RPF -II

CENTRAL INSTITUTE FOR RESEARCH ON GOATS
MAKHDOOM, FARAH, MATHURA- 281 122, U. P.

Network Project on Sheep Improvement
(Muzaffarnagari Unit)

ANNUAL PROGRESS REPORT (2007-2008)

PART-I: GENERAL INFORMATION

600 Project Code :

6001 Institute Project Code No. :
6002 ICAR Project Code No. : 2.10

601 Name of the Institute and Division

6011 Name and address of Institute : Central Institute for Research on Goats, Makhdoom, Farah, Mathura (UP)
6012 Name of Division/Section : Goat Genetics & Breeding Division
6013 Location of the project : Central Institute for Research on Goats, Makhdoom

602 Project title

Genetic evaluation and improvement in Muzaffarnagari sheep for body weight and wool yield.

603 Priority area
6031 Research Approach : Applied Res./ Basic Res./ Process / Transfer of Tech. or Tech. Dev.

01 02 03 **04**
Applied research & TOT

604 **Specific area** : Sheep Breeding
605 Duration of project : Long term project
6051 Date of start of project : 1992
6052 Likely date of completion of project : Continuing
6053 Period for which report submitted : 01.04.2007 – 31.03.2008
606 Total cost of the project
6061 Expenditure (2007-08) : Rs. 3,65,471

607 Summary Achievements:

Monitorable targets and achievements (2007-08):

Traits	Targets	Achievements
Body weight at 6 month (kg)	22.00	25.92±0.71
Body weight at 12 month (kg)	30.00	37.91±1.72
Lambing % (on ewes available basis)	85	89.3
Mortality up to one year (%)	<8	2.18
Mortality adult annual (%)	<8	2.35
Culling up to one year (%)	<10	0.0
Culling adult annual (%)	<8	12.3
Age at first lambing (days)	650	726
Replacement rate (%)	30	28.2

608 Key Words : Muzaffarnagari sheep, Body weight, Wool yield, Genetic improvement.

PART-II: INVESTIGATOR PROFILE

(Please identify clearly changes, if any in project personnel)

610 Principal Investigator

6101 Name : Dr. Gopal Dass
6102 Designation : Senior Scientist
6103 Division/Section : Genetics & Breeding
6104 Location : C.I.R.G., Makhdoom
6105 Institute address : Central Institute for Research on Goats, Makhdoom, Farah, Mathura (UP).

611 Co-investigator

6111 Name : Dr. S.D. Kharche
6112 Designation : Senior Scientist
6113 Division/Section : Physiology, Reproduction & Shelter Management
6114 Location : C.I.R.G., Makhdoom
6115 Institute address : Central Institute for Research on Goats, Makhdoom, Farah, Mathura (UP).

612 Co-investigator

6121 Name : Dr. A.K. Das
6122 Designation : Scientist
6123 Division/Section : Goat Product Technology
6124 Location : C.I.R.G., Makhdoom
6125 Institute address : Central Institute for Research on Goats,

Makhdoom, Farah, Mathura (UP).

613 Co-investigator

6131	Name	:	Dr. V.K. Gupta
6132	Designation	:	Veterinary Officer (T-9)
6133	Division/Section	:	Goat Health
6134	Location	:	C.I.R.G., Makhdoom
6135	Institute address	:	Central Institute for Research on Goats, Makhdoom, Farah, Mathura (UP).

614 Co-investigator

6141	Name	:	Dr. Hari Prasad
6142	Designation	:	Farm manager (T-7-8)
6143	Division/Section	:	Genetics & Breeding
6144	Location	:	C.I.R.G., Makhdoom
6125	Institute address	:	Central Institute for Research on Goats, Makhdoom, Farah, Mathura (UP).

PART-III : TECHNICAL DETAILS

620 Introduction and objectives

The Muzaffarnagari sheep is one of the heaviest and largest mutton breeds in India and is widely distributed in the semi-arid region of western Uttar Pradesh, near Meerut, Muzaffarnagar, Bulandshahar, Bijnor and in some parts of Delhi and Haryana states. The breed is carrying high reputation for good growth rate. The Central Institute for Research on Goats (CIRG), Makhdoom, Mathura, is endowed with a unit of "Network Project on Sheep Improvement" on Muzaffarnagari sheep. This unit was established in 1976 with the main objective to improve body weight through crossbreeding of Muzaffarnagari sheep with exotic breed of Dorset and Suffolk. Later on, the project was modified to **Network Project on Sheep Improvement on Muzaffarnagari sheep** with the aim to improve the mutton and carpet wool production by selective breeding. Breeding rams are being selected through selection indices on the basis of 6 months body weight and greasy fleece yield.

6201 Immediate objectives:

1. To conduct selective breeding in Muzaffarnagari sheep for bringing out an improvement in the breed in the institute based flock.

2. Selection of males based on 6 months body weight and first 6 monthly greasy fleece yield.
3. Survey of Muzaffarnagari breed in its home tract.

6202 Long term objectives: To attain 35 kg body weight at 12 months of age.

6203 Specific objectives for the year (as detailed in RPF-I).

1. To conduct selective breeding in Muzaffarnagari sheep for bringing out an improvement in the breed in the Institute based flock.
2. Selection of males based on the 6 months body weight and first greasy fleece yield (using sire 1993 -on words).

Annual targets for year 2008-09:

- Body weights at 6 and 12 month : 25 & 35 kg.
- Lambing on available basis : 90%
- Mortality up to one year and adult annual : < 8%,
- Culling up to one year and adult annual : <10 & <8%
- AFL : 650 days
- Replacement rate : 30%.

621 Project Technical profile

6211 Technical programme :
(Indicate briefly plan of procedure, techniques, instruments and special materials, organisms, special environment etc..)

- A flock of 250 breeding sheep will be maintained.

- Selection of males have to be done on the basis of their 6 months body weight and first clip greasy fleece yield for further breeding programmes and should be put for breeding at not later than 1.5 years of age.

6212 Man months involvement of component project workers for the specified year

Principal investigator : 06 month
Co-investigator : 21 month

622 Progress of work

623 Achievements in terms of targets fixed for each activity

Staff position:

S.No.	Name of person	Designation
1.	Dr. Gopal Dass	Sr. Scientist & Principal Investigator
2.	Dr. Hari Prasad	Technical Officer (T-7-8)
3.	Dr. V.K. Gupta	Veterinary Officer (T-9)
4.	Sh. M.P. Agrawal	T-3
5.	Sh. Manik Chand	T-2
6.	Sh. Daryab	S.S.Grade III
7.	Sh. Bhagwan Dass	S.S.Grade III
8.	Sh. Ram Kishore	S.S.Grade II
9.	Sh. Sukh Ram	S.S.Grade I
10.	Sh. Narayan Hari	S.S.Grade I
11.	Sh. Duli Chand	S.S.Grade I

Besides above, 4 DPLs were also engaged as full time workers in the project.

Management:

The sheep at different stages of production viz. pregnant, dry, lactating were kept in separate sheds. Newly born lambs were kept with their dams in lactating pens for 4-5 days and then shifted to lamb nursery. The animals were maintained under two systems of feeding management i.e. intensive and semi-intensive. Lambs were weaned at 2 months age due to poor milk production as well short lactation period of their dams. Some of the lambs were put under the intensive system of feeding up to 6 months of age, in which they were provided up to 800 g of growth ration/animal/day, consisting of 72% TDN and 16% DCP. Essential ingredients of this ration were maize/rice police (15%), barley (20%), ground nut cake (35%), wheat bran (20%), molasses (7%), mineral mixture (1.5%) and salt (1.5%). Lambs were given dry and green fodders *ad libitum* and were not allowed to graze. The remaining animals were maintained under the semi-intensive system under which they were provided 400 g of growth ration, dry and green fodders

and 6 hrs grazing. Ewes at 100 days onwards of pregnancy and during lactation were provided supplementary feeding, where as dry ewes were fed on maintenance ration. Green fodder was supplied by farm section of the institute throughout the year as per availability in different seasons. The dry fodder like Gram or Arhar bhusa was also fed to the animals. The animals were sent for grazing for 5-6 hours daily. The grazing area of the institute is undulating ravine of sandy land with low organic C and available N and dominated with Kans and other saccharum infested.

Breeding:

Controlled breeding was practiced at the farm. Heat detection of ewes was done in the morning and evening during the breeding season. The ewes in heat were mated with the selected sires in the morning. Mating plan was designed in such a way so that inbreeding could be avoided. Sheep were bred twice in one estrous. Breeding seasons were restricted in such a way that the lambing takes place in optimum environmental period of the year and as such two breeding seasons namely (1) May-June and (2) October-November, practiced with lambing in October–November and March-April months of the year. Moreover, most of the ewes (70-80%) exhibited estrous in above mentioned seasons.

Health cover:

All animals were inspected thoroughly in the morning before sending out for grazing for any kind of abnormalities/sickness. Animals showing any abnormality or ailment were sorted out and kept in isolation ward for the observation of Veterinary Officer. Regular treatment and strict prophylactic measures were practiced for vaccination against Enterotoxaemia, Foot and Mouth Disease, Sheep Pox, H.S., PPR etc. Deworming with different anthelmintics was practiced at pre-monsoon and post monsoon seasons and as and when required. Dipping was done after 15-20 days of each shearing. All sheds and corrals were disinfected frequently with lime. All sheds were disinfected with lime at regular interval. The culling of the animals was done mostly on three grounds viz. health, production/reproduction and old age.

Flock statistics:

Flock strength of Muzaffarnagari sheep as on 01.04.2007 was 147 sheep (58 male and 89 female, out of witch 67 breeding females) while the closing balance on 31.03.2008 was 223 (61 male and 162 females, out of witch adult females were 110). The addition was due to birth of 100 lambs (47 males and 53 females) and purchase of 27 adult females from breeding tract while the reduction was due to death, culling and sale of breeding males. Low strength of breedable females was because of heavy mortality due to sheep pox outbreak in January-March, 2007. There were surplus breeding rams in the project for supply to the field during the year.

Culling and mortality:

The overall culling in 0-3, 3-6 and 6-12 age group was nil, while in adults it was 12.35%. The overall culling in all age groups was 7.66%. The mortality was recorded to be 1.85, 2.56, 2.25 and 0.42% in the 0-3, 3-6, 6-12 age group and adults respectively. The overall culling and mortality was 7.66 and 3.65%. This year the overall mortality and culling was minimum as compared to previous many years. The overall culling on health ground was 1.09%.

Growth performance:

The overall least-squares means of body weights of lambs at birth, 3, 6, 9 and 12 month age were 3.26±0.08, 16.90±0.53, 25.92±0.71, 32.75±1.49 and 37.91±1.72 kg, respectively during the year under report (Table 4). The effect of sex was highly significant ($P<0.01$) on all body weights. Male lambs gained higher weights as compared to female lambs at all stages. As compared to previous two years the lambs showed highly significant improvement in body weights at all growth stages.

Average daily weight gain (ADG) and meat quality attributes:

The average daily gain of Muzaffarnagari lambs during 0-3, 3-6, 6-12 and 3-12 months were 151.23±5.45, 99.00±4.12, 63.80±6.27 and 79.03±4.27g under semi-intensive feeding management (Table 5). Similar to body weights, male lambs showed higher ADG than female lambs for all age groups. As compared to previous two years the lambs showed highly significant improvement in average daily gains in all age intervals.

Rams (3) of Muzaffarnagari maintained under semi-intensive feeding management were slaughtered for evaluating important carcass and non carcass attributes. The mean values for carcass traits viz. slaughter age, slaughter weight, empty body weight, carcass weight, dressing percentage (SW), dressing percentage (EBW), fore quarter, hind quarter, loin eye area and total body fat were 1035.±3.38 days, 54.00±3.21 kg, 48.17±0.54 kg, 27.64±1.76 kg, 50.20±0.40 %, 57.51±0.69%, 15.37±0.96 kg, 12.30±0.84 kg, 14.28±0.13 cm^2 and 2.95±0.51 %. The averages for non-carcass traits viz. blood %, head %, skin % and GI tract % were 4.64±0.14, 6.23±0.09, 9.88±0.06 and 6.10±0.12, respectively (Table 6).

Reproductive performance:

Tupping, lambing on ewes available basis and lambing on ewes bred basis were respectively 66.7, 61.6, 92.5% and 95.2, 88.9, 93.5% in first and second season (Table 7). The annual tupping, lambing on available basis and lambing on bred basis were 93.7, 89.3 and 95.6.9. The overall twinning during the year of report was recorded 11.0%. Tupping, lambing and twinning significantly improved during this year as compared to previous years. The least squares means for weight at first service, age at first service, age at first lambing and ewes' weight at lambing were 35.1kg, 571days, 726days and 39.5kg, respectively.

Replacement rate:

The replacement rate for the breeding ewes was calculated as :A*100/B

Where, A = No. of ewes added during the year (2007-2008)
B = Ewes available on first day of the year (01.04.2007)
The overall replacement rate was = 19*100/67 = **28.3%**

Greasy fleece yield:

The overall least squares means for lambs 1st and 2nd six monthly and adult annual clips were calculated to be 478.53±39.98, 466.62±20.09 and 1117.68±30.88g, respectively (Table 9). Sex had highly significant (P<0.01) influence on lambs and adult clip. The males produced significantly higher greasy fleece yield than females in all the

clips which might be due to larger surface area for wool growth in males as compared to females.

Genetic and phenotypic parameters:

The h^2 estimates of birth, 3, 6, 12 month body weights and first six monthly clip were 0.050±0.061, 0.095±0.072, 0.343±0.127, 0.242±0.105 and 0.450±0.148, respectively (Table 10). The h^2 estimates of birth and 3 month weights were not found reliable might be because of great influence of maternal and other environmental effects on the growth of lambs. All the genetic and phenotypic correlations of body weights and greasy fleece weights were positive. The genetic correlations between and among body weights were relatively lower as compared to phenotypic correlations. The phenotypic correlations of body weight with body weights and fleece yield with body weights decreased with the increase in age.

Selection of breeding rams:

The selection of breeding rams was done through selection index comprising of 6 months body weight and first 6 monthly greasy fleece yield of lambs. The selection differential for the traits under selection were 5.2kg and 170g. The selection index value of the selected and un-selected rams were 2.91307 and 2.46968, respectively. Following selection index was used for the ranking of breeding rams:

Index= 0.11029*6-Month body Weight + 0.00176 * First Shearing Wool Yield.

A total of 10 breeding rams were selected for breeding of ewes during the year. All 10 rams were screened for their breeding soundness in terms of semen qualities. Semen collection of rams was carried out in six replicates at weekly intervals. Five rams donated semen in all six trials. One ram for five times, one ram in four trials, one in 3 trials, one in single time and one ram did not ejaculate at all. 7 rams showing better libido and semen qualities in terms of volume of semen, sperm concentration, mass motility, individual motility, live and dead sperm count percentage abnormal sperms, were finally selected and used as breeding rams in the flocks (Table 10).

Distribution of rams:

A total of 17 breeding rams were supplied for breed improvement programme under field conditions through CVO, Animal Husbandry Department, Uttar Pradesh Government. This year the distribution was relatively low due to less availability of surplus stock in the project. This was because high mortality in the flock which caused death of majority of lambs and weaners during year 2007. Distribution of rams to field from year 2002-03 to 2006-07 is given in Table 11.

Field survey:

Survey was conducted in the breeding tract of Muzaffarnagari sheep during January, 2008 to record important production and morphometric traits and managemental practices of the breed. From survey it was found that breed is generally reared by Pal/Gadaria and Khatik communities belonging to low income group. Flocks are maintained on extensive feeding management system in which animals were grazed for 6-8 hours grazing on the common grazing land or on the road and canal sides with zero supplementary feeding. The animals are taken for grazing at 10.00-11.00 AM and return with sunset after traveling 5-15 KM/day. In some cases animals got the opportunity to graze on Parti land to consume post harvest crop residues. It was recorded through interviews with sheep owners that grazing land was on continuous decline due to availability of irrigation facilities and practicing of intensive cropping system. In general, the animals are kept in thatched sheds erected on Kuchcha floor and fenced with thorny/wooden materials and muddy walls. However, some breeders had sheds made up of bricks and cement along with Kuchcha/bricks flooring. Rams and ewes are grazed and housed together and usually one breeding rams is kept in a flock. The lambs below 2 months of age are kept loose with their dams during nights and left behind at the home during the day time. The lambs are kept in house for about 15 days after birth and thereafter join the flock for grazing. The animals are generally brought to the water points (canal, ponds, tube wells) to drink water twice or thrice a day during the summer season.

In field, the breeding takes place throughout the year as breeding rams always stay with the flock. However, majority of breeding falls in the month of April-June and September-November with lambing in September-November and February-April.

Muzaffarnagari sheep is primarily maintained for mutton purpose, although it also produces fleece from 800-1000g/annum. The fleece of this breed is coarse hence not suitable for carpet manufacture. The price of wool varied from Rs. 15-25/kg. The shearing is conducted two times in a year in the months of October/November and May/June. Some of the farmers shear the animals thrice a year in the month of March, June and September. The shearing is carried out either by farmer's themselves or by their relatives and usually sold locally or to the traders of Panipat city. Sheep are vaccinated against Haemorrhagic septicemia and sheep pox through Department of Animal Husbandry of U.P. state. No de-worming is practiced in farmers' flock. Dipping in ordinary water is done twice a year. The medical cover is generally provided by Veterinary Hospital.

The overall least squares means of body length, height at withers, chest girth and tail length were 25.11 ±1.09, 33.91±0.64, 36.16±0.55 and 21.86±0.52 cm., respectively in the lambs of age group 0-1 month. The corresponding figures of body measurements were 52.28±0.79, 57.41±0.75, 56.56±0.84, 36.94±0.80 cm in 1-3 month, 56.79 ±0.70, 61.13±0.47, 63.39±0.58, 43.66±0.50 cm in 3-6 month, 66.85 ±0.96, 69.98±0.94, 70.44±0.95, 43.17±0.96 cm in 6-9 month, 81.67 ±0.83, 76.22±0.78, 79.91±0.54, 51.98±0.76 cm in 9-12 month and 82.30 ±0.43, 83.31±0.39, 84.88±0.45 and 53.04±0.47cm in adult animals.

The overall least squares averages for body weights during 0-1, 1-3, 3-6, 6-9, 9-12 month and adults age groups were 6.32 ±0.53, 14.80±0.44, 19.82±0.37, 22.75±0.51, 25.57±0.48 and 42.33±0.72 kg., respectively. Sex showed highly significant ($P<0.01$) influence on 1-3, 3-6, 6-9, 9-12 month and adult age groups. Results indicated that males gained about 2.7 (1-3 month), 2.5 (3-6 month), 3.5 (6-9 month), 5.7 (9-12 month) and 12 kg (adult group) more weight than females.

Progress of work in relation to time target for completion of work and reasons for non-achievement of target if any:

1. Technical programme was executed as defined in RPF-I.

2. Overall performance during the period under report was very good. Almost all the annual targets were achieved except the minimum breedable population could not be maintained because of high mortality from sheep pox outbreak during year 2006-07.

6222 Questions – Answered.

6223 Process/Product/Technology/Developed during the year.

6224 Utility of the results obtained so far.

623 Publication and material developed.

6231 Research papers:

A. Research papers published:

1. **Gopal Dass** (2007). Production performance and management practices of Pugal sheep in the home tract. *Indian Journal of Anim. Sciences***, 77:** 763-766.

2. **Gopal Dass** and Hari Prasad (2007). Morphological characteristics, live-weights and management practices of Muzaffarnagari sheep in the home tract, *Indian Journal of Small Ruminants*, **13**: 27-30.

B. Research Abstract published:

1. **Gopal Dass**, A.K. Das, Hari Prasad and N.P. Singh (2007). Growth, carcass and meat characteristics of Muzaffarnagari lambs maintained under intensive and semi-intensive feeding management. Presented in a symposia held at College of Veterinary Sciences, Tirupati, from June 20-22, 2007, pp 187.

2. **Gopal Dass** and Hari Prasad (2007). Morphological characteristics, live-weights and management practices of Muzaffarnagari sheep in the home tract. National symposia held at College of Veterinary Sciences, Tirupati, from June 20-22, 2007, pp 58.

3. H.K. Narula, **Gopal Dass,** P.R. Sharma and Vimal Mehrotra (2007). Impact of selection on growth and reproductive performance of Marwari sheep in arid region of Rajasthan. National symposia held at College of Veterinary Sciences, Tirupati, from June 20-22, 2007, pp 49.

C. Popular article published:

1. **Gopal Dass** (2008). Saghan pravandhan mein bhedon se adhik aay. Ajamukh, Hindi quarterly magazine, January-March, 2008, pp: 4.

6233 Reports: Prepared monthly, quarterly, six monthly and annual for year 2007-08.

6234 Seminars and workshops (relevant to the project) in which the scientist have participated.

1. Participated in a symposia on " Recent trends in policy initiatives and technological interventions for rural prosperity in small holders livestock production system" held at College of Veterinary Sciences, Tirupati, from June 20-22, 2007.

2. Participated in a National seminar on " National Goat Fair and Scientists-Entrepreneurs-Farmers interactive meet" held at Central Institute for Research on Goats, Makhdoom from March 1-3, 2008.

3. Attended a National training programme on "Genetic analysis of animal breeding data using advanced software packages" at Centre for advanced studies (CAS), Dairy Cattle Breeding Division, National Dairy Research Institute, Karnal (Haryana) from October 10-30, 2007.

6235 Infra-structural facilities developed: Nil

PART – IV : PROJECT EXPENDITURE (SUMMARY)

630 Recurring Expenditure:

6301 Salaries : (2007-2008)

Name	**Designation**	**Salary**
i). Scientific		
Dr. Gopal Dass	Senior scientist	2,70,000
Dr. S.D. Kharche	Senior scientist	1,30,000
Dr. A.K. Das	Scientist	81,000
ii). Technical		
Dr. V.K. Gupta	T-9	1,26,000
Dr. Hari Prasad	T-7-8	3,24,000
Sh. M.P. Arawal	T-3	1,56,000
Sh. Manik Chand	T-2	1,32,000
iii). Supporting		
Sh. Daryab	SSGr. –III	1,08,000
Sh. Bhagwan Das	SSGr. – III	1,02,000
Sh. Ram Kishore	SSGr. – II	96,000

Sh. Sukh Ram	SSGr. – I	96,000
Sh. Narayan Hari	SSGr. – I	96,000
Sh. Duli Chand	SSGr. – I	96,000
iv). Daily paid labour		
4 DPLs	DPL	3,60,000
Total		**21,73,000**

6302 Expenditure/Income:

S.N.	**Particulars**	**Expenditure/ Income (Rs)**
1.	Cost of dry fodder	1,07,340
2.	Cost of green fodder	17,125
3.	Cost of adult pelleted feed	1,70,689
4.	Cost of hogget pelleted feed	32,912
5.	Cost of mash feed	27,781
6.	Expenditure on health cover	8,631
7.	Miscellaneous expenditure	993
	Total Expenditure	**3,65,471**
1.	Sale of breeding rams	43,900
2.	Culling of animals	33,707
3.	Slaughter of animals	6,634
	Total income	**84,241**

*** Approximate budget estimate for year 2008-2009: Rs. 4,02,000**

Signature of the PI

Signature of the Co-PI

1. **Dr. S.D. Kharche**
2. **Dr. A.K. Das**
3. **Dr. V.K. Gupta**
4. **Dr. Hari Prasad**

Signature & comments of the Head of the Division/Section

Signature &comments of the Director

Table 1: Annual flock statistics for the year 2007-2008.

Age Group	Opening Balance 01-4-07	Additions			Reduction						Closing balance 31.03.08
		Birth/ Pur.	Draft	Total	Death	Slaughter	Sale	Culling	Draft	Total	
Male											
0-3 M	03	47	-	50	01	-	-	-	24	25	25
3- 6 M	14	-	24	38	-	-	-	-	32	32	06
6-12 M	14	-	32	46	01	-	-	-	30	31	15
Adult	27	-	30	57	03	03	17	19(1)	-	42	15
Total	58	47	86	191	05	03	17	19(1)	86	130	61
Female											
0-3 M	05	53	-	58	01	-	-	-	30	31	27
3- 6 M	10	-	30	40	02	-	-	-	36	38	02
6-12 M	07	-	36	43	01	-	-	-	19	20	23
Adult	67	27*	19	113	01	-	-	(2)	-	03	110
Total	89	80	85	254	05	-	-	(2)	85	92	162
	147	127	171	445	10	03	17	21(3)	171	222	223

*** purchased animals, Figures in parenthesis are animals culled on health ground.**

Table 2: Annual culling and mortality percentage for the year 2007-2008.

Age group	Culling (%)			Death (%)			Total (%)		
	M	**F**	**Total**	**M**	**F**	**Total**	**M**	**F**	**Total**
0 – 3M	0.00 (50)	0.00 (58)	0.00 (108)	2.00 (50)	1.72 (58)	1.85 (108)	2.00 (50)	1.72 (58)	1.85 (108)
3 – 6M	0.00 (38)	0.00 (40)	0.00 (78)	0.00 (38)	5.00 (40)	2.56 (78)	0.00 (38)	5.00 (40)	2.56 (78)
6–12M	0.00 (46)	0.00 (43)	0.00 (89)	2.17 (46)	2.32 (43)	2.25 (89)	2.17 (46)	2.32 (43)	2.25 (89)
Adult	33.33 (57)	1.77 (113)	12.35 (170)	5.26 (57)	0.88 (113)	0.42 (170)	38.59 (57)	2.65 (113)	14.70 (170)
Overall	18.09 (105)	1.78 (169)	**7.66** (274)	4.76 (105)	2.96 (169)	**3.65** (274)	22.86 (105)	4.14 (169)	**11.31** (274)

*** Culling on health ground = 1.09 %**

Table 3: Mortality and culling on health ground with post-mortem findings for the year 2007-08.

Diseases particulars	Death								Culling on health ground							
	0-3M		3-6M		6-12M		Adult		0-3M		3-6M		6-12M		Adult	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
A. Non-specific diseases:																
1. Gen. systemic disorder	01	-	-	-	-	01	01	-	-	-	-	-	-	-	-	-
2. Alimentary System	-	-	-	-	01-	-	01	-	-	-	-	-	-	-	-	-
3. Hepatic System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4. Circulatory System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	01	02
5. Respiratory System	-	-	01	-	-	01	-	-	-	-	-	-	-	-	-	-
6. Uro-genital System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7.Nervous System	-	-	-	-	-	-	01	-	-	-	-	-	-	-	-	-
8. Integumentary System	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
B. Specific diseases:																
1. Seep pox	-	01	-	-	-	-	-	01	-	-	-	-	-	-	-	-
C. Others:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	**01**	**01**	**01**	**-**	**01**	**02**	**03**	**01**	**-**	**-**	**-**	**-**	**-**	**-**	**01**	**02**

Table 4: Growth performance of Muzaffarnagari lambs (kg) – excluding feedlot data.

Particulars	Birth wt.	3M Wt.	6M Wt.	9M Wt.	12M Wt.
Overal1 mean	3.27±0.03 (472)	15.43±0.23 (407)	22.01±0.32 (328)	27.19±0.55 (264)	32.42±0.64 (211)
Sex	*	**	**	**	**
Male	3.34±0.05 (222)	16.14±0.31 (185)	23.16±0.43 (153)	28.67±0.68 (114)	34.41±0.78 (86)
Female	3.19±0.04 (250)	14.73±0.29 (222)	20.86±0.41 (175)	25.71±0.61 (150)	30.44±0.71 (125)
Year	**	**	**	**	**
2005	3.37±0.05 (204)	14.81±0.29 (184)	20.50±0.38 (178)	24.90±0.44 (157)	29.09±0.47 (142)
2006	3.17±0.04 (209)	14.59±0.30 (169)	19.60±0.51 (99)	23.90±0.55 (94)	30.27±0.70 (59)
2007	3.26±0.08 (61)	16.90±0.53 (54)	25.92±0.71 (51)	32.75±1.49 (13)	37.91±1.72 (10)

* Significant (P<0.05), ** Significant (P<0.01)

Table 5 : Average Daily weight gain (ADG) of Muzaffarnagari lambs (g) – excluding feedlot data.

Particulars	ADG (0-3M)	ADG (3-6M)	ADG (6-12M)	ADG (3-12M)
Overall Mean	134.59±3.31 (407)	75.65±1.86 (313)	53.98±2.33 (209)	61.57±1.59 (211)
Sex	**	**	*	**
Male	141.22±3.18 (185)	83.31±2.58 (145)	56.53±2.86 (86)	68.21±1.95 (86)
Female	127.69±2.93 (222)	67.99±2.44 (168)	51.43±2.59 (123)	54.92±1.76 (125)
Year	**	**	**	**
2005	126.70±2.95 (184)	67.70±2.30 (166)	43.16±1.71 (141)	51.90±1.16 (142)
2006	125.84±3.08 (169)	60.26±3.01 (96)	54.98±2.59 (58)	53.77±1.75 (59)
2007	151.23±5.45 (54)	99.00±4.12 (51)	63.80±6.27 (10)	79.03±4.27 (29)

* Significant (P<0.05), ** Significant (P<0.01)

Table 6: Carcass characteristics of adult males under semi-intensive feeding Management

Traits	Values
Carcass traits:	
Slaughter age (days)	1035±3.38
Slaughter weight (kg)	54.00±3.21
Empty body weight (kg)	48.17±0.54
Carcass weight (kg)	27.64±1.76
Dressing percentage	50.20±0.40
Dressing percentage *	57.51±0.69
Fore quarter (kg)	15.37±0.96
Hind quarter (kg)	12.30±0.84
Loin eye area (cm^2)	14.28±0.13
Total body fat (%)	2.95±0.51
Non-carcass traits:	
Blood (%)	4.64±0.14
Head (%)	6.23±0.09
Skin (%)	9.88±0.06
GI tract (%)	6.10±0.12

* On the basis of empty body weight

All other percentage are on the basis of slaughter weight

Table 7: Reproductive performance of Muzaffarnagari ewes (2007-08).

Particulars	Season – I	Season – II	Annual
Ewes available	60	83	127
Ewes bred	40	79	119
Tupping (%)	66.7	95.2	**93.7**
Abortions	02	01	03
Still birth	-	01	01
Death	01	-	01
Lambing	37	72	109
Lambs born	40	81	121
Twins born	06	18	24
Twinning (%)	8.1	12.5	11
Lambing (A) %	61.6	88.9	**89.3**
Lambing (B) %	92.5	93.5	**95.6**

Replacement rate = 19*100/67 = 28.3%

Table 8: Greasy fleece yields of lambs and adults (g).

Particulars	Lambs Clip		Adult annual
	First season	Second season	
Overall mean	574.83±15.07 (406)	504.75±09.15 (409)	1118.65±17.35 (520)
Sex	NS	**	**
Male	585.68±18.44 (196)	543.61±13.36 (164)	1369.84±31.23 (45)
Female	563.98±17.87 (210)	465.90±11.78 (245)	867.47±11.50 (475)
Year	**	*	**
2005	750.42±14.00 (212)	536.22±13.52 (159)	1136.22±18.45 (244)
2006	495.54±15.75 (168)	511.41±12.96 (179)	1102.06±19.00 (222)
2007	478.53±39.98 (26)	466.62±20.02 (71)	1117.68±30.88 (54)

Table 9: Genetic and phenotypic parameters of body weights (2002-07).

Category	Birth Wt.	3 M Wt.	6 M Wt.	12 M Wt.	I Clip
Birth Wt.	**0.050±0.061**	0.508	0.400	0.394	0.283
3 M Wt.	< 0	**0.095±0.072**	0.791	0.603	0.545
6 M Wt.	0.389±0.434	0.945±0.121	**0.343±0.127**	0.771	0.582
12 M Wt.	0.386±0.461	0.897±0.183	0.897±0.076	**0.242±0.105**	0.358
I Clip	< 0	0.508±0.284	0.479±0.205	0.087±0.288	**0.450±0.148**

Diagonal h^2 estimates, above diagonal are phenotypic, Below diagonal genetic correlations

Table 10: Semen evaluation of breeding rams (2007-08).

S. No.	Ram No.	Ejaculation %	Mass motility	Individual motility	HOS %	Concentration billion/ml	Dead sperm %	Live sperm %	Percent Abnormal sperms	Remarks
1	6567	100	4.83	91.66	17.87	5.43	12.26	87.73	1.75	Selected
2	6573	100	4.83	93.33	35.12	6.87	12.83	87.16	1.40	Selected
3	6607	83.33	4.6	87	17.92	6.55	9.5	90.5	4	Selected
4	6659	66.67	4	75	12.25	4.48	33.59	66.40	1.95	Selected
5	6721	100	5	90	16.31	6.15	15.47	84.52	1.69	Selected
6	6735	100	4.83	88.33	21.78	3.96	23.05	76.94	1.65	Selected
7	6737	100	4.83	88.33	34.25	3.85	13.10	86.89	1.45	Selected
8	6725	0	0	0	0	0	0	0	0	Rejected
9	6727	16.67	1	75	30	1.75	21.73	78.26	6.08	Rejected
10	6731	50	2.33	31.66	39.16	4.46	20.83	79.16	4.16	Rejected

*** A total of 3 dystocia cases were handled. In 2 cases live foetus were taken out while in one case dead foetus was recovered.**

Table 11: Distribution of breeding rams.

Year	Number of rams distributed
2005-06	31
2006-07	19
2007-08	17
Total	**67**

Table 12: Body measurements of Muzaffarnagari sheep under field conditions.

Age group	Sex	No.	Body length (cm)	Body height (cm)	Chest girth (cm)	Tail length (cm)
0-1 month	**Pooled**	35	25.11±1.09	33.91±0.64	36.16±0.55	21.86±0.52
	Effect		*	**	****	*
	Male	16	27.75±1.61	35.81±0.95	37.75±0.81	22.87±0.76
	Female	19	22.47±1.48	32.00±0.87	34.58±0.74	20.84±0.70
1-3 month	**Pooled**	86	52.28±0.79	57.41±0.75	56.56±0.84	36.94±0.80
	Effect		**	**	****	**NS**
	Male	34	55.29±1.23	60.03±1.17	59.70±1.30	37.41±1.24
	Female	52	49.27±0.99	54.79±0.95	53.42±1.05	36.46±1.00
3-6 month	**Pooled**	97	56.79±0.70	61.13±0.47	63.39±0.58	43.66±0.50
	Effect		**	**	****	**NS**
	Male	44	60.39±1.03	63.09±0.70	65.54±0.85	44.36±0.74
	Female	53	53.19±0.94	59.17±0.64	61.24±0.77	42.96±0.68
6-9 month	**Pooled**	45	66.85±0.96	69.98±0.94	70.44±0.95	43.17±0.96
	Effect		**	*	****	**NS**
	Male	20	71.10±1.43	72.40±1.40	75.45±1.41	44.50±1.44
	Female	25	62.60±1.28	67.56±1.26	65.44±1.26	41.84±1.29
9-12 month	**Pooled**	35	81.67±0.83	76.22±0.78	79.91±0.54	51.98±0.76
	Effect		NS	**	**NS**	*
	Male	17	83.29±1.19	78.88±1.12	80.88±0.78	54.18±1.08
	Female	18	80.05±1.16	73.55±1.09	78.94±0.76	49.78±1.06
Adults	**Pooled**	214	82.30±0.43	83.31±0.39	84.88±0.45	53.04±0.47
	Effect		**	**	****	*
	Male	28	85.61±0.80	87.21±0.72	87.64±0.84	54.36±0.89
	Female	186	78.99±0.31	80.20±0.28	82.12±0.32	51.72±0.34

** Significant (P<0.01), * Significant (P<0.05), NS Non significant.

Table 13: Body weights (kg) of Muzaffarnagari sheep under field conditions.

Age group	Overall mean	Sex	Male	Female
0-1 month	6.32±0.53 (35)	NS	6.39±0.78 (16)	6.25±0.72 (19)
1-3 month	14.80±0.44 (86)	**	16.14±0.68 (34)	13.47±0.55 (52)
3-6 month	19.82±0.37 (97)	**	21.04±0.55 (44)	18.61±0.50 (53)
6-9 month	22.75±0.51 (45)	**	24.51±0.77 (20)	20.99±0.68 (25)
9-12 month	25.57±0.48 (35)	**	28.41±0.69 (17)	22.72±0.67 (18)
Adults	42.33±0.72 (214)	**	48.21±1.34 (28)	36.46±0.52 (186)

** Significant (P<0.01), NS Non significant.