons. However, SNF and TS content of Jamunapari goat milk were not statistically different between winter and spring/autumn season. The yield of paneer was highest (14.43 ± 0.14) in spring/autumn and lowest (12.35 ± 0.17) in summer. Intermediate results were obtained during rainy and winter season showing non-significant difference between two.

Seasonal variation in total solids content of Jamunapari goat milk followed the pattern of fat probably due to very high correlation (Table 1) between fat and TS content in all the seasons. Fat and TS content also had highly significant correlation with the paneer yield in Jamunapari goat milk ($P < 0.01$).

Fig. 5: Influence of seasons on milk composition and paneer yield of Jamunapari goats



Effect of multiple births on goat milk composition

Milk samples (31) were collected From Jamunapari goats to study the effect of multiple births on composition. No significant difference was observed between single and twins birth milk in respect of fat, solids-not-fat, total solids, protein and ash content.

Table 1: Correlation among milk constituents and paneer yield in different seasons

Season	Constituents	Solids-not-fat	Total solids	Paneer yield
Summer N = 65	Fat	0.375**	0.704**	0.481**
	SNF	-	0.850**	0.109NS
	TS	-	-	0.414**
Rainy N = 69	Fat	0.620**	0.941**	0.629**
	SNF	-	0.822**	0.440**
	TS	-	-	0.619**
Winter N = 90	Fat	0.723**	0.974**	0.856**
	SNF	-	0.857**	0.625**
	TS	-	-	0.840**
Spring/autumn N = 50	Fat	0.286*	0.908**	0.790**
	SNF	-	0.655**	0.285*
	TS	-	-	0.757**

Table 2: Effect of multiple birth on milk composition of Jamunapari goats (Mean ± SE)

Type of birth	Fat	SNF	TS	Protein	Ash
Single (16)	2.87 ± 0.20	8.44 ± 0.26	11.31 ± 0.29	2.68 ± 0.13	0.79 ± 0.07
Twins (15)	2.99 ± 0.36	8.38 ± 0.21	11.41 ± 0.34	2.90 ± 0.16	0.71 ± 0.05
Overall (31)	2.93 ± 0.19	8.41 ± 0.17	11.36 ± 0.22	2.78 ± 0.10	0.75 ± 0.04

Effect of stage of lactation on milk Composition of Barbari goats

51 samples of Barbari goat milk were collected during different stages of lactation (early-20, middle-13 and late-18) and analyzed to study the variation in milk composition. Fat content was highest (4.84 ± 0.28) during late stage of lactation and lowest (3.86 ± 0.21) during early stage of lactation in Barbari goats. The difference was highly significant ($P < 0.01$) (Table 3). The total solids content also showed a similar trend but it was statistically non-significant. The solids-not-fat, protein and ash content in Barbari goat milk were found to be non-significant between the different stages of lactation. However, Calcium content in goat milk was observed higher (150.73) during early stage of lactation followed by middle (147.11) and late (131.96) stage of lactation. No significant difference was found in zinc content of goat milk during different stages of lactation.

Table 3: Effect of stage of lactation on milk Composition of Barbari goats (Mean ± SE)

Lactation Stage	Fat	S.N.F.	T.S.	Protein	Ash	Calcium	Zinc
Early (20)	3.86A ± 0.21	10.91 ± 0.50	14.76 ± 0.47	3.40 ± 0.13	0.77 ± 0.03	150.73A ± 2.44	0.47 ± 0.02
Middle (13)	4.23AB ± 0.25	10.46 ± 0.74	14.69 ± 0.69	3.44 ± 0.18	0.78 ± 0.04	147.11A ± 6.58	0.48 ± 0.04
Late (18)	4.84B ± 0.28	10.59 ± 0.49	15.43 ± 0.64	3.58 ± 0.12	0.76 ± 0.03	131.96B ± 5.38	0.43 ± 0.03
Overall (51)	4.30 ± 0.15	10.68 ± 0.32	14.98 ± 0.34	3.47 ± 0.09	0.77 ± 0.02	143.18 ± 2.90	0.46 ± 0.02

Means in the same column with the different superscripts differ significantly ($P < 0.05$)

NFRPT XI/3.2: Evaluation of Carcass Traits, Meat Quality and Products from Goat Meats

A.K. Das and R.B. Sharma

Effect of Concentrate Supplementation with Area Specific Mineral Mixture on Carcass Traits and Meat Quality of Barbari Kids

Fifteen post-weaned male Barbari kids (3 months old) were divided into three equal groups to study the effect of supplementation of concentrate mixture along with area specific mineral mixture (ASMM). The kids under Group A and Group B were allowed 5-6 hrs grazing daily. The kids under Group A were supplemented with barley grain @2% of body weight along with common salt and kids under Group B were supplemented with concentrate mixture (CP-18.87%, TDN-70.33%) @2% of body weight along with ASMM. The kids under Group C were fed under intensive system with same concentrate mixture containing ASMM @2% of body weight with gram straw and green fodder offered *ad lib*. Five kids from each Group were slaughtered at 10 months of age. Though there was no significant difference between the Groups, supplementary feeding with mineral mixture on an average improved the slaughter weight by 1-1.5 kg. Hot carcass weight was higher in Group B (10.34 kg) and C (10.48 kg) than Group A (9.24 kg). Similarly improved dressing percentage was obtained in Group B (49.12%) than Group A (46.10%). The Groups supplemented with concentrate mixture containing ASMM showed significantly ($P<0.05$) higher forequarter percentage (27.93%, 27.18%) than the control (25.61%). Intensive feeding coupled with ASMM (Group C) significantly ($P<0.05$) improved GR and breast fat thickness (1.22 mm; 2.16 cm) than Group A (1.06 mm; 1.82 cm) and Group B (1.08 mm; 1.82 cm) whereas loin eye area was not significantly different in these Groups.

Group B had significantly ($P<0.05$) higher separated lean (71.65%) than Group C (66.38%) but Group C deposited significantly more fat in the muscles. Different dietary treatments significantly affected variety meat yield and Group C had significantly lower yield than other Groups. Concentrate mixture feeding (Group B and C) had positive effect on fat deposition in different depots and omental fat was significantly ($P<0.05$) higher in Group B and C than Group A. Supplementary feeding along with deficient mineral mixture improved various cuts weight in Barbari kids maintained under semi-intensive system. The loin cut weight was significantly higher ($P<0.05$) in Group A and Group B. However, no differences were observed in the chemical composition of *Longissimus dorsi* muscle among various dietary treatment Groups. Cholesterol content of the muscles was not significantly different among the treatments and values were within the range of 83.73-87.25mg/100g. It is concluded that concentrate supplementation along with area specific mineral mixture may be used for improving goat meat productivity.

Antioxidant effect of curry (*Murraya koenigii*) leaf powder on quality of fresh ground goat meat

The curry leaf powder (CLP) had potent antioxidant effect as measured by DPPH method (Fig. 1) and its use in fresh meat did not impart any negative effect on meat quality. CLP though did not significantly influence odour but improved odour score. Fresh goat meat had acceptable odour upto 5 days whereas in control sample it was upto 3days. CLP treated sample had significantly lower free fatty acids content (0.31 to 0.71) as compared to control sample (0.37 to 0.93). Addition of 0.2% CLP to ground goat meat is sufficient to lower the free fatty acids, thiobarbituric acid and peroxide values. The control sample was not acceptable after day 3 while treated sample could be acceptable up to day 5 during refrigerated storage.

Fig. 1: DPPH radical scavenging activity of the extracts from curry leaf powder

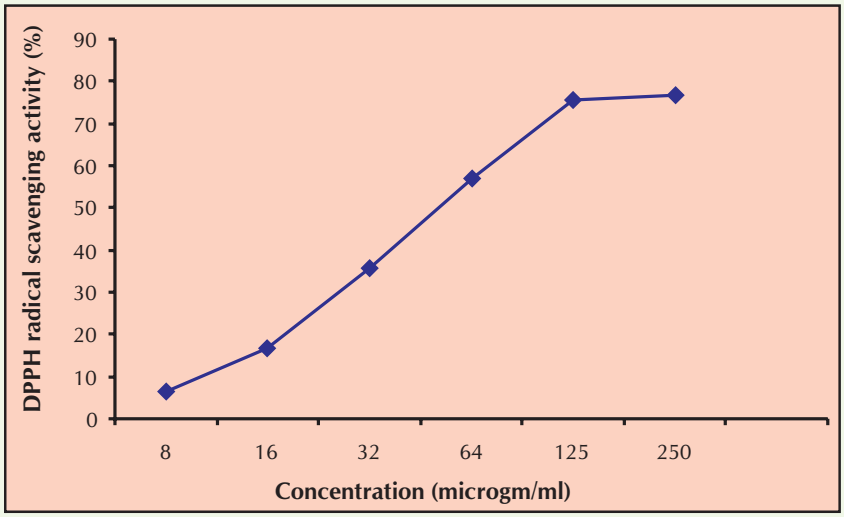


Table 1: Effect of CLP on free fatty acids, peroxide and thiobarbituric acid values of fresh goat meat

Treatments	Storage period (days)					Treatment Effect
	1	3	5	7	9	
Free fatty acids						
Control	0.37d	0.58c	0.65c	0.78b	0.93a	**
CLP	0.34e	0.46d	0.55c	0.57bc	0.71a	
Peroxide values						
Control	1.74a	2.21b	2.52c	3.01d	3.56e	**
CLP	1.52a	2.04b	2.17b	2.61c	2.82d	
Thiobarbituric acid values (mg malonaldehyde/kg)						
Control	0.56d	0.68d	0.87c	1.05b	1.22a	**
CLP	0.47e	0.58d	0.73c	0.90b	0.93a	

Means in the same row with different superscripts are significantly different ($P < 0.05$), **$P < 0.01$

Effect of fat levels on microwave cooking properties and quality of goat meat patties

Patties with various fat levels (5%, 10%, 15% and 20%) were cooked in a microwave oven with full power (700W) operating at 2450 MHz. Results showed that fat level did not affect emulsion stability of batter but it decreased as fat level increased. Microwave cooking time decreased as fat levels increased. Patties with 5% fat level showed lower cooking loss than other fat levels. As fat level increased, shear force value decreased indicating soft texture. Subjective colour evaluation indicated patties with 5% fat were darker and were redder than patties with more fat. Sensory analysis revealed that goat meat patties with 5% and 10% fat had less flavour and juicer than patties with 15% and 20% fat. Tenderness and oiliness increased significantly with an increase in fat level. Patties with 10% and 15% fat rated higher overall palatability than others. Cooking properties and quality of goat meat patties with different fat level were affected when cooked by microwave energy.

Table 1: Effect of fat levels on microwave cooking properties and quality of goat meat patties

Variables	Fat level (%)			
	5	10	15	20
Emulsion stability (%)	93.50 ± 0.65	93.12 ± 0.52	91.87 ± 0.69	91.42 ± 0.58
Cooking time (s)	164.37 ± 1.85a	148.46 ± 5.41b	133.85 ± 3.68c	114.62 ± 3.86d
Cooking loss (%)	8.81 ± 0.73b	10.82 ± 1.17b	11.87 ± 1.22b	15.20 ± 1.25a
Surface colour	4.41 ± 0.16a	4.24 ± 0.10ab	4.05 ± 0.15ab	3.85 ± 0.11b
Shear force (kg/cm2)	0.82 ± 0.06a	0.69 ± 0.03b	0.58 ± 0.02b	0.41 ± 0.02c
Tenderness	4.68 ± 0.30c	4.91 ± 0.25c	6.02 ± 0.22b	7.03 ± 0.15a
Juiciness	5.28 ± 0.21c	6.29 ± 0.24b	6.54 ± 0.13ab	6.88 ± 0.15a
Oiliness	4.35 ± 0.07c	4.82 ± 0.23c	5.38 ± 0.20b	5.91 ± 0.16a
Flavour	4.97 ± 0.18b	5.48 ± 0.16b	6.34 ± 0.22a	6.73 ± 0.16a
Overall palatability	5.21 ± 0.13c	5.85 ± 0.20b	6.52 ± 0.29a	6.90 ± 0.16a

Means in the same row with the different superscripts are significantly different ($P < 0.05$)
Visual colour score based on 5 point scale, in which 5 = tan and 1 = pink
Sensory core based on an 8 point scale, in which 8 = excellent and 1 = extremely poor

AICRP on Improvement of Feed Resources and Nutrient Utilization in Raising Animal Production

U.B.Chaudhary and S. D. Kharche

Based on deficiency observed in the samples of feed, fodder, water, soil and plasma of different livestock species, collected at farmers end from three agro-climatic zones of UP, area specific mineral mixture was formulated separately for each of three agro-climatic zones. To validate the formulated area specific mineral mixture, on farm trials were conducted on cattle and buffaloes suffering from problems of repeat breeding and anoestrous. Results obtained up to 31st of March, 2008 indicated that out of 81 Cattle and Buffaloes suffering form problem of repeat breeding, 58 (72%) became pregnant on no return basis, where as out of 26 cases of anoestrous cattle and buffaloes, 4 (15%) became pregnant with in 15-65 days of initiation of feeding of area specific mineral mixture. Feeding of area specific mineral mixture is in progress and there may be increase in number of recovery cases of cattle and Buffaloes suffering from reproductive problems. Results of on farm trial conducted on Milch cattle and Buffaloes did not show any positive effect of mineral feeding on milk production.

Another study conducted to observe the effect of area specific mineral mixture on productive performance of male goats maintained under intensive system of management for a period of 308 days, indicated higher body weight gain, better rumen fermentation pattern and more economic gain from the group of goats fed area specific mineral mixture in comparison to corresponding non mineral fed group. However in a similar study conducted on male goats maintained under semi-intensive system of feeding management for a period of 4 months indicated no effect of feeding area specific mineral mixture on productive efficiency as well as fermentation pattern of goats. It may be attributed to intake of required minerals by non mineral fed goats through browsing. Initial observation collected in terms of semen quality and quantity of bucks and testosterone level in serum did not show any pronounced effect of feeding of area specific mineral mixture. In order to create more awareness amongst the livestock farmers about the importance of feeding mineral mixture for improvement of productive and reproductive efficiency of livestock, field trials of area specific mineral mixture are in progress.

Table 1: Effect of feeding area specific mineral mixture to treat reproductive problems in cattle and buffalo at farmer's level.

No. selected villages & commercial dairy farm	Total no of animals for trial	No of days of min, mix feeding	No of animal become pregnant	Percentage	Case history of problematic animals
Villages- 18 Commercial dairy farm -2	107 R.B.: 81 Anestrus: 26	15-65	R.B.: 58 Anestrus: 4	71.60 15.3	Most of the repeat breeder buffaloes and cattle repeated at least 4 -5 times at regular intervals of 21-30 days prior to feeding of area specific mineral mixture. In case of cattle and buffaloes suffering from problem of anestrous attained the age of > 4years and never came in heat prior to feeding of area specific mineral mixture.

Table 2: Effect of feeding area specific mineral mixture on growth, intake and fermentation pattern of male Barbari goats maintained under intensive system of management

Particulars	Control (A)	Experimental (B)
No of goats	08	08
Age of animals	03 months	03 months
Intake in terms of straw (g/d/goat)	439.47 ± 16.73	452.7 ± 14.52
Initial body wt. (kg)	6.78 ± 0.55	6.93 ± 0.66
Final body wt. (kg)	22.41 ± 1.68	23.77 ± 1.39
Gain in body weight (kg) /goat	15.63	16.84
Rumen Fermentation Pattern		
Ammonia N2 (mg/dl)	0.45 ± 0.05	0.42 ± 0.04
VFA (m mol/dl)	7.96 ± 0.41	8.04 ± 0.22
pH	7.0 ± 0.05	7.28 ± 0.26

Table 3: Economic details of feeding of area specific mineral mixture to the goats maintained under intensive system of management

Particulars	Control (A)	Mineral fed (B)
No goats under study	08	08
Age and breed	Barbari male, 3 months of age	Barbari male, 3 months of age
Duration of study	308 days	308 days
Consumption of Arhar straw /goat and its cost (@Rs. 200/100kg)	270.0 (135.35)	278 (139.43)
Consumption of green fodder/goat and its cost (100/100kg)	154 (154.0)	154 (154.0)
Consumption of barley grain (kg)/ goat and its cost (@ 8/kg)	Rs. 340.0 (42.50)	Rs. 354.8 (44.35)
Consumption of mineral mixture/ goat and its cost (@ Rs.40/kg)	–	35.48 (0.887)
Cost of total input (Rs)	764	822.28
Body weight gain	15.7	17.01
Total meat (kg) @50 % dressing	7.85	8.50
Cost of meat (Rs) @ 150/kg	1177.5	1275.0
Net profit/goat during the experimental period	413.5	453.0

AP Cess Project: Isolation and Identification of Efficient Exotic Fungi for Improvement of Pasture/ Fibre Digestibility in Goats

U.B.Chaudhary and V.K.Gupta

Amplification of ribosomal ITS2 region

The ribosomal ITS2 region defined by primers JB206F 5' GGAAGTAAAAGTCGT AACAAGG 3' and JB206R 5' TCCTCCGCTTATTAATATGC 3' was amplified from genomic DNA of rumen anaerobic fungi using PCR. The PCR was performed in a 50 µl volume containing (final concentration): forward and reverse primers, 150 pmol each; 1X PCR master mix (Banglore Genei) having *Taq* DNA polymerase, dNTPs and reaction buffer with $MgCl_2$ at optimum concentration, 25 µl; template, 4 µl and sterile water to make up the vol. to 50 µl. The ribosomal ITS2 region of different species was amplified from genomic DNA and gave amplification of approx 700bp.

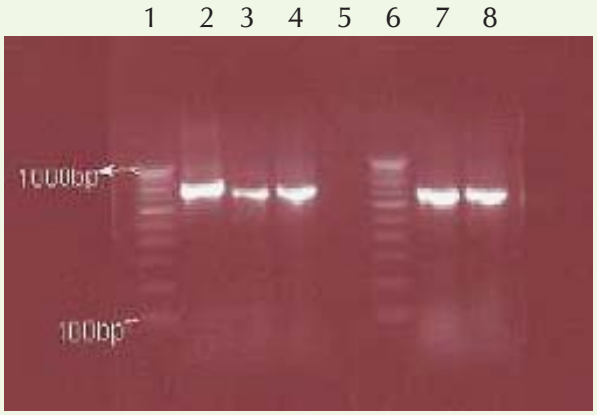
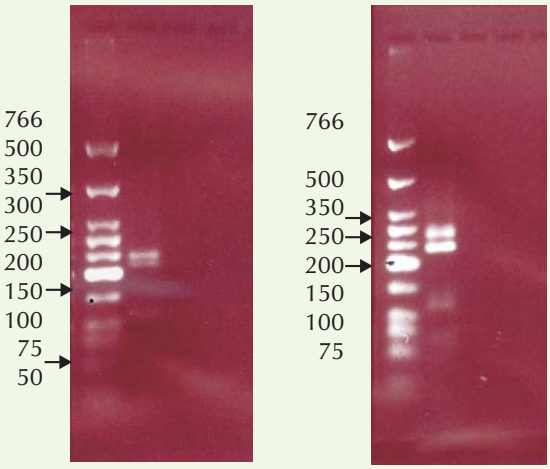


Fig.: Amplification of ITS 2 region.(700bp App.) of *Piromyces* and *Orpinomyces*.
Lane 1and6: Standard 100bp molecular weight marker.
Lane 2, 3and4: ITS 2 region of *Piromyces*
Lane 7 and 8: ITS 2 region of *Orpinomyces*

RFLP analysis of *Orpinomyces* species isolated from Nilgai and Goats

The amplified intergenic spacer ITS2 region was digested by site specific restriction enzyme (Dra I). After digestion with DraI, PCR amplicon of *Orpinomyces* species isolated from Nilgai and goats generated fragments of 300, 250, 130, 65 bp (approx) and 250,240, 130 bp, respectively.

RFLP of ITS 2 region of *Orpinomyces* sp. RFLP of ITS 2 region of *Piromyces* sp. isolated from Nilgai isolated from Goats.



Effect of cross inoculation of exotic fungi *Orpinomyces* sps. (isolated from Nilgai) on growth, feed intake, digestibility, rumen microbes and rumen fermentation pattern in Barbari goats

Efficient fungal sps. (*Orpinomyces*) isolated from Nilgai was selected on the basis of higher estimated fibrolytic enzyme activity, observed during last two years. This species of anaerobic fungi was cultivated in the laboratory in serum bottles (100ml) containing 40ml of non defined Joblin's medium and antibiotics. All the components of the medium were same except 40% of clarified rumen liquor (CRL) in place of 15% and an extra addition of 0.2% milled Arhar straw. Higher proportion of CRL was used for making exotic fungal sps. adapted in goat rumen liquor. Survivability of fungal culture was checked under microscope and live culture of exotic fungi was used for cross inoculation. For experimental trial, 10 male Barbari goats of approx. 9 months of age were selected and divided equally into two groups (C andD). Animals of both the groups were kept separate in iron cages and were receiving Arhar straw + Pelleted feed @ 100g /day daily. Animals of group C, were administered 40ml of un inoculated fungal medium containing 0.2% milled arhar straw and antibiotics at weekly

interval. Where as in case of group D, animals were administered 40 ml of 48 hrs. old culture of *Orpinomyces* sps.(isolated from Nilgai) containing 0.2% milled arhar straw and antibiotics at weekly interval using stomach tube and syringe. Regular inoculation in control (C) and treated (D) groups was done at weekly interval up to 3 months. Observations in terms of growth rate, (fortnightly) and intake of arhar straw (daily) was recorded.

Results related to the productivity and rumen fermentation pattern affected by inoculation of exotic fungi are presented in Table 1. Significantly higher ($P < 0.05$) intake of arhar straw under group D in comparison to group C. Reason seems to be associated with the effect of inoculated exotic fungi. Higher concentration of VFA ($P < 0.05$) observed in group C needs to be correlated with the results of digestibility trial. Lower values of microbial population in terms microcrystalline cellulose degrading bacteria, fungal and protozoal population under group D indicated that inoculated exotic fungi could not establish symbiotic relationship with native fauna and flora. Results of metabolic trial are under statistical analysis.

Table 1: Effect cross inoculation of exotic fungi on productivity and rumen fermentation pattern in goats.

Particulars	Group C (Control)	Group D (Treated)
Breed and sex of the goats	Male Barbari	Male Barbari
Number of goats	05	05
Initial body wt.	16.82 ± 1.0	16.5 ± 0.56
Final body wt.	19.38 ± 0.93	18.56 ± 0.81
Gain in body wt.	2.56	2.06
Intake of straw (g/d)	788.48 ± 13.75a	830.54 ± 14.26b
Rumen fermentation pattern		
pH	6.84 ± 0.03	6.35 ± 0.35
TVFA (m/dl)	10.98 ± 0.61a	8.56 ± 0.15b
Ammonia Nitrogen (mg/dl)	1.7 ± 0.37a	1.82 ± 0.42a
Rumen Microbial Population		
Total Viable Count of microcrystalline cellulose degrading bacteria (X 1011/ml)	128.3 ± 8.39a	108.9 ± 2.41b
Total fungal Count X103/ml	4.6 ± 2.47a	3.7 ± 1.79a
Total Ciliate Count X106/ml	3.94 ± 0.34a	3.7 ± 0.28a

Mean followed by the different superscript (s) in the same row differ significantly ($P < 0.05$)

AP Cess project: Development of Supplementation Strategies for Goats under Field Conditions

T. K. Dutta and P.Tripathi

In vitro evaluation of goat feeds/fodders collected from the semi-arid region

Some farmers supplement grain component (home grown) to their goats. Therefore, four combinations of rations were prepared using the ingredients collected from each block of surveyed districts. Total of 16 combinations of rations were prepared for two districts (Aligarh and Agra). Addition of concentrate mixture (20%) in the ration increased CP% in the total mixed ration (TMR). Inclusion of mineral mixture (3%) in the ration improved the major and trace mineral status in the TMR. *In vitro* evaluation of the above rations was done using PC based synchronized Bio-fermentor module. Each ration was subjected to *in vitro* incubation for 48 hours under this module to observe total gas production, IVDMD and fermentation pattern. Supplementation of barley grain or concentrate mixture (with mineral mixture) in the roughage based rations (as followed in the village condition) increased IVDMD, thereby, improved the total VFA, NH3-N and total-N concentrations in the incubation medium. pH was also influenced by such treatments. Therefore, supplementation of deficient nutrients (energy, protein and minerals) may improve the production potential in goats under field condition. The similar supplementation patterns were further validated in the growing

Table 1: Effect cross inoculation of exotic fungi on productivity and rumen fermentation pattern in goats.

Parameters	*T1*	*T2*	*T3*	*S.E.M.*	*Significance*
Weigh gain and FCE					
Initial BW (kg)	7.97	8.08	7.63	0.99	NS
Final BW (kg)	8.55	9.92	10.13	1.00	NS
Weight gain (kg)	0.58a	1.83b	2.50b	0.51	P<0.05
ADG (g)	9.72a	30.56b	41.67b	8.53	P<0.05
DM intake (g)/d	270.21	268.72	288.44	27.58	NS
Feed conversion efficiency (%)	3.60a	11.37b	14.44b	3.04	P<0.05
Rumen fermentation pattern					
pH	6.64b	6.53b	6.24a	0.13	P<0.05
TVFA (mmol/dl SRL)	9.83	9.78	10.83	1.10	NS
Total-N (mg/dl SRL)	44.10	52.40	53.05	5.35	NS
NH3-N (mg/dl SRL)	19.88a	28.85b	27.48b	1.39	P<0.01

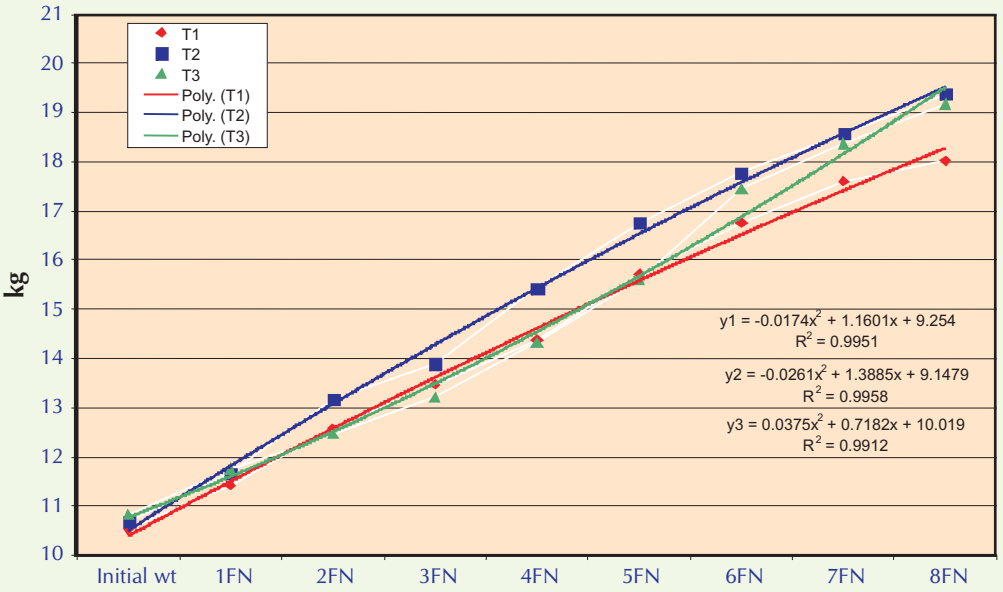


Fig. 1. Growth perfomance of kids with different supplementations

GOAT HEALTH DIVISION

XI/GH-1 Project title: Monitoring and Surveillance of Important Goat Diseases in India.

D.K. Sharma, V.K. Gupta, Rajneesh Rana, Ashok Kumar and V.S. Vihan

Passive surveillance:

Questionnaire was developed to collect the information regarding various important diseases of goats. The questionnaire was sent to 42 goat farmers by post. The result has been presented in Tables 1, 2 and Fig.1. A total of 10 goat farmers had responded. The data were critically analyzed and interpreted. The colostrums were fed to newly born kids by all the farmers. It was also observed that 60 per cent farmers do get veterinarian help for the treatment of their animals even than the mortality in 0-1 M and 3-5 M kids was 32.5 and 38.4% respectively. All the farmers got their goats vaccinated. Vaccination for PPR was observed in 60 per cent cases but none of the farmers adopted complete schedule of vaccinations. Of the total 145 pregnant animals, 63 aborted giving an occurrence of abortion to be 43.4 per cent. All the abortions were, however, reported in middle of pregnancy.

Active surveillance:

A total of 45 faecal and 83 serum samples of goats were collected from Bhadawari Farm, Itawah, UP and tested for important disease. A total of 22 faecal samples were found positive for gastrointestinal nematodes, 03 for Moniezia and 45 for coccidian oocysts. During the year, outbreaks in goats were attended in Bah, Agra and Naujheel, Mathura. The serum and faecal samples were collected from these outbreaks. The faecal samples were tested for parasitic and Johne's disease and the sera samples were tested for Brucellosis and CCPP. The serum samples were also sent to IVRI Mukteshwar for PPR, goat pox, blue tongue and FMD testing. Most of the samples were positive for PPR, Blue tongue and Goat pox.

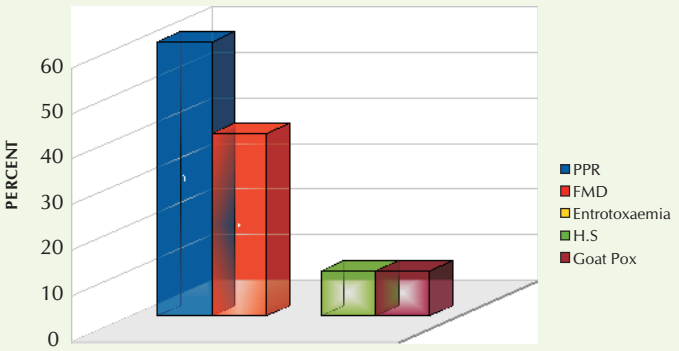


Fig. 1: Vaccination in Owner's Flock (Questionnaire Response)

Table 1: Mortality in Farmers goat flock (Response to Questionnaire)

Total mortality	Age-wise Per cent Mortality				
	0-1M	> 1-3 M	> 3-6 M	> 6-12 M	Adult
52	32.6 (17)	9.6	38.4	3.84	5.76

Table 2: Abortion in Farmers goats flock (Response to Questionnaire)

Total Pregnant goats	Abortions	Occurrence (Per cent)	Time of Abortion
52	63	43.4	Middle stage

Table 3: Status of diseases in goats at Bhadawari Farm Itawah (UP)

Type of sample	No. of samples	Diseases considered	No. positive
Serum Samples	83	Brucellosis	Nil
	80	CCPP	59
Faecal Samples	45	Johne's disease	22
		Gastrointestinal nematodes	22
		Coccidiosis	45
		Cestodes	03

XI/GH-2 Diagnosis and Development of Prophylaxis and Treatment of Important Diseases of Goats

XI/GH-2.1 Modulation of Caprine Coccidiosis through Herbal Therapy

D.K. Sharma and Ashok Kumar

Literature on herbal medicine to be used against coccidiosis was thoroughly and exhaustively searched for their therapeutic activities. 15 plants were selected for in-vitro and in-vivo trials against different stages of coccidia. Materials from the selected plants were collected, dried under shade and processed for their extraction. The methyl alcohol was used as extracting solvent. The extracts of *Holarrhena antidysenterica, Allium sativum, Calotropis procera* and *Aloe vira* were prepared through soxhlet method and stored in refrigeration for further use in in-vitro and in-vivo trials against coccidia oocysts. In-vitro trials of *Holarrhena antidysenterica* and *Allium sativum* with coccidia oocysts were conducted using different extract concentrations. In vitro effect of various extracts at

different interval (24, 48, 72 and 96 hrs) were recorded. The concentrations of extracts for trials remained same with all herbal extracts. The ascending concentrations used in in-vitro trials were 0.5, 1, 2, and 4 %. The observation were recorded and compared with controls. As coccidia infection was of mix nature, the sporulated and unsporulated oocysts were counted irrespective of their species. The results of in-vitro trials were presented in per centage in Table 1 and 2. Effect of *Holarrhena antidysenterica* on Eimerian oocysts sporulation was not in regular pattern and remains obscure. On the other hand *Allium sativum* extract successfully checked sporulation even in lowest used concentration.

Table 1: Sporulation of Eimerian oocysts in different in concentrations of *Holarrhena antidysenterica*

S.No.	Extract concentrations (%)	Sporulation (%)			
		24 hrs	48 hrs	72 hrs	96 hrs
1	0.5	33.3	88.23	100.0	-
2	1.0	42.3	92.59	100.0	-
3	2.0	30	96.61	100.0	-
4	4.0	33.3	100.0	100.0	-
5	Control	72	100.0	100.0	-

Table 2: Sporulation of Eimerian oocysts in different in concentrations of *Allium sativum*

S.No.	Extract concentrations (%)	Sporulation (%)			
		24 hrs	48 hrs	72 hrs	96 hrs
1	0.5	-	-	-	-
2	1.0	-	-	-	-
3	2.0	-	-	-	-
4	4.0	-	-	-	-
5	Control	73.3	93.3	94.1	96.6

XI/GH-2.2: Development of Herbal Anti-diarrhoeal Drug for Goats

Ashok Kumar, Rajneesh Rana, V S Vihan and Vinod Kumar Gupta

Selection of plants: On the basis of results of preliminary screening of medicinal plants in the previous institute project, eight potential plant candidates were selected for further clinical study by preparing combinations for synergistic activity. These plants were coded as CIRG-1 (leaves), CIRG-2A (Leaves), CIRG-2B (Bark), CIRG-3A (Leaves), CIRG-3 B (Bark), CIRG-4 (leaves), CIRG-5 (leaves) and CIRG-6 (leaves). The plants were collected, authenticated, dried and methanolic extracts were prepared by soxhlet extraction assembly and evaporated under vacuum to maintain bioactivity of the active ingredient. The per cent yield was calculated on as such basis and their physical characteristics were also noted. The yield varied from 20.5 to 34%.

Qualitative chemical analysis: Qualitative chemical analysis was conducted for flavonoids, alkaloids, saponins, Carbohydrates, glycosides, steroids, tannins and phenolic compounds and protein and amino acids by standard methods. The result is portrayed in Table 1.

Table 1: Chemical constituents in methanolic extract

Sl.No.	Coded extract	Plant constituents								
		Flavonoids	Alkaloids	Saponins	Carbohydrates	Glycosides	Steroids	Tannins	Triterpenoid and phenolics	Protein and Amino Acid
i.	CIRG-1	+	+	-	+	-	-	-	+	-
ii.	CIRG-3 A	-	-	-	+	-	-	+	+	-
iii.	CIRG-2 A	+	-	-	-	-	-	+	-	-
iv.	CIRG-6	-	-	-	-	-	-	+	-	-
v.	CIRG-4	-	-	-	-	-	-	+	+	-
vi.	CIRG-5	-	-	-	+	-	-	+	-	+

Chemical compatibility analysis of combination of plant extracts:

Individual extracts and in combinations of two, three and four extracts were tested. Test methanolic plant extract dissolved in methanol and applied 5 μl on thin layer plate (Aluminum silica plate) at the concentration of 0.35 gm/ml and subjected to run in Toulene: Ethyl acetate (70:20) solvent system. The developed test plates were examined for presence of spot in both single and combination extracts. In first experiment, 6 single extract and 15 different extracts were tested, which did not reveal any interaction among fractioned spots. In second experiment, 20 different combinations of three extracts were tested in similar way, also not exhibited any interaction in fractioned spots (Fig 1). In third experiment, 15 different combinations of four plants were tested and results showed that expression of all spots were there in both single and mixed extract spot. The results of this study indicated any plant extract may be mixed for development of prototypes.

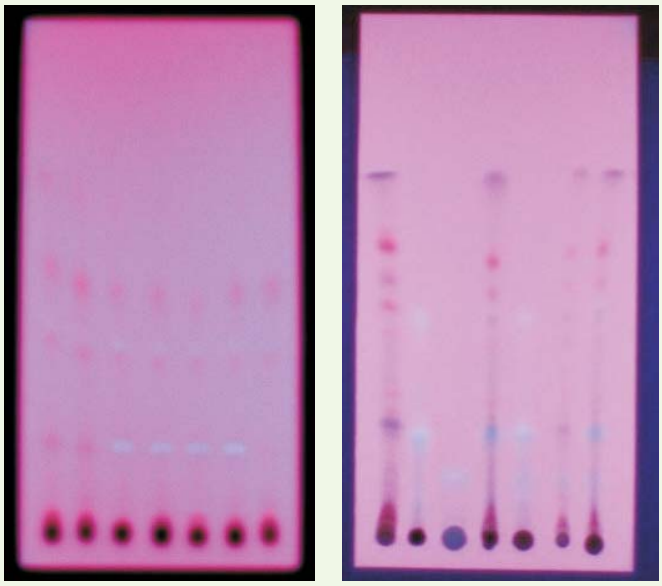


Fig. 1: Chemical compatibility analysis of combination of plant extracts by TLC

Isolation of organism for antobiogram: For testing in vitro antibacterial property of plants extracts against pathogenic stain of E coli, the organisms were isolated from clinical cases of diarrhoea in kids and goats of Jamunapari and Barbari goat breed. Isolates were characterized as *Escherichia coli*. Antibiogram of both the isolated were evolved against all commonly used antibiotics. Plant extract was dissolved in suitable solvent, then test plant extract solution with different concentrations (500 mg/ml, 250 mg/ml, 125 mg/ml, 62.5 mg/ml and 3.25 mg/ml) and impregnated disc with 25 μl of each serial dilution of extract solution contain different concentration (12.5, 6.25, 3.12, 1.50 and 0.78 mg/disc) respectively of extract. The susceptibility and resistance level were observed.

The organisms were isolated from the different places in order to identify the difference in the level of susceptibility/resistance. The organisms (*E.coli*) isolated from Jamunapari kids revealed the susceptibility to most of the antibiotic discs used (Cephalexin, Cephotaxime, Cephadroxil, Ceftazidime, Cefaclor, Ciprofloxacin, Norfloxacin, Sparfloxacin, Lomefoxacin, Gatifloxacin, Tobramycin, Amikacin, Gentamycin, Kanamycin, Roxithromycin, Oxytetracycline, Furazolidone, Chloramphenicol and Co-Trimoxazole), except colistin and sulphadiazine. In contrast to the organism isolated from Jamunapari kids, the isolate from Barbari kids showed the resistance to most of the antibiotic disc used, except amikacin, gentamycin, furazolidone and colistin.

Antibiogram of Prototypes: In order to study in the enhancement in antibacterial activity, some selected combination of extracts was tested. The ratio of 50:50 of the individual extract was prepared. Antibiogram property of was evaluated against isolated and characterized pathogenic ETEC *Escherichia coli*, at the concentration of 12.5,6.24,3.12,1.56,0.78 and 0.39 mg/disc by disc diffusion test. In CIRG-5 + CIRG-6, CIRG-5 + CIRG-3A, CIRG-1 + CIRG-6, CIRG-2B + CIRG-6, CIRG-1 + CIRG-2B, CIRG-2A + CIRG-1 and CIRG-5 + CIRG-2B. There were no synergistic antibacterial activity were reported in any prototypes, however, in CIRG-5 + CIRG-4 and CIRG-5 + CIRG-6, there was antagonistic effect in these combinations (Fig 2).

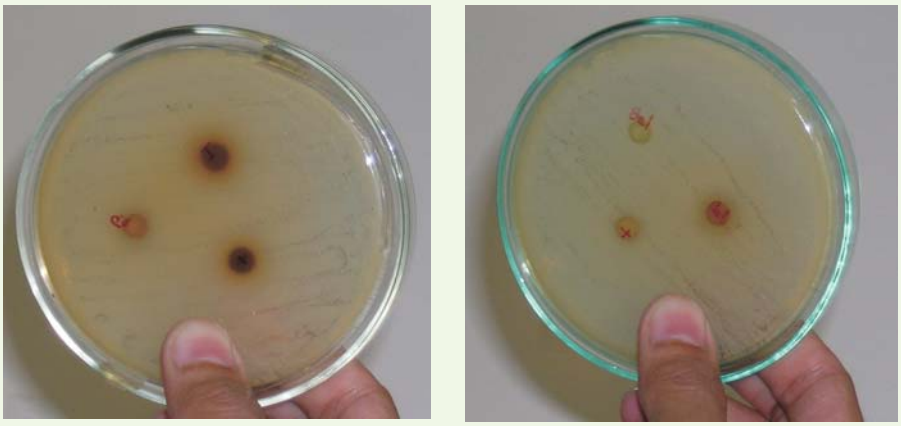


Fig. 2: Antagonistic antibacterial activity of CIRG-5 + CIRG-4 and CIRG-5 + CIRG-6

Clinical trails of Prototypes in oral liquid formulation: Four prototypes, Prototype A (CIRG-2A + CIRG-1), Prototype B (CIRG-1 + CIRG-2B), Prototype C (CIRG-4 + CIRG-2B) and Prototype D (CIRG-5 + CIRG-2B) were prepared in ratio of equal amount. Therapeutic efficacy of extracts were evaluated in clinical cases of diarrhoea kids at the dose rate of 10 mg/kg bwt for 1- 2 days orally and observed degree of recovery (score) and recovery days. In clinical trials (6 kids), pretreatment values of appetite (Good 1, Low 2, No appetite 3), fecal consistency (Watery 1, Semi solid 2, Loose ball 3, Normal 4) and dehydration (+1, +2, +3, +4) were recorded on score basis on the basis of their

severity. Rectal temperature was recorded in both the groups. Recovery score recorded as (Poor 1, Partial 2, Moderate 3, and Complete 4. In CIRG-2B, on same dose rate mean recovery score was 3.8 ± 0.19 and mean recovery days were 1.0 ± 0.00 days. In diarrheic kids, Appetite score was 1.0 ± 0.00, Fecal core was varied from 1.6 to 1.80. The mean duration of diarrhoea varied from 2.2-2.5 days. In prototypes A, mean recovery score was 4.0 ± 0.19 and mean recovery days were 2.41 ± 0.08 days. Similarly In prototypes B, mean recovery score was 4.0 ± 0.00 and mean recovery days were 2.50 ± 0.06 days. In prototypes C, mean recovery score was 4.0 ± 0.00 and mean recovery days were 2.40 ± 0.06 days and In prototypes D, mean recovery score was 4.0 ± 0.00 and mean recovery days were 2.50 ± 0.09 days. All are showing potential as antidiarrhoeal in goats.

XI/GH-2.3 Control of Brucellosis in Goats by Molecular Diagnosis and Epidemiology.

V.K. Gupta, S.V. Singh and V.S. Vihan

Isolation of *Brucella* from specimens: The following specimens were used for isolation of *Brucella* sp.

Table 1: Isolation of *Brucella* isolates from different source of goat origin

S.No.	Specimen	Number	Number of suspected *Brucella* isolates
1.	Milk	20	nil
2.	Vaginal swab	15	05
3.	Fetal membranes	08	05
4.	Aborted fetus	06	03
5.	Fetal stomach content	06	02
6.	Uterus	05	01
7.	Supramammary lymph nodes	05	nil
	Total	65	16

The suspected isolates were further subjected to identification and characterization.

Identification of *Brucella* organisms

There is no single test by which an organism like brucella can be identified. A combination of growth characteristics, serological and bacteriological methods usually enable brucella to be correctly identified.

Morphology and staining: All the 16 suspected *Brucella* isolates were Gram-negative, cocco-bacilli, usually arranged singly. The morphology was fairly constant in 10 isolates however 06 isolates showed pleomorphic character. True capsule was not detected in any of 16 isolates.

Growth characteristics: Suspected *Brucella* colonies which were close to colonies of contaminants were picked and re-streaked on Brucella agar medium. After incubation for 4-5 days, the plates were examined for colonial morphology. There were several types of suspected Brucella isolates colonies were seen, representative colonies of each isolates were selected for further characterization. In most of the cases the growth was smooth, clear, pale honey-colored appearance. The colonies producing haemolysis on blood agar or lactose fermentation on Mac-Conkey agar were eliminated from further consideration as *Brucella*.

Antigenic characteristics: Out of 16 *Brucella* isolates, 06 were with smooth surface antigens and reacted in agglutination with antisera prepared against smooth *Brucella* culture. Rest 10 isolates did not reacted with antisera. These 10 isolates were either may be rough *Brucella* or variants of *Brucella*.

Biochemical tests: Brucella cultures were oxidative rather than fermentative in metabolism. All the 06 smooth Brucella were oxidase and urease positive.

Typing of *Brucella* culture: After it was established that out of 16 suspected *Brucella* isolates, only 06 were identified as genus *Brucella*, it is important to try to establish its species and biovar. Species identification was based on 2 main sets of properties:

i. lysis by phages and ii. Oxidative metabolic profile on selected amino acid and carbohydrate substrates.

For characterizing the *B.melitensis* at the biovar level four (04) main tests were used:

i. carbon di oxide (CO_2) requirement,
ii. production of hydrogen sulphide (H_2S),
iii. dye (thionine and basic fuchsine) sensitivity, and
iv. agglutination with monospecific A and M antisera.

The characteristics of all 06 *Brucella* isolates as revealed by the routine typing tests are presented in Table 2.

PCR-RFLP for molecular typing of *Brucella* culture: PCR-RFLP analysis has been used of Brucella omp2 gene. Omp2 gene was used as a locus of two nearly homologous repeated copies that differ slightly among Brucella species and biotypes in presence or absence of the *Pst* 1 site to differentiate between them.

PCR and oligonucleotide primers: The PCR test was performed with all 06 *B. melitensis* biovars isolated from goats. The PCR technique has increasingly been used as a supplementary method in *Brucella* diagnosis. We have used a molecular biotyping approach which has been proposed on the basis of restriction endonuclease polymorphism in the genes encoding the major 25- and 36- KDa outer membrane proteins of *Brucella i.e.* omp2. The *Brucella omp*2 gene was used as target DNA. The forward 5' primer (p1 [TGGAGGTCAGAAATGAAC]) and reverse 3' primer (p2 [GAGTGCGAAACGAGCGC]) were used to amplify an *omp2* gene segment.

Validation of the method with prototype strains: The PCR was first performed to test specificity by comparing *Brucella* species DNAs to the DNAs from several other bacteria, including the taxonomically closely related *Agrobacterium* and *Rhizobium* strains. A single band with the expected size of 282 bp was obtained only when *Brucella* DNA was used as a template. All other bacterial strains and a water sample failed to produce an amplified fragment.

The *omp 2* gene exists as a locus of two nearly homologous repeated copies (*omp2a* and *omp2b*) that differ slightly among *Brucella* spp. We used this information to design specific primers that amplify a 282-bp fragment (Fig.1). The results revealed that DNA fragments obtained from *B. melitensis*

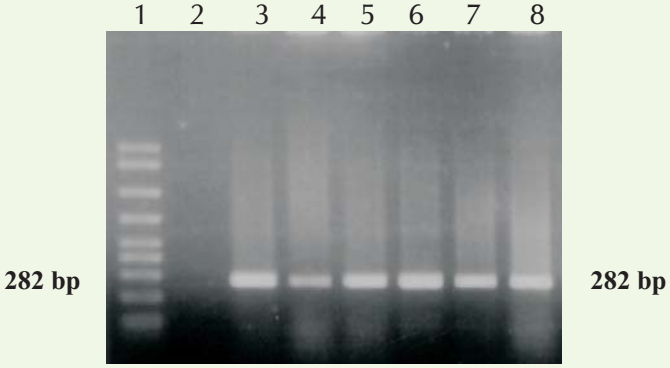


Fig. 1: Agarose gel electrophoresis of PCR-amplified *omp2* gene fragments from isolated *Brucella* strains. The Fig. shows a single band, a 282-bp DNA fragment. Lanes 1: M, molecular size ladder (in base pairs); 2, negative control; 3 and 4, *B. melitensis* strain 16M; 5,6,7 and 8, *B.melitensis* biovar 3

standard 16M strain and two isolates from seropositive goats identified as *B. melitensis 16M* strain produce three bands, an intact 282-bp fragment from the amplified *omp2a* gene that lacks the *Pst I* site and two smaller fragments of 238 and 44 bp, the product obtained from digestion of the omp2b amplified fragment. In contrast *B. melitensis biovar 3* produced only two smaller fragments from both genes; (*omp2a* and *omp2b*), a 238-bp fragment and a 44-bp fragment.

The two isolates identified as *B.melitensis* 16M strain and 03 isolates were identified as *Brucella melitensis* biovar 3. The profiles of the digested PCR products DNA were analyzed by polyacrylamide gel electrophoresis, as shown in Fig (2). The purpose of this analysis was to visualize the smaller fragment that was not shown by agarose gel electrophoresis. In Fig (2), besides the 282- and 238-bp DNA bands, all samples produced an additional identical smaller fragment, which was calculated to be 44-bp. It was calculated that the two small bands (44 and 238 bp) together were the same size as the uncut DNA

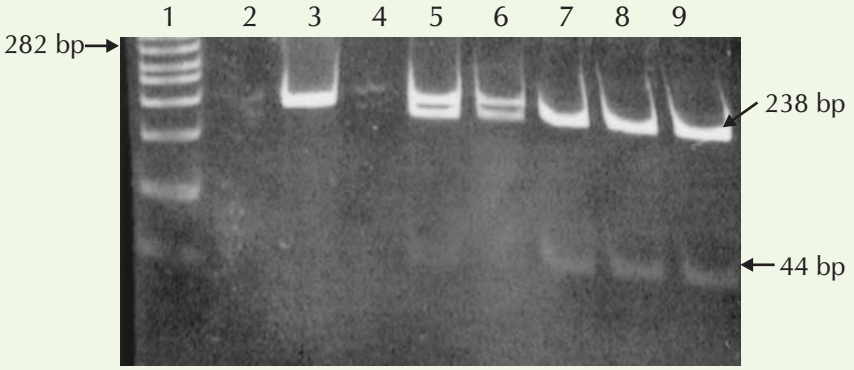


Fig. 2: Polyacrylamide gel electrophoresis of *Pst 1* digests of amplified *omp2* gene fragments from isolated *Brucella* strains.. Lanes 1: M, molecular size ladder (in base pairs); 2; negative control, 3: *Brucella melitensis* biovar 3 omp2 gene uncut, 5 and 6: *Pst I* cut *B. melitensis* 16M DNA fragments with sizes 282, 238 and 44 bp respectively, 7, 8 and 9: *B.melitensis* biovar 3 omp2 gene *Pst I* cut and uncut DNA fragments with sizes 238 and 44 bp

A total of 16 suspected *Brucella* isolates were isolated and on morphological, biochemical and molecular characterization it was found that the two isolates identified as *B.melitensis* 16M strain and 03 isolates were identified as *Brucella melitensis* biovar 3. Sixth one was the variant of *Brucella* spp.

Table 2: Species and biovar differentiation of the species of the genus *Brucella* isolated from goats.

		Growth characteristics					Monospecific sera				Phage typing						Inter-pretation
Suspected *Brucella* isolates	Source	Urea	H_2S	CO_2	BF	TH	A	M	R	Ac	Tb	Wb	BK_2	Fi	Iz	R/C	
P1	Foetal membrane	+ +	-	-	+	+	-	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* 16M
P2	Stomach content	+ +	-	-	+	+	-	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* 16M
P3	Stomach content	+ +	-	-	+	+	+	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* biovar 3
P4	Stomach content	+ +	-	-	+	+	+	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* biovar 3
P5	Vaginal Swab	+ +	-	-	+	+	+	+			NL	NL	CL	NL	PL	NL	*Brucella melitensis* biovar 3
P6	Vaginal Swab	+ +	-	-	-	+	-	-			NL	NL	CL	NL	PL	NL	*Brucella variant*

BF = Basic fuchsin at 20µl/ml (1/50,000 w/v); TH = Thionin at 20µl/ml (1/50,000 w/v);
Ac = 0.1% acriflavin; CL = Confluent Lysis; PL = Partial lysis; NL = No lysis
Plq = Plaques; NL Some lytic activity observed, but not considered true lysis

XI/GH 2.4: Development of Specific Diagnostic for Caprine Pleuropneumonia in Goats using Native *M. mycoides* subsp *capri* Isolate.

Rajneesh Rana, V.K. Gupta, P.K. Rout, Ashok Kumar and V.S. Vihan

Preparation of respective medium of choice for the growth of native *M. capri* isolate: Hank's Balanced salt solution (both solid and liquid) medium was prepared for the growth of four native *M. mycoides* subsp *capri* isolates including standard strain. All the isolates are regularly being maintained under Health Division. The ingredients of Hank's I, II and III were mixed and pH was adjusted to 7.6 7.8. Later, medium was filtered and stored under refrigeration till further use.

Bulk cultivation of the organism and its sonication: All the 4 isolates were cultivated in solid and liquid H.B.S.S. medium. Approximately 1-liter growth of 3 native *M. capri* isolate and 2 liter growth of isolated standard strain was obtained and harvested. The harvested organism was sonicated @ 14-20 μH_z for 10 minutes with an alternate gap.

Rising of hyper immune serum against standard native *M. capri* isolate: The standard native *M. capri* antigen was sonicated. Its protein concentration was estimated and standardized with UV spectrophotometer. Later the standardized antigen having protein concentration @ 2 mg/ dose after proper mixing with CFA was inoculated sub-cutaneously at neck region in 2 different goats. A booster of same dose via same rout was given separately to these animals at 21st day. The standard protocol of Krogsgaard-Jensen (1971) with some minor modifications was followed. Later the animals were test bled and the high titer serum (tested with IHA and Latex agglutination tests) was collected, filtered and kept at 20 ^{0}C till further use.

Preparation of protein samples for standardization of SDS-Polyacrylamide gel electrophoresis: The proteins of *Mycoplasma mycoides* subsp *capri* native isolates including standard native was prepared using 2 different protocols (Archer 1979 and Solsona *et al*. 1996) with minor modifications. The growth of 72 hrs cultures was harvested @10,000 rpm at 4^{0}C for 20 minutes. Later the pellet was washed thrice with PBS and resuspended in 100μl of PBS containing Triton X-100 and was further incubated at 20^{0}C for 15minutes. The volume was further centrifuged at 10,000 rpm for 10 min. under refrigeration and supernatant was harvested (Archer 1979). The second sample of antigen was reconstituted and washed in 200 μl TBS (0.125 M pH 6.8) and boiled in water for 5 min. The sample was centrifuged at 10,000 rpm and supernatant was collected (Solsona *et al*. 1996). The protein of both the samples was estimated by BCA method. The 20μl of protein sample of later one was mixed with equal volume of sample buffer (Distilled water, Tris-HCL 0.5 M pH 6.8, Glycerol, SDS, Brilliant blue and 2-Mercaptoethanol). The mixture was boiled for 5 minutes and high speed centrifuged. Now the supernatant was collected for loading in PAGE.

Electrophoresis by SDS-PAGE: SDS-PAGE of whole cell proteins of all the four mycoplasma strains were carried out as per the method of Laemmli (1970) adopted by Anthony *et al*. (1997) with slight modifications. The gel of 0.75 mm (12%) was prepared for a foresaid purpose (Bio-Rad mini gel apparatus).

Preparation of Stacking and resolving gels: A 12% separating gel was prepared by mixing the reagents and poured immediately in the casting assembly to fill the space of sandwich. Gel was overlaid by thin layer of isopropanol without disturbance. Later it was allowed to polymerize at room temperature for 30 minutes approximately. Further the layer of isopropanol

was washed-off. A 5% stacking gel was further prepared and poured immediately on the separating gel by leaving 5mm space from the top of the spacer plate. Further a Teflon comb was inserted into the layer of stacking gel solution and additional stacking gel was added to fill the spaces in the comb completely. The gel was allowed to polymerize at room temperature.

Sample loading for electrophoresis, staining and distaining and estimation of molecular weights: The gel sandwich was removed from the casting apparatus and fit into running tank assembly. The tank was filled with tank buffer (Glycine, Tris base, SDS and distilled water) further the combs were removed. Now the sets of prepared proteins were loaded by mixing with bromophenol blue dye in different wells along with protein molecular weight marker (205 kDa-3 kDa) and electrophoresis was carried out at constant voltage of 60V. The gel was stained in staining solution for two hours and then destined with destining solution with several changes until background disappear. Molecular weight of protein bands was estimated using computerized gel-documentation system. The protein bands resolved in all the samples of *M. capri* were ranged from 151 kDa 2.4 kDa (Fig. 1 and 2).

Immunostaining: Blocking, binding of primary antibody and conjugate Probing

After completion of protein transfer on NCP, the membrane was kept in blocking solution (Tris-HCl, NaCl, 5% skim milk, 1% BSA) for 2 hours at room temperature. After blocking the NCP was washed twice for 5minutes with wash buffer-I (Tris-HCl, NaCl, pH-7.4; 0.1% Tween-20). Further the membrane was placed in a solution of serum diluent (Tris-HCl, NaCl, pH-7.4; 0.1% skim milk) with primary antibodies and incubated for hours at 37^{0}C in shaking water bath. Further the NCP was washed thrice with wash buffer-I for 5 minutes. Later the membrane was transferred in a conjugate diluent (Tris-HCl, NaCl, pH-7.4; 0.1% skim milk) containing antigoat-rabbit HRPO conjugate and incubated for 60 minutes at 37^{0}C. After incubation NCP was washed thrice for 5 minutes each with wash buffer-II (Tris HCl, pH-7.6).

Visualization with Luminescent Substrate: The Genie made DAB kit was used to develop the NCP. The immuno-reactive protein bands were found to be in higher range of 90 kDa to 250 kDa. Moreover 2 promising immuno-reactive bands were observed at 20 kDa and 30 kDa. (Fig. 3) which needs further study.

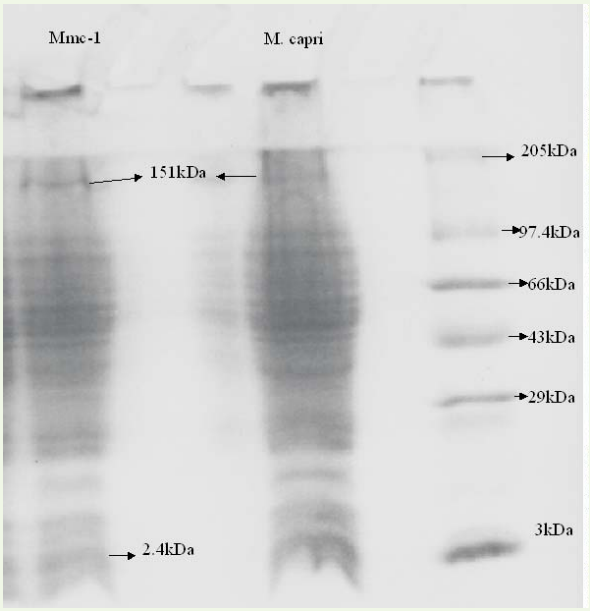


Fig 1: SDS PAGE of *M. mycoides* subsp *capri* (native isolates) exhibiting protein bands from 151 kDa to 2.4 kDa

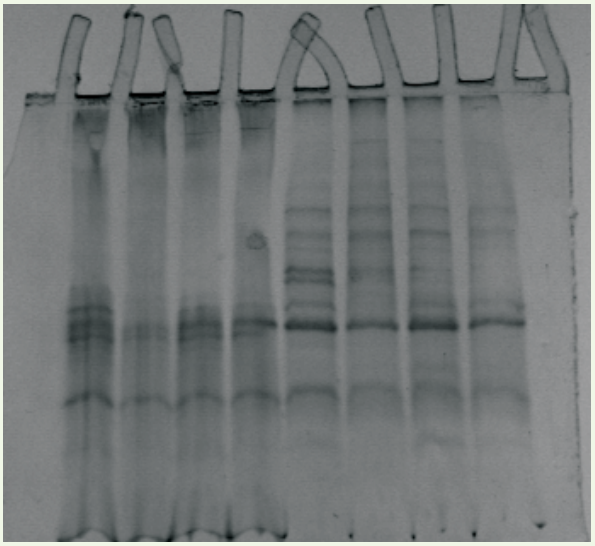


Fig 2: SDS PAGE of 4 native *M. mycoides* subsp *capri* isolate with 2 different protocols

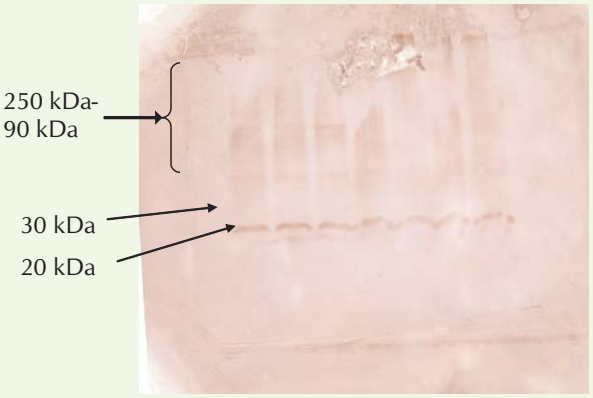


Fig. 3: Western blot analysis of native *M. mycoides* subsp *capri* isolate exhibiting various immunoreactive bands in lower and higher protein range

XI/GH - 2.5: Field trials of indigenous vaccine against Johne's disease in goats and sheep farms located in different agro-climatic regions of the country

S.V. Singh

Following trials of the first 'Indigenous Inactivated Johne's Disease Vaccine' (IIIJDV) were conducted in goats and sheep, after the success of 'in-house trials'. Presently extended field trials are underway.

I. Vaccination of new flocks

A. Semi-arid zone: Sirohi, Barbari, Jamunapari, Jakhrana and local goat flocks at CIRG, Makhdoom and Jamunapari goat flock at Etawah.

B. Arid Zone: WRC, CSWRI, Bikaner, Rajasthan

C. Temperate zones: SRC, CSWRI, Mannavanur, TN

II. Monitoring of vaccinated flocks

A. Semi-arid zone (CIRG, Makhdoom): Jamunapari and Barbari (south west UP), Sirohi and Marwari (Rajasthan) and Non-descript (local) goatherds of CIRG, were endemic for JD. After the success of 'In-house' trials (1 classical trial with double challenge proved 'prophylactic efficacy' and 2 trials on advance clinical cases of JD proved 'Therapeutic effects' of this 'Indigenous inactivated vaccine' using 'native strain of MAP, 'Indian Bison Type' - S 5 strain), the policy of JD control through vaccination was extended to breeding farms.

i. **Prevalence of JD in Barbari and Sirohi goats of farmer's flock:** Fecal and serum samples of 66 goats were screened by ELISA and two types of sero-reactors were identified.

a. Type I sero-reactors: Goats in strong positive category of S/P ratio were considered positive.

b. Type II sero-reactors: goats in positive and strong positive categories were taken as positive.

By microscopic examination prevalence of map was 31.8% in farmer's goats of 2 breeds (40.5 and 20.6% in Sirohi and Barbari). By ELISA sero-prevalence of map was 19.6% in 2 breeds (Sirohi- 29.7% and Barbari- 6.8%), in type 1 reactors. In type ii reactors, sero-prevalence was 75.8% (Sirohi - 83.8% and Barbari 65.5%). Goats in strong positive, positive, weak positive and suspected categories were shedding map, but correlation was high with strong positive and positives categories. Indigenous ELISA kit had substantial to nearly perfect proportional agreement with microscopic examination.

Post vaccination performance of goats: Average body weights of different goat breeds recorded steady improvement in 10 months post-vaccination. Of the 5 breeds, average gain in body weights at the end of 10 months period were similar in Barbari, Jamunapari and Sirohi goats followed by non-descript and Marwari (Fig. 1). Male goats as compared to females showed higher response to vaccination. Of the 150 goats monitored up to 10 months, 9.3% lost in body weights and rest 90.7% showed increase in body weights.

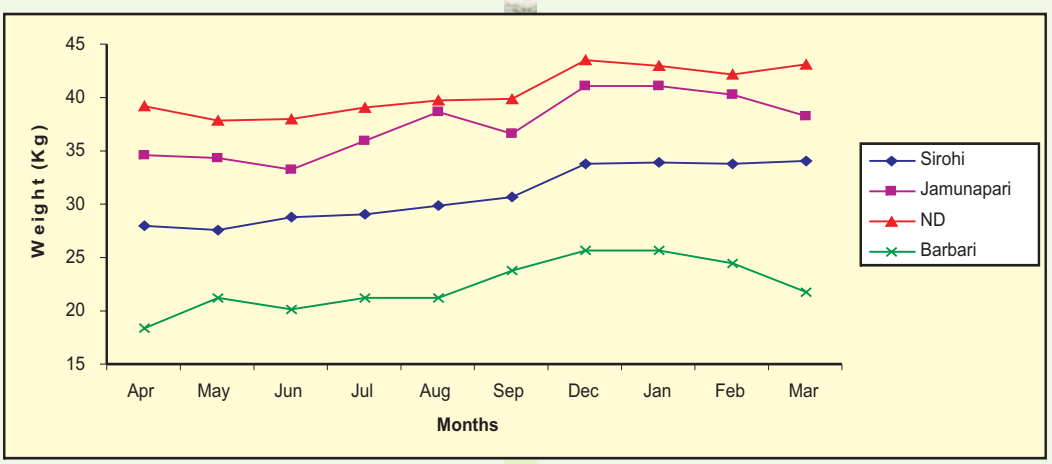


Fig. 1: Average body weights of goats at CIRG at monthly intervals post-vaccination

Monitoring of the humoral immune response of vaccinated goats: Humoral immune response was monitored by 'Indigenous ELISA kit'. Peak titers were achieved 3 months post vaccination and in next six months, titers showed gradual decline, however at the end of 9 months, titers remained higher than the initial titers. Male goats exhibited better immune response to vaccine as compared to female goats.

Morbidity and mortality rates: Morbidity due to diarrhea (suspected JD) reduced consistently in the post vaccination period.

ii. Jakhrana goat flock: Prevalence of JD: Screening of 30% goats for JD on vaccination day by ELISA and microscopic examination (shedding status), 45.2 (Type II reactors) and 38.0% goats were positive, respectively. Physically 35% of the sampled goats were clinical cases of JD (weak, skin hard, rough and ruffled).

Vaccination trial: Goats after vaccination showed immediate gain in body condition, body coat luster and apparent improvements in physical conditions. As compared to females, males showed significantly higher response to vaccine. Average body weights of females were doubled at the end of 10 months from the pre-vaccination average body weights. There was 30.0% increase in milk production. Frequent diarrhoeal episodes in the flock recorded sharp decline. There was positive gain in all production parameters. Of the 167 goats vaccinated, 28.0% goats lost in body weights, whereas 72.0% goats recorded increase in body weights. Male Jakhrana goats showed significantly higher increase in body weights both in weight and number of high responders. However number (36.1%) of females lost weight since Jakhrana goats are high milk yielder (Fig. 2). After vaccination, antibody titer against MAP increased slowly and peaked at 3 months post vaccination and afterward showed deceasing trend for next 6 months. However at the end of 9 months titers remained above initial titers.

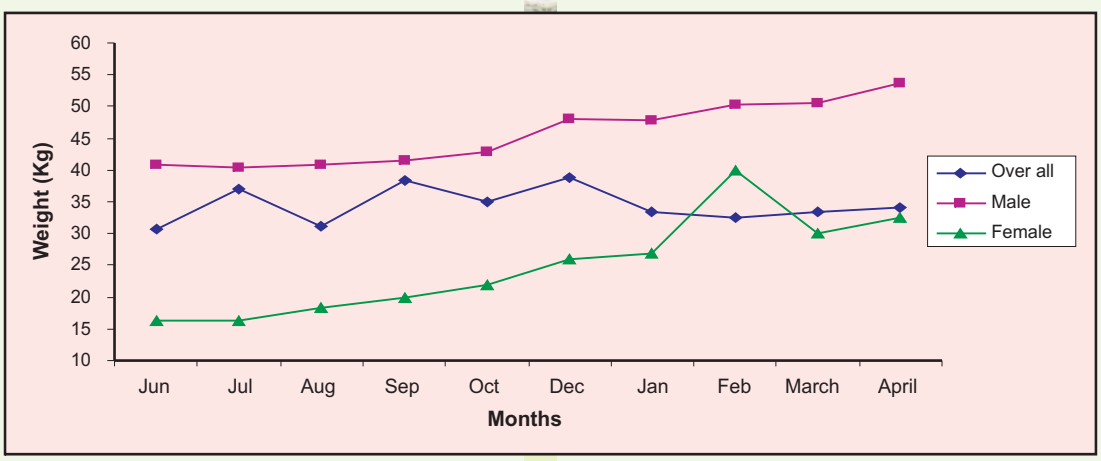


Fig. 2: Average body weights of Jakhrana goats at monthly intervals after vaccination

Morbidity and mortality rates: Morbidity due to diarrhea and weakness were reduced after vaccination as compared to before vaccination in adults and young age groups (Fig. 3). In comparison to un-vaccinated goats, mortality rates in the vaccinated goats, were significantly reduced and showed downward trend.

Improvements in Production traits: Vaccinated animals showed improvement in body coat shining and luster. Female goats recorded increase in twining rate, milk production birth weight, growth rate and overall improvement in 'flock health' and 'productivity'.

Improvement in Milk yield: Average milk yield/ week/ goat in the 4th month after kidding in vaccinated goats recorded increase of 3.7 liters. This increase was significantly higher in vaccinated goats lactating between May to October, 2007 as compared to January to April, 2007.

B. Arid zone (WRC, Bikaner, Rajasthan): Marwari was reported to be resistance to JD as compared to Magra. of 94 serum samples of Magra sheep, 42 were positive in 'ELISA kit' (Type II category). Body weight gain ranged from 0.2 to 4.6 kg and 0.4 to 5.6 kg in vaccinated males and females, respectively. Rate of shedding of MAP was also reduced. Of the 10 control sheep, 9 also showed improvements in body weights (0.6 to 5.8 kg). Vaccinated sheep showed peak titer at 3 months post vaccination and in next 6 months there was gradual drop in vaccination titer but was above the initial titer.

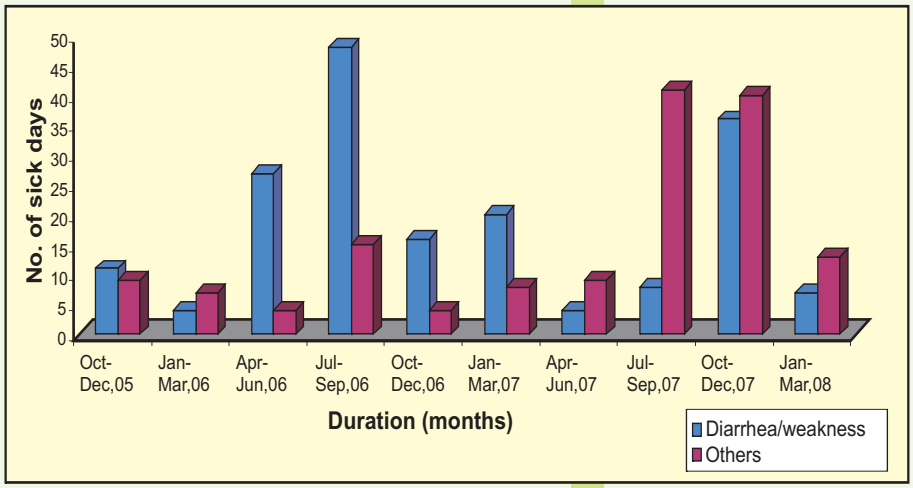


Fig. 3: Morbidity rates before and after Johne's disease vaccination

III. Temperate zone (SRC, Mannavanur, TN)

Sheep flocks (Bharat Merino and Avikalin): Prevalence of JD was observed in the flock with 50.8% sheep shedding MAP.

Vaccination of sheep flock: A total of 145 sheep were vaccinated. The animals showed very good response with marked reduction in cases of diarrhea and there was no mortality due to JD.

Jamunapari goat flock at CIRG, Makhdoom: Profiles of Jamunapari herd vaccinated for JD (Indigenous vaccine) was 526 (male: 161, female: 365) in different age groups on the day of vaccination.

Growth rates and body weights: Vaccinated goats (>3 months) showed marked improvements in health and body weights. Improvement was significant in body weights of goats in different age groups.

Culling rate: Of the 34 stunted kids listed for culling were vaccinated. Of these, 24 recovered to normal health within 5 months of vaccination. Kids examined for MAP by microscopic examination were negative.

Mortality rates: Mortality rates due to JD and weakness in 2006 (Pre vaccinated) were 28.6% indicating high MAP infection in herd. After vaccination Oct-Dec, 2006 there was no mortality due to JD. Over all mortality was also reduced significantly.

Humoral response in goats: Humoral response was measured by ELISA for 1 year post vaccination. Sero-conversion rate was higher during each of next interval up to 5 mpv and after that titer was maintained by vaccinated goats.

Shedding of MAP: From initial shedding rate of >32.0%, shedding rate in different times at the end of 1 year of vaccination was 5.8% (average) in random screening of Jamunapari goats at 15 days intervals.

A. Prevalence of MAP (CIRG goat farms): Samples from 399 goats suspected for JD submitted time to time were screened by microscopic examination. Of 399 fecal samples screened, prevalence of JD was 27.0%. The prevalence of MAP was high (37.1-53.3%) in un-vaccinated goats. Prevalence was low (12.8 to 24.3%) in vaccinated herds.

Prevalence of MAP (Other sheep and goat farms): In Jamunapari farm (Etawah, UP), prevalence of MAP was 26.2 to 51.1%. JD prevalence in sheep located in temperate (Bharat Merino and Avikalin) and arid zones (Magra and Marwari), was 27.8 and 52.6%, respectively.

B. Screening of young kids for Johne's disease: Serum and fecal samples of 30 newly purchased young kids (2-3 months) from local markets (Farah) were screened for MAP Prevalence of MAP in young kids was 60.0 and 30.0% by ELISA and microscopic examination, respectively. Vaccinated kids showed increase in humoral immune response 2 months after vaccination as compared with control kids.

Molecular Epidemiology of *Mycobacterium avium* subspecies *paratuberculosis* in Northern India: Study was conducted to know molecular diversity of Indian *Mycobacterium avium* subspecies *paratuberculosis* isolates recovered from animals, commercial milk and human beings in different regions of North India. Genotyping of MAP isolates was done by, IS*1311* PCR-REA. 'Bison type' was predominant genotype (83.7%) recovered from North India followed by 'Cattle type' (16.2%). 'Bison type' genotype was recovered exclusively from goats, sheep, buffaloes and blue bulls surveyed in the vicinity of CIRG, Makhdoom. From cattle, human beings and bovine milk samples both 'Bison type' and 'Cattle type' genotypes were recovered. 'Bison type' was major genotype recovered from herds located in CIRG (Makhdoom). 'Cattle type' was major genotype from New Delhi and Agra cities. 'Sheep type' genotype of MAP was not recovered in surveyed regions of North India.

Standardization of amplification of MHC-II DRB gene in goats: There is considerable evidence that resistance / susceptibility to infectious disease in animals has a genetic basis and that additive genetic variation exists among animals in their response to various infectious challenges This study is now started in Jamunapari breed of goats and before associating this genotype with disease resistance /susceptibility, conditions for nested PCR (using nested primers as described by Amills *et al.*, 1995) and further restriction digestion has been standardized.

i. DNA isolation: DNA was isolated from blood using Bangalore Genei (DNA isolation from blood) kit.
ii. Polymerase chain reaction (PCR):

Primers: The amplification of the second exon of the caprine DRB gene was achieved using primers DRB 1.1: TAT CCC GTC TCT GCA GCA CAT TTC and DRB 1.2: TCG CCG CTG CAC ACT GAA ACT CTC. Red dye PCR master mix (Bangalore Genei) kit was used for amplification. A 50 μl of PCR cocktail consist of 1.0 μM of both forward and reverse primers, 40 μl of red dye PCR master mix and 100 ng of template DNA.

PCR reaction mixture and cycling conditions: After initial denaturation at 94°C for 3 min. the PCR reaction was cycled for 1 min at 94°C, 2 min at 60°C and 1 min. at 72°C for 30 cycles.

Restriction polymorphism: Initially only one PCR product was tested for digestion with two restriction enzymes namely *Pst* I and *Taq* I (Fast Digestive RE, Fermentas, USA) according to manufacturer instruction. Amills *et al.*, 1995 have reported presence of polymorphic *Taq* I restriction site at 122 bp (two possible restriction pattern 'T'- 122 bp and 163 bp, or 't'- 285 bp) and polymorphic *Pst* I restriction site at position 244 bp (two possible restriction pattern 'P'- 226 bp, 44 bp and 15 bp, or 'p'- 270 bp and 15 bp) of the amplified product. *Taq* I REA resulted in single bands of 285 bp (absence of polymorphic site at 122 bp) and showed t restriction pattern. *Pst* I REA resulted in bands of 226 bp, 44 bp and 15 bp (P restriction pattern) (Fig. 4).

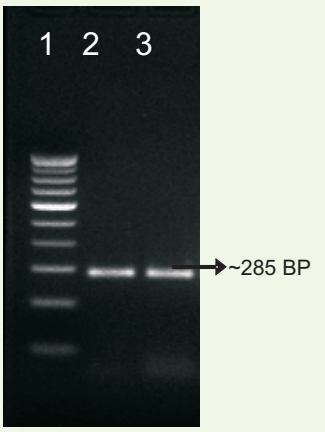


Fig. 4.1

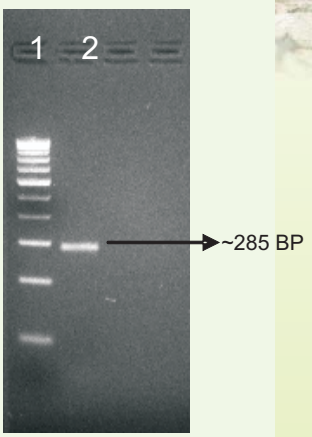


Fig. 4.2

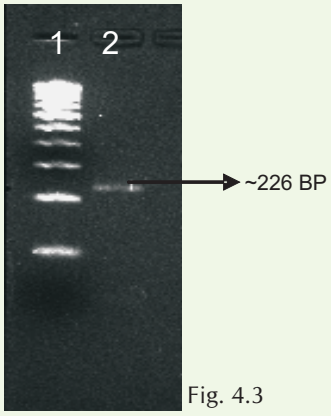


Fig. 4.3

Fig. 4: (4.1) Lane 1- 100 bp DNA ladder; Lane 2-3,PCR products of expected size (~285 bp). (4.2) Lane 1- 100 bp DNA ladder; Lane 2, Taq I digested PCR product of ~285 bp). (4.3) Lane 1- 100 bp DNA ladder; Lane 2, Pst I digested PCR products of ~226 bp.

Identification and characterization Cell Wall Deficient (CWD) forms of MAP: Recently large number of Cell Wall Deficient (CWD) colonies were observed on the surface of dried medium of HEYM with mycobactin J on prolonged incubation (> 6 months after regular MAP colonies seen in culture) of negative culture tubes (for typical MAP) colonies. CWD colonies were like tiny dew droplets (1-3 mm) or large droplets (> 4 mm). On over incubation (> 120 days), 50.7 and 38.3% colonies of CWD were seen on earlier negative (for typical MAP colonies) HEYM with mycobactin J dried slants. Usually CWD colonies appeared alone late and on further incubation some of these colonies developed opaque 'typical MAP colonies'. Some times CWD colonies appeared along with typical MAP colonies on the same slants.

Typical CWD colonies were acid fast negative and of irregular shape. However, the DNA from these CWD colonies was isolated by freeze and thaw method and resultant DNA was characterized using IS900 PCR. On further sub-genotyping of these CWD colonies by IS*1311* PCR-REA, these colonies were identified as 'Bison type'. Similar CWD colonies were observed in culture of tissues (mesenteric lymph nodes and intestine) from goats (50.1%) and sheep (41.0%). The 37.9% CWD colonies were observed in addition to 26.3% typical MAP colonies cultured from commercial pasteurized milk samples. In a typical outbreak of Johne's disease, where all the animals (young and adults) were infected with MAP. However on screening of 35.% goats by fecal culture only 77.1% goats were found positive for typical MAP colonies. However, in further incubation of MAP negative HEYM slants, CWD colonies were observed on large number of these slants and collectively with typical MAP gave prevalence of 91.4%, which gave realistic picture of the outbreak of JD and number of clinical cases of JD.

EXTENSION EDUCATION AND SOCIO-ECONOMICS SECTION

EESE 8.14: Multi-Disciplinary Project on Transfer of Technology for Sustainable Goat Production System

Project coordinator: N.P. Singh

Transfer of technology programme was undertaken in the four villages namely Pohpa Burj, Pauri Shahjadpur, Jalal and Barka Nagla adopted under this project. A team of subject matter specialists visited the adopted villages every week.

1. Extension Education Component:

R.L. Sagar, Braj Mohan and Khushyal Singh

Visits and advisory services

In all 170 visits were made by the extension scientists and the technical staff to the four adopted villages and made individual contact with about 500 goat farmers/ farm women at their home. They were educated and motivated about the scientific/ commercial goat rearing and convinced them to take the services from the Barbari Breeding bucks which were distributed in the adopted villages under TOT programme for the purpose of breed improvement.

Extension activities

i. Organized a *Field day* cum Scientist-Farmers interaction in the adopted village Jalal on 21 July 2007. About 150 goat farmers/ farmwomen from Jalal participated in the Scientist- Farmers Interaction.
ii. A *health camp* was also organized at Jalal village on 21.07.2007. In all 182 goats were examined by Veterinary Officers, among them 132 were vaccinated against FMD and 50 were treated for various ailments.
iii. Coordinated an *on-campus training* programme for the goat farmers/ farmwomen of Barka Nagla village on 18.01.2008, wherein 9 goat farmers and 13 farmwomen participated.
iv. Organized four *one-day off-campus trainings* on goat reproduction, nutrition, breeding and goat health in the adopted villages, wherein 61 goat keepers participated.
v. Organized 8 *group discussions* on improved goat husbandry practices two each in every adopted village. About 100 goat farmers got benefited from the group discussion.
vi. Helped in conducting vaccination, de-worming and treatment of goats and

arranging demonstration on preparation of goat milk paneer in the adopted villages.

Following *leaflets* were prepared and distributed to the farmers/farm women in the adopted villages:

i. Unnat Bakri Palan se Sambandhit September ke Mah Mein Dhyan Rakhne Yogya Mukhya Jankariyan
ii. Vaigyanik va Unnat Tarike se Bakri Palan ke Liye October ke Mah Mein Mukhya Sujhav November mah mein kya Karen?

Visits to villages of Baldeo and Goverdhan Blocks of Mathura

A team of the scientists/collaborators of the TOT programme visited the 6 villages of in Baldeo Block and 5 villages of Goverdhan Block of Mathura District to collect information on goats in connection of establishing a TOT Centre of the Institute. The villages in Buldeo and number of goats therein were as follows: Chholi Meerpur (700 goats), Khapparpur (200 goats), Noorpur (700 goats), Nabipur (200 goats), Nagla Khutia (300 goats) and Hyatpur (1500 goats).

Benchmark survey of adopted villages conducted in 2006-07

During the year 2007-08 the data were compiled on different aspects of goat production of goat farmers in all four adopted villages i.e. Pauri Shahjadpur, Pohpa Burj, Jalal and Barka Nagla. Some of the important findings of benchmark survey on the project are presented here.

Utilization of mass media (agriculture and animal husbandry practices)

The goat farmers of all the four adopted villages were not regularly receiving the information on improved agricultural technology, animal husbandry practices and goat production technology through mass media. The major mass media sources were exhibitions/ kisan melas (67.94%), television (41.22%), newspapers (26.72%) and radio (25.95%). Farm publications, educational films, and poster were used quite low by the goat farmers because they were not easily approachable to them.

Utilization of personal cosmopolite sources of information

The major personal cosmopolite sources of information of the goat farmers were neighbours (87.79%) followed by farmers of other villages (64.89%), scientists from CIRG, Makhdoom (36.64%) and Village Development Officer (9.92%). Specialists from Department of Animal Husbandry, Block Development Officer were used quite low by the goat farmers because they were not easily available to them. Extension Officer and Bank Personnel were not used at all by the goat farmers for getting the information about agriculture as well as animal husbandry practices and goat production technology.

Credit position of goat farmers loaning agencies in the adopted villages

The goat farmers of the adopted villages have been utilizing credit facilities provided by the private money lenders and nationalized banks. The goat farmers received total loan of Rs. 1,54,000 from banks and private money lenders, of which Rs 40,000 has already been paid back with Rs. 1,14,000 outstanding. Most of the amount (Rs. 1,24,000) was taken by the marginal goat farmers and Rs. 30,000 by the landless goat farmers for the development of goat and animal husbandry. It has been observed that loan amount taken by the landless goat farmers had not been returned at all whereas 22.62% and 52.50% loans were repaid to the banks and private money lenders respectively by the marginal farmers. The small

farmers did not take any loan. Five goat farmers took loan from private money lenders and 04 from nationalized banks. Nationalized banks advanced loan worth Rs. 84,000 (54.55%) and Private Money Lenders worth Rs. 70,000 (45.45%).

Disease status

In all 125 animals of different age group were affected from various diseases. Maximum 54 animals of 0-3 month followed by 43 animals above 9 months and 28 of 3-9 months were affected from various diseases in all adopted villages. In case of diseases, 45 animals were affected from diarrhoea followed by 23 from FMD, 21 from pneumonia, 17 from ectoparasite, 8 endoparasite and 4 from abortion. A few animals were affected with mastitis and mange. In all 41 animals were died from various diseases. In these 41animals, 16 were died from pneumonia followed by 13 from diarrhoea, 6 from abortion, 4 from FMD and 2 from ecto parasitic load. Maximum (22 animals) died at the age of 0-3 months, followed by 10 above 9 months and 9 at the age of 3-9 months.

Adoption of technologies

The goat farmers were not aware of vaccination against infectious diseases in goats. As a result the adoption of vaccination in goats was nil. The adoption of artificial insemination in goats was nil due to lack of awareness, motivation and non-availability of AI facility in the adopted villages

Production status of milch goats in the adopted villages

The age at puberty, age at first kidding, lactation period, kidding interval, number of services per conception, litter size and average milk yield in one lactation had been observed 9.77 months, 14.90 months, 3.16 months, 6.98 months, 1.44 number, 1.98 and 103.57 kg milk respectively in case of Barbari goats. In case of non-descript goats these values were 11.76 months, 17.15 months, 3.12 months, 6.99 months, 1.83, 1.51 and 138.25 kg (one lactation), respectively.

Marketing of goats

Most of the goat farmers (93.34%) sold their animals by guess/estimate. Rest of the goat farmers sold their animals 4.00 % and 2.66% by weight and age, respectively. The majority of the goat farmers marketed their animals directly to the butcher (48%) and middlemen (48%) and rest to other goat farmers (4%). Almost all the goat farmers sold their animals inside the village in all adopted villages. Not a single animal was sold outside the village. In all 155 goats of which 34, 57, 38 and 26 were sold in Pohpa Burj, Pauri Shahjadpur, Jalal and Barka Nagla respectively. An amount of Rs. 2,29,650 was obtained by selling of 155 goats. On an average a goat was sold about Rs. 1482. In Pauri Shahjadpur the goat were sold on higher price @ Rs. 1646 per goat while the goat farmers of Barka Nagla sold their goat on lower price @ Rs. 1181 in comparison to other villages.

2. Socio-Economics and Marketing Component

Shalander Kumar

A total of 44 visits were made to the adopted villages during this year. The major objective was to motivate farmers to adopt improved technologies and appropriate marketing strategies. Hence understanding existing production and marketing system and capacity building and training of farmers was the focus of this component. In that order participated and contributed in 19 scientists-farmers group discussion and interaction meetings and made 308 individual contacts with the goat farmers to motivate them to integrate scientific goat rearing

in the existing farming system and adopt innovative and efficient marketing strategies to sale their surplus goats. Accordingly for organizing the resource poor goat keepers, motivated and supported 10 of them to form a self help group (SHG) namely Shri Ganesh Bakri Palan Svyam Sahayata Samuh in the village Bar ka nagla. To promote TOT efforts, coordinated a video shooting of on 15th January 2008 by Delhi Doordarshan being telecasted on its Krishi Darshan programme.

A Krishi Darshan team of Delhi Doodarshan comprising of three persons visited Jalal village on 15.1. 2008. The team covered (Video and Audio) various R and D activities related to goat rearing in the village. Subsequently this video documentary was telecasted on Krishi Darshan Programme of DD1 (6.30 am) on several occasions.

Goat rearing and marketing interventions

Majority of the goat keepers were illiterate (Fig. 1) and resource poor with a small flock size of goats as subsidiary activity. One of the reasons for low income from goat rearing was identified as poor realization of market price by farmers for their surplus live goats. Due to lack of knowledge and certain constraints, farmers were not taking benefit of lucrative prices during Eid festival and for good quality pure breed animals (Table 1 and 2). Scarcity of feed during winter, paucity of housing space during rainy season, urgent cash needs, poor health of animals and low level of awareness were the major factors for poor realization of price and distress sale.

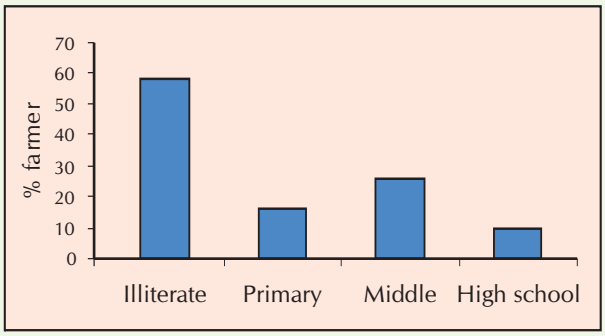


Fig. 1: Educational status of goat farmers

Table 1: Flock Size of goats in adopted villages

Villages	Adult male	Adult female	Kids	Total flock size
Jalal	0.11	3.89	4.56	8.56
Nagla Bar	0.63	6.25	6.00	12.88
Pohpa Burj	0.00	2.33	2.33	4.66
Pouri -Shahajadpur	0.09	3.46	5.00	8.55
Pooled	0.23	4.16	4.87	9.26

Table 2: Farmers' preference for timing of sale of goats

Preferred timing of sale	Reason	Farmer %
Any time	Need of cash	38.71
Winter	Fodder scarcity/ better price	38.71
Eid	Better price	9.68
Rainy season	Risk of disease	19.35

With our capacity building efforts, the goat farmers could learn about appropriate marketing strategy viz. the type of goats to be sold, place of sale, right time and age of sale and right method of sale of goats. There was a considerable change in the attitude of farmers. A number of farmers started preparing castrated male goats for selling them during the festival of Eid (Fig. 2). The average price realization during Eid for a male of 1-2 years of age was about 70 per cent higher than the price realized during normal sale in the villages (Fig. 3). This year farmers in the adopted villages sold 32 castrated males during Eid (Fig. 4). During the normal sales the goats in the villages fetched a price of Rs. 60- 65 per kg of live body weight, while it fetched Rs. 100 150 per kg of live body weight

during Eid festival. The farmers were also sensitized and made aware of the fact that the pure breed goats (Barbari in this area) sold to breeders/ rearers also attract much higher price as compared to goats sold for meat.

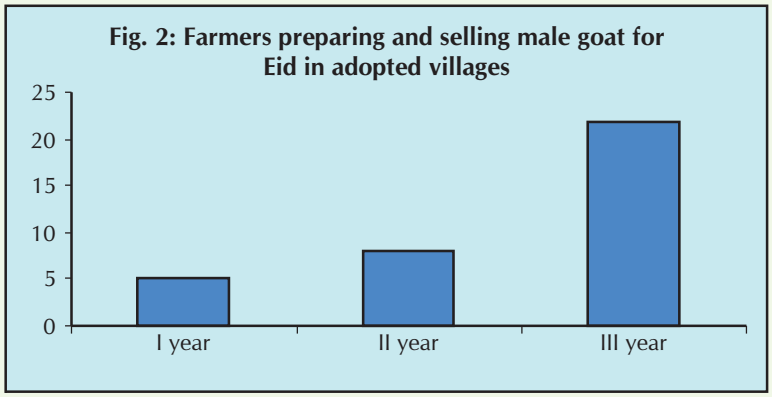


Fig. 2: Farmers preparing and selling male goat for Eid in adopted villages

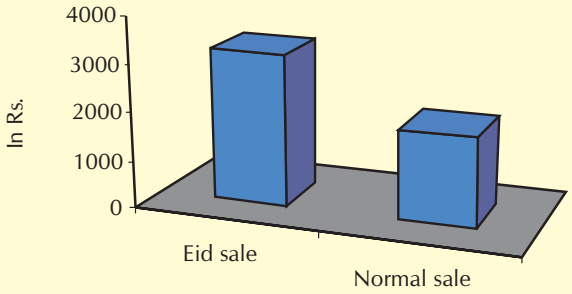


Fig. 3: Market price of male goat (1-2 yrs)

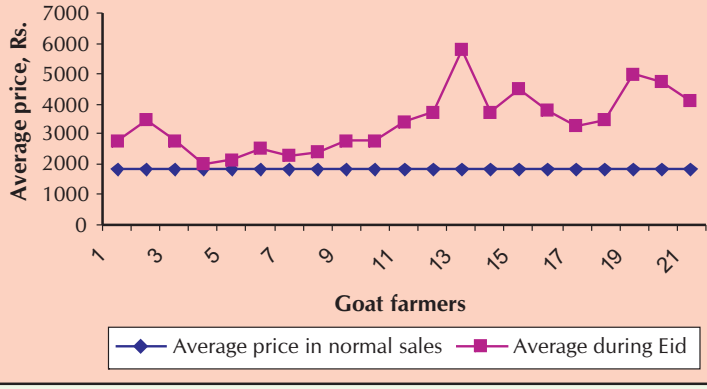


Fig. 4: Average price of male during Eid and normal sale

3. Breeding Component

M.K. Singh

Fifty-four visits were performed in four adopted villages during the period from April 2007 to March, 2008. The goat farmers of these four villages were motivated to adopt breeding technologies/interventions developed by the institute through individual interaction, organizing camps, farmers' day, and demonstrations at their villages. Two elite Barbari buck were provided in addition to already supplied four bucks to cater the need as most of goat farmers preferring to cover

their does with Barbari buck. These bucks used to provide services to 67.5, 70.0, 56.0 and 76.8% goats in Jalal, Bar Ka Nagla, Popa-burj and Pauri-Sahjadpur village, respectively. Effectiveness of TOT programme motivated new persons to set up goat units in the adopted villages and many others in surrounding villages of the institute. The impact (2007-08) of buck distribution (2006) resulted in an increase of Barbari and Barbari type of adult goats from 52.2 to 61.2% in Jalal, from 7.6 to 10% in Bar Ka Nagla, from 22.7 to 29.1% in Popa burj and from 21.6 to 27.5% in Pauri-Sahjadpur. The actual proportion of Barbari and Barbari type goats would be higher as kids born from Barbari buck provided by the institute will be part of gene pool of these adopted villages. The per centage of Barbari/Barbari type kids born out of total kids born were 87.5, 70.0, 69.0 and 78.9%, respectively in the village Jalal, Bar ka Nagla, Popa-Burj and Pauri- Sahjadpur, respectively. The multiple births recorded were 32.5, 53.3, 62.9 and 76.7%, respectively in the village Jalal, Bar ka Nagla, Popa Burj and Pauri- Sahjadpur, respectively. The body weight of kids born during the year was recorded with respect to breed/type, type of birth, sex and buck used. The overall body weight of males in Jalal was 2.76 ± 0.13, 7.8 ± 0.4, 13.0 ± 1.04 and 18.2 ± 0.9 kg, and for females were 2.78 ± 0.13, 8.0 ± 0.3, 12.8 ± 0.6 and 16.8 ± 0.9 kg, respectively. The corresponding estimates in Bar- Ka- Nagla for males were 2.73 ± 0.07, 8.21 ± 0.2, 13.8 ± 0.3 and 19.0 ± 2.09 kg, and for females were 2.5 ± 0.11, 7.37 ± 0.2, 12.8 ± 0.4 and 18.3 ± 0.7 kg, respectively. The corresponding estimates in Popa-Burj for males were 2.82 ± 0.05, 7.92 ± 0.2, 13.7 ± 0.3, 22.5 ± 1.7 kg, respectively and for females were 2.56 ± 0.07, 7.21 ± 0.2, 12.0 ± 0.4 and 15.7 ± 0.8 kg, respectively. The corresponding estimates in Pauri-Sahjadpur for males were 2.87 ± 0.06, 9.35 ± 0.4, 16.2 ± 0.3, 21.5 ± 1.5 kg and for females were 2.80 ± 0.07, 8.80 ± 0.3, 15.3 ± 0.5, 18.3 ± 1.5 kg, respectively.

Table 1: Breed composition of adult goats and kids

Village (s)	No of Goat Keepers	Year	Breed composition in adult goats (%)			Breed composition in kids (%)		
			Barbari	Barbari type	Non descript	Barbari	Barbari type	Non descript
Jalal	26	2006-07	10.8	41.9	47.2	0.0	92.3	7.7
		2007-08	25.0	43.7	31.5	40.0	47.5	12.5
Bar ka Nagla	26	2006-07	0.0	7.6	92.4	0.0	30.8	69.2
		2007-08	2.7	6.8	90.0	20.0	55.0	25.0
Popa -Burj	29	2006-07	0.0	22.7	72.3	4.5	68.2	27.3
		2007-08	3.6	25.4	70.9	6.8	62.0	31.0
Pauri - Sahjadpur	29	2006-07	4.0	17.6	78.4	12.0	60.3	27.6
		2007-08	5.0	22.5	72.5	10.5	68.4	21.0

Table 2: Status of Service provided by the institute buck in adopted villages

Village	Institute buck (%)	Local buck (Non descript) (%)
Jalal	84.3	15.6
Bar ka Nagla	70.0	30.0
Popa Burj	56.0	46.0
Pauri-Sahjadpur	76.8	23.2

Table 3: Status of Type of birth in adopted villages (%)

Village	Single	Twins	Triplets
Jalal	67.5	32.5	0.0
Bar ka Nagla	47.2	45.0	83.0
Popa Burj	37.0	53.0	90.0
Pauri-Sahjadpur	23.3	66.7	10.0

Table 4: Overall body weight of kids at different ages in adopted village (kg)

Village	Sex	Body Weight	3 month Weight	6 month Weight	9 month Weight
Jalal	M	2.76±0.13 (17)	7.8±0.4 (14)	13.0±1.04 (9)	18.2±0.8 (5)
	F	2.78±0.13 (20)	8.0±0.3 (16)	13.0±0.6 (13)	16.8±0.9 (4)
Bar Ka Nagla	M	2.73±0.07 (34)	8.21±0.2 (20)	13.8±0.2 (23)	19.0±2.4 (3)
	F	2.51±0.11 (27)	7.37±0.2 (22)	12.8±0.4 (13)	18.3±0.7(11)
Popa Burj	M	2.82±0.05 (42)	7.92±0.2 (37)	13.7±0.2 (27)	22.5±1.1 (2)
	F	2.56±0.07 (31)	7.21±0.15 (30)	12.0±0.4 (17)	15.7±0.8 (10)
Pauri-Sahjadpur	M	2.87±0.06 (21)	9.35±0.4 (21)	16.2±0.3 (11)	21.0±1.5 (4)
	F	2.80±0.07 (28)	8.89±0.34 (22)	15.3±0.2 (16)	18.3±1.5 (4)

M: Male, F: Female

4. Reproduction Component

A.K. Goel

To achieve the goal, regular visits (60) were undertaken in all (4) adopted villages. Existing reproductive practices in terms of breedable age and weight of goats, mating practices and inter kidding period were studied by recording information on prescribed schedule developed for this purpose. Participated in a Field day ScientistsFarmers Interaction and Health Camp in Jalal Village on 21.7.07. Contributed as SMS during Village Seminar and Clinical Camp organized at Pauri Shahjadpur. Developed and distributed a Pictorial hand-out of Reproductive Health Calendar for Goats in operational villages. A total of 124 goats were covered by improved Barbari and village bucks. Pregnancy diagnosis was carried out in 106 goats. Anoestrus and abortions were encountered as major (59.00%) reproductive problems in farmer's goats. Reproduction related parameters of 174 goats kidded during the period were recorded and analyzed. Multiple births occurred to the tune of 51.00%. Kidding rate averaged 1.51.

Reproductive Health Calendar for Goats:

A colored pictorial handoutReproductive Health Calendar (Reproductive Cycle in Goats) was developed and distributed to goat farmers in all the adopted villages.

Services Provided in Terms of Reproductive Technologies

Mating of Goats in Operational Area by Barbari Bucks: Farmers were emphasized to mate oestrous goats at appropriate stage of oestrus (heat) for increased pregnancy rate. A total of 105 goats were covered in different villages by Barbari buck provided by the institute.

Pregnancy Diagnosis in goats: Goats (106) of different villages were diagnosed for their gestational stage by abdominal palpation around 2.5 to 3 months of post-mating. This was done for profitable goat production. In all 106 goats were screened for pregnancy status. Goat owners were taught for care and management of does before, during and after kidding and importance of timely feeding of colostrum.

Diagnosis and Treatment of Reproductive Diseases in Goats: Reproductive health care of affected goats of different adopted villages was undertaken. In total forty one cases of specific reproductive ailments were diagnosed and appropriately treated in all four villages. Caesarean sections were

also performed in four goats to relieve dystocia/facilitate kidding. The incidence of various diseases was of moderate degree (Table 1 and Fig. 1).

Table 1: Occurrence of Reproductive diseases in adopted villages

Disease	No.
1. Anoestrus	17
2. Abortion (3 -4 M)	7
3. Dystocia	5
4. Retention of Placenta	5
5. Parturition failure	3
6. Pre mature/Still birth	2
7. Repeat Breeding	2
Total	41

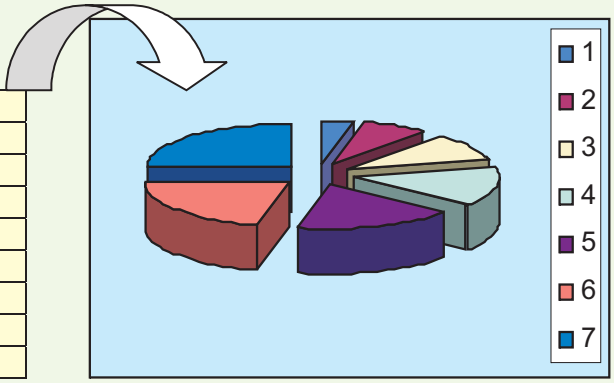


Fig.1: Reproductive diseases in village goats

Reproduction Rate and Multiple births in Village Goats:

Kidding rate is largely determined by ovulation rate but is also modified by fertilization and embryonic and foetal losses. In total 174 kidding occurred in the adopted villages. The incidence of twinning was 48.27%, indicating good prolificacy (Fig. 2). A few goats (2.87) also kidded with triplets. Kidding rate in different villages ranged 1.23 to 1.69 (average: 1.51) as shown in Fig. 3.

Number of kids born per doe per year: 1.51

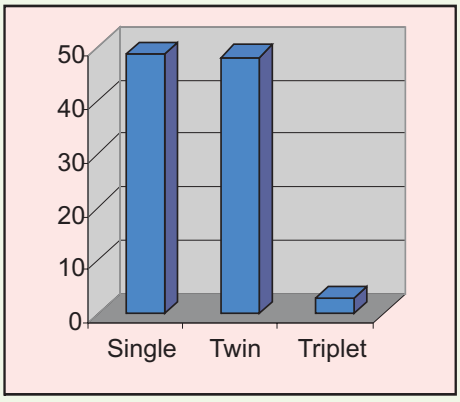


Fig. 2: Kidding Frequency in village goats

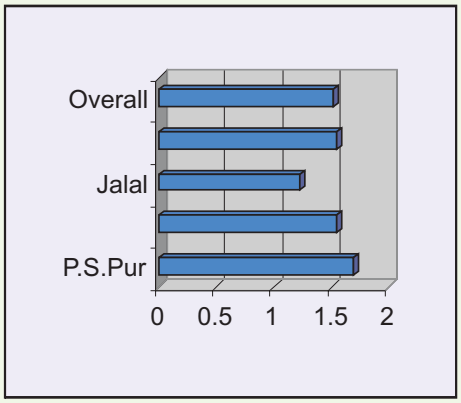


Fig. 3: Kidding rate in village goats

5. Management Component

B. Rai and Dharma Singh

Goats in the villages are being kept under extensive system of management and in zero input. The goats found in this area are Barbari, Barbari type and admixture of other breeds. The flock size is small (5-10) and they are let out for grazing at lease for 4-6 hrs per day. The goats are mainly dependent on grazing and they are offered feed/fodder in a meager quantity in the form of supplementation. Farmers do not provide separate housing for goats. Some of the goat keepers maintain small paddock for their goats (Fig. 1). The goat keepers of two adopted villages provided 20% goat housing, where as in other two villages the goat housing was only 13.33% (Table 1). Sanitation, deworming and vaccination were not commonly practiced by the farmers. With the

intervention of TOT programme, the farmers were sensitised for these inputs. Farmers were also advised on clean milking, watering and appropriate housing for their goats. A total of 25 visits were made in four adopted villages during the period under report. Three large flock owners, two farmers from Bar Ka Nagala and one farmer from Jalal, were selected for demonstration of improved goat houses in the villages. Three model goat houses were erected in the adopted villages with the help of goat keepers by using institute's resources.

Fig.1: Goat housing in the adopted villages

Table 1: Status of Goat Housing in Adopted Villages

Sl. No.	Name of the village	Housing provided (%)	Housing not provided (%)
1.	Pauri Shahjadpur	20.00	80.00
2.	Popa Bhurj	20.00	80.00
3.	Jalal	13.33	86.67
4.	Bar Ka Nagla	13.33	86.67

6. Health Component

Ashok Kumar and H.A. Tewari

Health technologies were applied to prevent important infectious diseases and parasitic infestation, particularly with timely vaccination, deworming, ectoprasitic injection as well as treatment.

Morbidities and Mortalities: A total 1109 clinical registries were recorded during the Year (May, 2007 to March, 2008) for the treatment of different goat diseases. The proportional morbidities (%) were highest due to diarrhoea (47.5) and followed by RTI/ pneumonia(15.4), off fed/anorexia (17.9), tympany/bloat (3.7), weakness /emaciation (3.68), septic wounds (2.96), lameness (2.55), Ecthyma (2.35), and others (4.41), which includes mastitis, endoparasitic infestations, abortion, skin infections) (Fig 1). Diarrhea (58.5 %) and Pneumonia (36.9%) were major clinical problems also in kids. It is also noted that Incidence of pneumonia was higher in kids than adult goats. Winter season is more prone for both diarrhoea and pneumonia in adult as well kids, followed by rainy season and clinical problem are least in summer season.

The proportional morbidities (%) were 4.3, 11.9.7.8, 11.9, 9.6, 9.6, 10.2, 9.5, 15.1, 7.7, and 2.5 from May to March respectively (Fig. 2). The clinical problems were highest in winter (42%), followed by Rainy (39%) and summer (19%), indicating that farmers need to improve managemental system in rainy and winter season. Relationship between number of clinical cases and total population was analysed, which revealed that higher clinical cases relate to poor adoption and managemental system. In this way, Bar ka nagla and Pohpa burj were poor responder. There was no outbreak of infectious diseases in these adopted villages because of timely vaccination, however, nearby villages of Mathura district and some of Agra district faced mortalities due to PPR, ET and Goat Pox. In these villages, kids mainly died due to pneumonia in winter season, associated with poor shelter in extreme cold.

Fig. 1: Proportional percent morbidities in adult goats

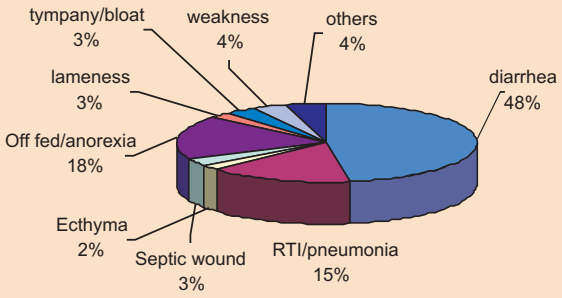


Fig. 2: Monthwise Morbidities in adopted villages

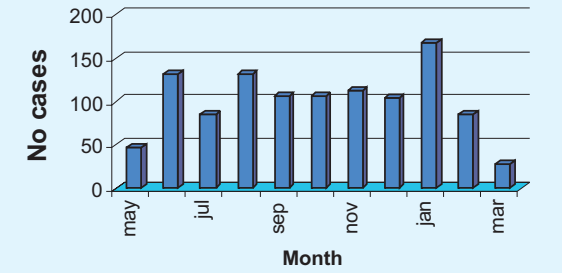
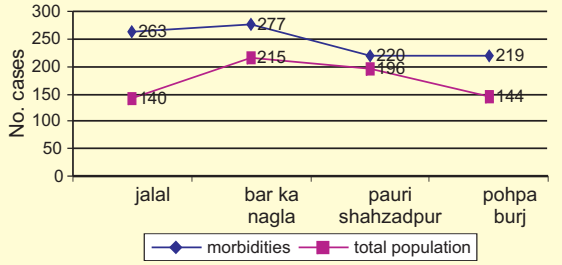
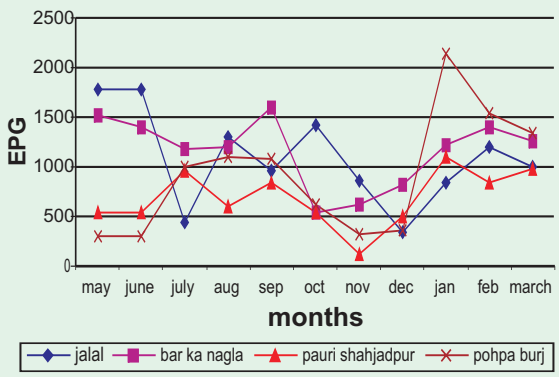


Fig. 3: Morbidities in relation to total population showing managemental system



Endoparasitic infestaion and Deworming: The EPG levels in different months revealed that January (1330.6), February (1240.52) and March (1145.4) have higher EPG range followed by in August (1054.85), September (1113.9); and May (1038.3) and June (1007.2), which indicated that rainy and winter season are conducive for internal parasitic infections (Fig 4). Highest EPG were reported in Bar ka nagla (1162.41) and Jalal (1087.05) followed by Pohpa burj (918.00) and lowest in Pauri Shahzadpur (688.41), which is directly associated with quality of drinking water and managemental system. Parasitic Infections were mainly dominated by bursate worm (Haemonchus *contortus*), and other infection

Fig. 4: Status of EPG in different months in adopted villages



includes Liver fluke and tape worm. Coccidial load were also present in adult animals. In preventive programme, two doses of anthelmintic were given in the month of June and July with Fenbendazole and second in September with Nilzan (Oxyclozanide+ Levamisole). The number of goats were dewormed in Bar ka nagla were (131,113), Jalal (139,184), Pauri shahzadpur (45,126) and Pohpa burj (135, 156), covering 64.7 and 83.00 % population, respectively.

Vaccination: The goats were vaccinated in all four villages against FMD, Enterotoxaemia and Goat pox, in Bar ka nagla (201,247,133 goats), Jalal (121,75,223), Pauri shahzadpur (60,69,100) and Pohpa burz (182,107,100), respectively, that covered 81.3,72 and 80.1% population, respectively. Farmers showed active interest in vaccination except a few.

7. Nutrition Component

U.B. Chaudhary

During the period of report, 36 visits of adopted villages were performed with the aim to improve the productivity of farmers' goats through nutritional interventions. Necessary knowledge related to balanced feeding was disseminated to goat farmers of the four adopted villages during each and every visit. Feeding practices of four breeding bucks distributed to each adopted village were monitored and pelleted feed (@ 9.0 Kg/month/buck) was made available by the Institute for maintenance of proper health of these bucks.

Farmers' goat feeding practices in different seasons:

Observations were collected on 200 goats regarding their feeding practices during summer season. It was revealed that goat farmers allowed 6-8 hours of grazing daily. Harvested field of wheat containing fallen wheat and weeds were the major feed resources for goats during grazing. Considering health status of goats in four adopted villages, it was observed that available feed resources were adequate to meet out the Dry matter and nutrient requirement of goats for maintenance and production up to certain extent. Some of the farmers were practicing supplementary feeding to goats. Health of dry and adult male goats during summer season was observed good but lactating and pregnant goats were needed supplementation in terms of roughages as well as concentrate for improved productivity.

During rainy season, observation from 183 goats maintained in four adopted villages were collected for record of prevailing feeding practices and available feed resources. During rainy season goats were restricted for 3-4 hours daily grazing in order to avoid more consumption of moist feed. Grazing material available for goats was constituted of seasonal grasses of high moisture contents (>82% moisture contents). In addition to grazing, goat farmers were supplementing harvested grasses and grain (in few cases). On dry matter basis, grasses were containing 28% DM, 10.15% crude protein, 2.57 % ether extract, 12.45 % ash. Health of goats of all categories was observed very poor due to intake of inadequate quantity of high moisture feed. In order to cope up the problem goat framers were advised for supplementation of leguminous straw, grains along with salt.

During winter season, observations from 222 goats were collected. Most of the goats were maintained strictly on grazing (6-8 hours daily). Grazing materials available to the goats was constituted of local bushes, tree leaves and grasses. On account of availability of variety of natural bushes in grazing area of Yamuna river to the goats of Pauri Sahjadpur, performance of these goats was observed better in comparison to goats of remaining three adopted villages.

Through organizing small gosthi and personal discussion in adopted villages, knowledge of balanced feeding and its importance for improved productivity was disseminated amongst the goat farmers. In Jalal village, encouraging results were obtained as with continuous persuasion and constant efforts most of the goat farmers of the village, purchased good quality Arhar straw for feeding the goats during winter season. Feeding of small quantity (100-150 g/d) of straw resulted in better health of goats in comparison to the other goats. Intake of 100-150 g of Arhar straw daily costing around Rs.8-9 per month resulted in better health of the goats in comparison to non-arhar straw fed groups.

Products Technology Component

R.B. Sharma

A total of 32 Visits were undertaken to the adopted Villages and made interaction with the farmers on clean milk production and value addition in goat milk. Contributed as a subject matter specialist in the Scientists Farmers Interaction and Health Camp organized in Jalal village on 21st July 20007 and Village Seminar and clinical camp organized by ARS Probationers (NAARM) on 28th March 2008 in village Shahjadpur. Conducted Demonstration on paneer making technology at village Jalal during the visit of Krishi Darshan team of Delhi Doordarshan on 15-01-08, which was telecasted by Doordarshan several times on DD1. The goat keepers of all 4 villages were taught the medicinal value of goat milk. The goat keepers were selling the goat milk @ Rs. 9/- per litre, which was quite lower than its real market value. The awareness among goat keepers was created for selling the surplus milk, if any, at a better price or by making several value added products.

Variation in goat milk composition in the adopted villages

Milk samples (71) from individual goats reared in all four adopted villages were collected and milk yield was recorded. The overall mean values for fat, SNF, TS, protein and ash content were 5.81, 8.04, 13.83, 2.81 and 1.00 per cent, respectively. The fat content in goat milk was higher and SNF content was lower in Bar ka Nagla, and Pouri villages. However, The TS content was highest in goat milk of village Jalal followed by Bar ka Nagla, Popha Burj and Pouri. Protein content was noticed higher in Popha Burj and Jalal. The Milk yield was obtained highest in Jalal and Podi villages followed by Popha Burj. Milk yield of goats was noticed lowest in Bar ka Nagla village. The fat content was observed higher with the goats yielding less quantity of milk and vice versa. The results are presented in Table 1.

Table 1: Variation in goat milk composition in adopted villages

Village	Fat	SNF	TS	Protein	Ash	Milk Yield
Popha- Burj	5.33	8.27	13.59	3.33	0.74	0.834
Jalal	5.41	9.2	14.69	3.22	1.71	0.925
Bar ka Nagla	6.05	7.84	13.88	1.77	0.75	0.340
Pouri Shahjadpur	6.45	6.86	13.17	2.91	0.81	0.925

Influence of goat breeds on milk composition

The milk samples were collected from non-descript and Barbari type goats reared in the adopted villages and the samples were analyzed for proximate composition. Fat and ash content was obtained higher in the milk of Barbari type goats. However, protein content was noticed higher with non-descript animals. The pH values were similar in both the cases. The results obtained from field were compared with goat milk composition of our farm animals. It was found that the fat and ash content was higher in the milk of field goats and SNF, TS and protein content was higher in our farm goats. The results have been presented in Table 2.

Table 2: Influence of goat breeds on milk composition

Source	Breed	Fat	SNF	TS	Protein	Ash	pH
Field	Non-descript	4.78	8.61	13.39	3.19	0.73	6.55
	Barbari Type	5.18	8.11	13.29	2.11	0.83	6.55
Farm	Barbari	4.30	10.68	14.98	3.47	0.77	-

Demonstrations on Paneer making

Farmers were motivated and demonstrations on paneer making technology from goat milk were conducted in all four adopted villages. Some of the goat keepers have shown interest to adopt the technology and 12 goat keepers have started making paneer from goat milk.

Demonstrations on clean milk production

The goat keepers were motivated to produce clean milk. The advantages of clean milk and the transmission of different infectious diseases through dirty milk were taught in all the four adopted villages. They were advised not to use dirty utensils for milking and to keep milk for longer duration. They were also given demonstrations time to time on different aspects of clean milk production.