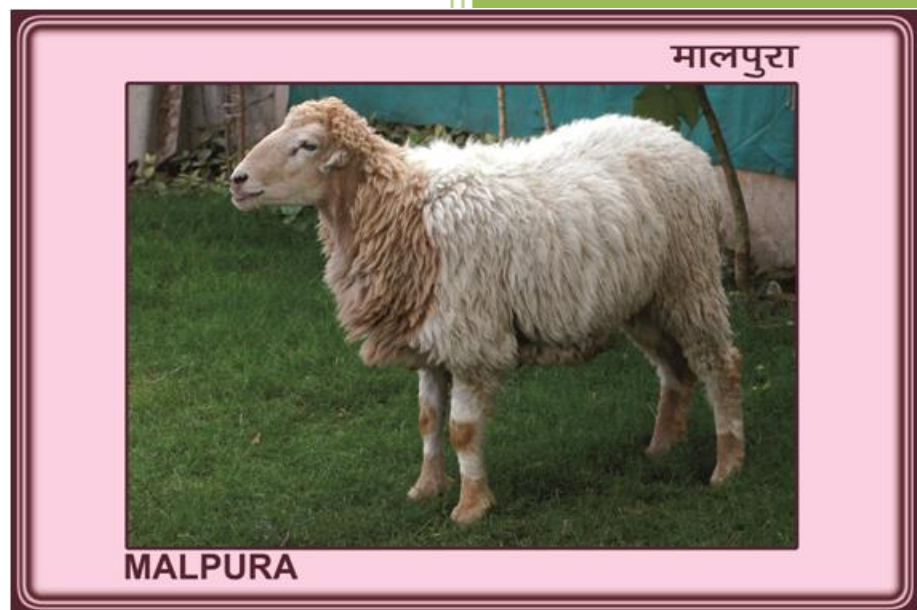


**RPP II  
2012-13**

**Genetic improvement of  
Malpura sheep for mutton  
production in farm and field**



Animal Genetics & Breeding

CSWRI Avikanagar

RPP II 2012-13

**INDIAN COUNCIL OF AGRICULTURAL RESEARCH**

**RESEARCH PROJECT PROFORMA FOR MONITORING ANNUAL PROGRESS  
(RPP- II)**

(Refer for Guidelines ANNEXURE-XI (E))

1. Institute Project Code
2. Project Title : **Genetic improvement of Malpura sheep for mutton production in farm and field**
3. Reporting Period : **2012-2013**
4. Project Duration: Date of Start – **01.04.2012** Likely Date of Completion– **31.03.2017**
5. Project Team (Name(s) and designation of PI, CC-PI and all project Co-PIs, (with time spent for the project) if any additions/deletions

S. No	Name, designation and institute	Status in the project (PI/CC-PI/Co-PI)	Time to be spent (%)	Work components to be assigned to individual scientist
1	Dr. G. R. Gowane Scientist (AGB)	Principal Investigator	50%	Selection of breeding rams, preparation and execution of mating plan, growth performance recording of field, data analysis and report preparation
2	Dr. A. L. Arora Head (AGB)	Co-PI	20%	Overall supervision and guidance Up to 30.09.2012
3	Dr. S. S. Misra Senior Scientist (AGB)	Co-PI	25%	Recording of growth data, reproductive performance and greasy fleece yield (GFY) in the farm
4	Dr. Rajkumar Scientist (TOT&SS)	Co-PI	25%	Field visits, field data recording for growth and reproduction of Malpura sheep
5	Dr. O. P. Koli Technical Officer (LFS)	Co-PI	30%	Overall management and treatment of Malpura sheep in the institute sheep flock

6. (a) Activities and outputs earmarked for the year (as per activities schedule given in RPP-I)

Objective wise	Activities	*Scientist Responsible	% of activity envisaged to be completed as per RPP1	% achieved as targeted
1. To evaluate and improve genetic potential of Malpura sheep for mutton production through selection in farm and field	Performance recording in the farm and field	GRG, SSM, RK	20	20
	Preparation and Execution of mating plan in the institute sheep flock	GRG, OPK	20	20
	Overall guidance	ALA	100	100
	Overall management and treatment of the sheep flock	OPK	20	20

	Data analysis for evaluation of genetic potential of sheep flock in farm and field	GRG, RK	20	20
2. To estimate genetic and phenotypic parameters of economically important traits to develop suitable selection criteria for improvement and to study the selection response for traits under selection	Estimation of genetic parameters using complex statistical models emphasising importance of all the significant factors on performance.	GRG, SSM	--	--
	Calculation of expected response to selection, Identifying actual response to selection	GRG, SSM	20	20

\*GRG: G. R. Gowane, SSM: S. S. Misra, OPK: O. P. Koli, RK: Rajkumar, ALA: A. L. Arora

(b) If shortfall, reasons for the same and how to catch up with the intended activities

## 7. Annual Progress Report (research results and achievements in bullets)

### 7.1 Project Technical profile

#### 7.1.1 Technical programme:

Improving sheep for mutton production will have major emphasis on improving the indigenous Malpura sheep through selection. Breeding ewes and followers are envisaged to be kept for improvement and ex-situ conservation. Young Rams would be ranked and selected on the basis of an index. Selection index to be followed is

$$\text{Index} = 6\text{WT}(2.31) + \text{ADG1}(0.23) + \text{ADG2}(0.12)$$

A component on field performance of Malpura sheep through recording and evaluation of scientific data is undertaken. An effort to improve the field flocks by identifying best germplasm and also by use of quality breeding rams of nucleus flock is envisaged.

Management of flocks in the institute: Animals according to their age, sex, physiological and health status are housed in the sheep shed. Overall management of the sheep flock of the projects of AGB Division is under the control of Livestock Farm Section (LFS). Sheep flock management, grazing by contractual services, supplementary feeding, heat detection and mating, treatment and culling of sick animals was managed by veterinary/ technical officers of LF Section under the administrative control of In-Charge, Livestock Farm Section. Scientists involved in the project have provided guidance to the staff of LF Section for effective management and proper implementation of the technical programme. Breeding was practiced so as to avoid lambing in harsh climate as per recommendations of RAC. Mating plan was designed to avoid inbreeding. Animals surplus to the project (weak and stunted growth, stray born, old age ewes, on production ground, *etc.*) were proposed for culling by the PI/CoPIs. Culling of sick animals on health basis was proposed by veterinary officer/technical officer at Sheep Sector under the control of LFS.

Data: The data on growth, reproduction, survivability and GFY etc. were collected by scientists (PI and Co-PIs) involved in the project. Young rams were selected on the basis of selection index incorporating 6 month weight, ADG1 and ADG2. Observations recorded:

Body weight at birth, 3, 6, 9 and 12 months of age, 1<sup>st</sup> Greasy fleece weight (GFW), Adult 6 monthly GFW, Adult annual GFW, Topping%, Lambing% (available and tugged basis), ewe weight at mating and lambing, survivability (pre and post-weaning, adult and overall). For field, data on growth performance such as birth weight, 3 month weight, and subsequent monthly weights up to adult stage. Reproduction (lambing on ewes available basis) was recorded.

## 7.2 Progress of work

Achievements in terms of targets fixed for each activity

### (A): Programme in the Institute Flock

#### (a) Population Statistics:

The flock strength on 01.04.2012 was 279 males and 573 females totalling 852 animals. After one year the flock strength remained 234 males and 473 females i.e. totalling 707 animals on 31.03.2013. The complete flock statistics is given in **Table 1**. Replacement rate for the year 2012-13 was 11.75% (51/434).

**Table 1. Flock statistics of Malpura sheep (01.04.2012 to 31.03.2013)**

Age	Opening balance		Addition						Total	
			Lambing		Int. Transfer		Ext. Transfer			
	M	F	M	F	M	F	M	F	M	F
0-3M	70	66	166	164			-	-	236	230
3-6M	45	48	-	-	88	83	-	-	133	131
6-12M	20	25	-	-	70	72	17	6	107	103
Adult	144	434	-	-	55	51	-	8	199	493
<b>Total</b>	<b>279</b>	<b>573</b>	<b>166</b>	<b>164</b>	<b>213</b>	<b>206</b>	<b>17</b>	<b>14</b>	<b>675</b>	<b>957</b>

Reduction												slaught ered		Total		Closing balance	
Death		Int. Transfer		Ext. Transfer		Culled		Pred/ missing		sold							
M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
15	13	88	83	-	-	1	-	-	-	-	-	-	-	104	96	132	134
13	16	70	72	20	6	26	21	-	1	2	15	1	-	132	131	1	-
6	8	55	51	6	3	19	21	-	-	1	7	5	4	92	94	15	9
8	14			26	24	28	118	-	-	51	7	-	-	113	163	86	330
<b>42</b>	<b>51</b>	<b>213</b>	<b>206</b>	<b>52</b>	<b>33</b>	<b>74</b>	<b>160</b>	<b>-</b>	<b>1</b>	<b>54</b>	<b>29</b>	<b>6</b>	<b>4</b>	<b>441</b>	<b>484</b>	<b>234</b>	<b>473</b>

#### (b) Growth Performance

The growth performance was studied in terms of body weights recorded at birth, 3, 6 and 12 months age and their least squares means are presented in Tables 2. Least-squares means for these body weights were 3.13±0.04, 12.40±0.28, 17.00 ±0.47 and 25.19 ± 0.76 kg, respectively. Sex of lamb didn't affect the body weights. Dam's weight at lambing significantly influenced the birth and weaning weights of lambs. Average daily gains (ADG) recorded for Malpura sheep during 2012-13 was 102.2±2.97, 45.04±2.88 and 36.17 ±3.43 g, respectively (Table 2a). There was sharp decline in the live weights of the lambs due to *atypical pneumonia* for which cause is still undiagnosed. This disease has significant impact on survivability and growth performance of the lambs. Incidence starts at 2 to 2½

months of age and persists nearly up to 12 months. Animals didn't respond to broad spectrum antibiotic treatment. Those animals which could recover again inflicted with the same disease repeatedly. Livestock Farm Section decided to isolate the 2012 born animals and thus they were shifted to sector 18, however, all these efforts could neither save the fall in live weights nor the survival efficiency. Immediate steps need to be taken so that next crop doesn't meet the same fate.

**Table 2. Least squares means for body weight (kg) in Malpura (2012 born)**

Particulars	Birth weight	3-m weight	6-m weight	12-m weight
Overall mean	3.13±0.042 (205)	12.40±0.28 (161)	17.00 ±0.47 (72)	25.19 ± 0.76 (23)
Sex	NS	NS	NS	NS
Male	3.13±0.059 (107)	12.72± 0.39 (82)	17.68± 0.70 (31)	26.76 ± 0.76 (9)
Female	3.13±0.061 (98)	12.07 ± 0.40 (79)	16.32 ± 0.61 (41)	23.62 ± 0.95 (14)
Reg. Ewe wt.	**	*	NS	NS

Within parentheses are number of observations; NS: Non-significant; \*\* P <0.01; \* P<0.05.

**Table 2a. Least squares means for birth weight (kg) in Malpura (2013 born).**

Particulars	Birth weight
Overall mean	3.31±0.03 (273)
Sex	NS
Male	3.37±0.05 (135)
Female	3.24±0.04 (138)

**Table 2b. Least squares means for average daily gains (g) in Malpura.**

Particulars	ADG1	ADG2	ADG3
Overall mean	102.2±2.97 (161)	45.04±2.88 (68)	36.17 ±3.43(23)
Sex	NS	NS	NS
Male	105.7±4.16 (82)	46.69± 4.26 (31)	37.46± 3.42 (9)
Female	98.67±4.24 (79)	43.38 ± 3.90 (37)	34.88 ± 4.29 (14)
Reg. Ewe wt.	NS	NS	NS

Within parentheses are number of observations; NS: Non-significant

**(c) Greasy fleece yield:**

Least-squares means for greasy fleece yield are presented in Table 3. The overall means for 1<sup>st</sup> and adult six monthly GFY were 490 g and 445 g in Malpura. The adult annual yield was 910 g for Malpura sheep

**Table 3. Least squares means for greasy fleece yield (GFY) in Malpura (2012 clips)**

Particular	1 <sup>st</sup> six monthly (kg)	Adult six monthly (kg)	Adult annual GFY (kg)
Over all mean	0.490±0.014 (176)	0.445±0.006 (454)	0.910±0.017 (304)
Sex	NS	**	**
Male	0.489±0.020 (82)	0.517±0.012 (167)	1.29±0.052 (39)
Female	0.490±0.019 (94)	0.374±0.005 (687)	0.854±0.015 (265)

SSN	NS	**	-
1	0.516±0.022 (89)	0.409±0.008 (450)	-
2	0.464±0.022 (87)	0.482±0.008 (404)	-
Regression on age at shearing	NS	**	-

Within parentheses are number of observations; NS: Non-significant; \*\* P <0.01; \* P<0.05.

#### e) Survivability

Survivability and culling percentage during the period under report is depicted in Table 4. It reveals that survivability at 0-3, 3-12 months and adult stage in Malpura was 93.99, 87.05 and 96.82%, respectively. The overall survivability (irrespective of age) of the flock in Malpura was 92.3 percent. The percent culling during 3-12 month and adult stage was 26.20 and 21.10 percent, respectively in Malpura. The *Atypical Pneumonia* that was undiagnosed remains the main culprit for excessive culling during 3 to 6 months of age that reflects in 3-12 months lowered survivability.

**Table 4: Percent survivability and culling in Malpura.**

Age group	% Survivability	% Culling
0-3 month	93.99 (466)	0.21 (466)
3-12 month	87.05 (332)	26.20 (332)
Adults	96.82 (692)	21.10 (692)
<b>Overall</b>	<b>92.33 (1213)</b>	<b>19.29 (1213)</b>

#### (f) Reproduction

Reproductive performance for the ewes lambed during 2012-13 is presented in Table 8. In Malpura, tupping was 91.15 % whereas lambing per cent on ewes available and ewes tupped basis were 89.68 and 98.38%, respectively. Twinning was 8.16 percent.

**Table 8: Reproductive performance in Malpura 2012-13**

Traits	Performance
% Tupping	91.15% (309/339)
% Lambing (available basis)	89.68% (304/339)
% Lambing (Tupped basis)	98.38%(304/309)

#### (g) Selection Differential (SD)

Selection differential of rams used during 2011 breeding season is given in table 9. The SD for 6-month body weight and ADG1 and ADG2 were 5.04 kg, 18.59g and 32.41g, respectively.

**Table 9. S.D. of Malpura rams used during 2011**

Groups	6-M body weight (kg)	ADG1 (gm) (pre-weaning, 0-3 month)	ADG2(gm) (post weaning, 3-6 month)
Selected rams (Mean)	31.96 (35)	168.52 (35)	145.89 (35)
Population Mean (2009-2010)	26.92 (208)	149.93 (277)	113.48 (204)
SD	5.04	18.59	32.41

### (h) Response to selection

Observed and expected response to selection is given in table no. 10. There was a huge difference between the expected and observed response due to fall in live weights and daily gains of the lambs born in year 2012. There was an incidence of *atypical undiagnosed pneumonia* in the flock. This disease started at the age group of 2 to 2½ months and continued up to 12 months of age. There was heavy morbidity followed by mortality. Growth potential of the animals was not expressed due to this disease. This was the main reason behind observed negative response to selection.

**Table10. Response to selection**

Traits	Generation	Mean		SD	Response	
		Population	Selected		Expected	Observed
6 M wt (kg)	Parents (2004 to 2011)	22.92 (393)	31.96	5.04	1.36	-5.24
	Offspring	17.68				
ADG1 (g)	Parents	136.5 (460)	168.52	18.59	4.28	-30.8
	Offspring	105.7				
ADG2 (g)	Parents	98.83 (384)	145.89	32.41	4.21	-52.14
	Offspring	46.69				

$$h^2: 6M wt = 0.27 \text{ ADG1} = 0.23, \text{ ADG2} = 0.13 \text{ Expected Response} = (h^2 \times SD)$$

### (h) Sale of Animals

For the year 2012-13, 1 hogget male and 51 adult males, 7 hogget females and 7 adult females were sold to farmers and government agencies.

### (B): Programme at the Farmer's Flocks

The programme of Malpura sheep genetic improvement and evaluation was started in the field at farmer's flock from the year 2012-13 (XII Plan). Basic objective of the programme is to identify the animals in the field, to record their performance and to evaluate the germplasm. Exchange of superior animals from institute nucleus to field flocks and vice versa shall also be practiced.

(a) **Flock Statistics** For the year 2012-13, we have identified 6 farmers who keep Malpura sheep and their crosses. Preliminary Flock statistics in six flocks studied at the start of the project. Initial baseline information was collected on dentition basis. Adult rams that are used for breeding are usually 1 to 2 in each flock. Adult females in flock 1 were 11 (2 teeth) and 41 ( $\geq 4$  teeth), in flock 2, adult females were 8 (2 teeth) and 52 ( $\geq 4$  teeth), in flock 3 adult females were 3 (2 teeth) and 26 ( $\geq 4$  teeth), in flock 4 adult females were 6 and 46, flock five they were 11 and 48 and in flock six they were 6 and 31 for 2 teeth and  $\geq 4$  teeth. Total strength covered under flock statistics at the start was **507**.

**Table 11. Flock strength of three flocks in September on dentition basis**

Flock No.	Farmer/Village	Dentition					Total
				0	2	$\geq 4$	
1	Jagdish/ Bheepur	sex	F	37	11	41	89
			M	8	1	0	9

		<b>Total</b>		<b>45</b>	<b>12</b>	<b>41</b>	<b>98</b>
2	Satyanarayan/ Amla	sex	F	47	8	52	107
			M	22	1	2	25
		<b>Total</b>		<b>69</b>	<b>9</b>	<b>54</b>	<b>132</b>
3	Abdullah/ Malpura	sex	F	9	3	26	38
			M	0	1	0	1
		<b>Total</b>		<b>9</b>	<b>4</b>	<b>26</b>	<b>39</b>
4	Gopal Jat/ Rindliya	sex	F	25	6	46	77
			M	15	0	1	16
		<b>Total</b>		<b>40</b>	<b>6</b>	<b>47</b>	<b>93</b>
5	Rodu/ Tantiya	sex	F	14	11	48	73
			M	12	1	1	14
		<b>Total</b>		<b>26</b>	<b>12</b>	<b>49</b>	<b>87</b>
6	Berda Khan/ Hatki	sex	F	12	6	31	49
			M	7	0	2	9
		<b>Total</b>		<b>19</b>	<b>6</b>	<b>33</b>	<b>58</b>

At the end of the financial year 2012-13 *i.e.* in the month of March 2013, the flock strength in these six flocks was 116 in flock 1 (Jagdish/ Bheepur), 141 in flock 2 (Satyanarayan/ Amla), 52 in flock 3 (Abdullah/ Malpura), 111 in flock 4 (Gopal Jat/ Rindliya), 116 in flock 5 (Rodu/ Tantiya) and 60 in flock 6 (Berda Khan/ Hatki). Thus total sheep covered was **596**.

#### (b) Live Weights in flocks covered

The live weights of the animals were taken in all the six flocks across age and sex. The least squares means for the live weights for different dentitions (0, 2 and  $\geq 4$ ) are given in table 11. Males weighed heavier than females for 2 stage and adult stage. However, as stringent selection is followed for males, they are culled at very early age. Thus, a few males are available in 0 dentition group, and thus weighed lesser than females.

**Table 11: Least Squares Means for live weights of Malpura sheep in field on dentition basis**

Dentition		Mean	N	SE
		$\mu$	26.57	507
0	F	18.11	144	0.77
	M	12.02	64	0.81
	Total	16.24	208	0.62
2	F	31.42	45	0.48
	M	44.38	4	4.01
	Total	32.48	49	0.73
$\geq 4$	F	33.49	244	0.25
	M	55.00	6	3.26
	Total	34.00	250	0.33

#### (c) Growth Performance

Monthly weight recording of the identified lambs is done on monthly basis. During the period under study we could observe birth weight, 3 month weights and 4 month weights of the lambs. Overall least squares means for birth, three and four month weights were  $3.21 \pm 0.06$ ,  $15.57 \pm 0.21$  and  $17.24 \pm 0.57$  kg, respectively.



**Table 12: Least Squares Means for growth traits (monthly weights in Kg) of Malpura sheep in field**

	<b>BWT</b>	<b>3WT</b>	<b>4WT</b>
$\mu \pm SE$	3.21 $\pm$ 0.06 (98)	15.57 $\pm$ 0.21 (98)	17.24 $\pm$ 0.57 (19)
Sex	**	NS	NS
M	3.46 $\pm$ 0.09 (47)	15.64 $\pm$ 0.31 (47)	17.20 $\pm$ 0.98 (5)
F	2.97 $\pm$ 0.08 (51)	15.51 $\pm$ 0.25 (51)	17.29 $\pm$ 0.58 (14)
Flock	NS	**	-
1	3.49 $\pm$ 0.19 (8)	19.32 $\pm$ 0.63 (8)	-
2	3.15 $\pm$ 0.13 (15)	14.89 $\pm$ 0.44 (15)	-
3	3.45 $\pm$ 0.15 (12)	14.67 $\pm$ 0.49 (12)	-
4	3.05 $\pm$ 0.23 (5)	14.64 $\pm$ 0.77 (5)	-
5	3.08 $\pm$ 0.09 (29)	14.93 $\pm$ 0.32 (29)	-
6	3.07 $\pm$ 0.09 (29)	14.99 $\pm$ 0.32 (29)	-

Flocks 1 to 6 belonged to Abdulla, Gopal Jat, Jagdish, Berda Khan, Rodu and Satyanarayan, respectively.

#### (d) Reproductive performance

Reproductive performance in the farmers flocks on ewes available basis was obtained for the major season lambing alone. Next year onwards annual lambing will be calculated. Overall lambing on ewes available basis was 56.06% for the one season that was covered during this period. In the six flocks, reproductive performance varied significantly, highest being in the flock 6 and least in flock 4.

**Table 13: Reproductive performance in Malpura (farmer's flocks) in only one season**

<b>Flocks</b>	<b>% Lambing (ewes available basis)</b>
$\mu \pm SE$	56.06% (162/289)
1	41.34% (12/29)
2	46.15% (24/52)
3	65.38% (34/52)
4	27.02% (10/37)
5	64.40% (38/59)
6	73.33% (44/60)

Flocks 1 to 6 belonged to Abdulla, Gopal Jat, Jagdish, Berda Khan, Rodu and Satyanarayan, respectively.

#### (e) Fibre quality parameters

In the field flocks, 16 samples were taken from the sheep for fibre quality evaluation at TMTC. Report as obtained from TMTC division is given in table 14. The quality is not good. Samples were highly medullated.

**Table 14. Fibre quality parameters**

Sr. No.	Tag No.	Fibre diameter	Standard Error	CV%	Hetero%	Hairy%	Medullation %	Staple length (cm)
1.	MA05	40.87	0.67	28.51	16	75	91	2.6
2.	MA04	43.15	1.75	70.17	25	25.33	50.33	2.5
3.	MA28	50.53	2.02	70.53	20.97	41.61	62.58	1.6
4.	MA32	69.35	2.88	71.81	19	48.67	67.67	2
5.	RG11	54.42	1.95	62.5	14.75	50.16	64.91	2.2
6.	RG21	33.75	1.34	70.34	32.27	25.88	58.15	2
7.	RG25	45.17	1.48	56.78	36.67	57	93.67	2.4

8.	RG57	43.79	1.43	58.41	27.81	62.19	90	2.2
9.	AS17	82.99	3.27	68.16	25.67	59.33	85	1.7
10.	AS45	61.55	1.8	50.68	23.33	69	92.33	2.7
11.	AS54	65.51	2.68	71.04	12	84	96	1.8
12.	AS71	42.24	1.02	45.38	29.43	60	89.43	3
13.	BJ18	71.63	3.59	86.92	23	43	66	2.8
14.	BJ25	55.67	1.73	54.49	17.26	80.78	98.04	3.6
15.	BJ47	68.69	2.63	66.4	25.67	53	78.67	3.5
16.	BJ43	62.96	1.91	54.23	2.5	75.94	78.44	3.4

#### (f) Animal disposal through sale

It was seen that farmers usually sell their lambs at very early age. From two month onwards surplus male lambs are sold and a few male lambs are kept for future breeding purpose. Female lambs are however retained for the purpose of replacement of the flock. Details of the sale of animals are as given under:

Farmer/Village	Animals sold	age	sex	Reason	Rate at which sold	Revenue generated
Jagdish/Bheepur	11	Nearly 3 months	Male	Surplus	Did not reveal	Did not reveal
Satyanarayan/Amla	9	Nearly 3 months	Male	Surplus	Rs. 2500/-	Rs. 22,500/-
Abdulla/Malpura	2	Nearly 3 months	Female	Surplus	Rs. 1100 and Rs. 2000	Rs. 3200/-
Gopal Jat/	17F, 10M	Nearly 3 months	M/F	Surplus	M: 2600/- F: 1000/-	Rs. 43,000/-
Rodu/Tantiya	-	-	-	-	-	-
Berda Khan	4	Nearly 3 months	Male	Surplus	Did not reveal	Did not reveal

#### C. Action Taken Report (IRC 2012)

1. Research on Malpura sheep is being undertaken in farmer's flock as advised by RAC 2012. Data recording on various production and reproduction parameters are recorded on the sheep. Individual animal identification by ear tagging is done for scientific data recording.
2. Round the year breeding in Malpura sheep is continued with a caution so as to avoid the lambing in harsh climate of the year.

#### 8. Output During Period Under Report

##### a. Special attainments/innovations

Individual animal identification by ear tagging is started in the field flocks. Scientific data recording in the field with complete pedigree and performance recording is initiated. Animals are weighed on target ages for evaluation. Data is recorded and digitised.

##### b. List of Publications (one copy each to be submitted with RPP-II)

i. Research papers

1. Ved Prakash, L.L.L. Prince, G.R. Gowane, A.L. Arora. 2012. Factors affecting post-weaning average daily gain and Kleiber ratios in Malpura sheep. *Indian Journal of Animal Science*. **82** (12): 1598–1600
2. Ved Prakash, L.L.L. Prince, G.R. Gowane, A.L. Arora. 2012. The estimation of (co)variance components and genetic parameters for growth traits and Kleiber ratios in Malpura sheep of India. *Small Ruminant Res.* (2012), <http://dx.doi.org/10.1016/j.smallrumres.2012.07.018>.

ii. Reports/Manuals

RPF-II (2011-12), RPF- III (2007-12), RPP (2012-17), Monthly progress report and Quarterly target and achievement report.

iii. Working and Concept Papers : nil

iv. Popular articles

1. G. R. Gowane, Ashish Chopra and LLL Prince (2012). Matritva prabhav ka Bhed prajanan me mahatva. *AviPunj* (9): 17-18
2. Ashish Chopra, G. R. Gowane, SS Misra and LLL Prince (2012). Pashu anuvanshik sansadhan sanrakshan: aavashyakata evam chunautiyan. *AviPunj* (9): 29-31

v. Books/Book Chapters

1. S. M. K. Naqvi and G. R. Gowane. 2013. Chapter 4 Sheep status in India- an overview. page 81-98. Prasad et al. (eds), In the book “New paradigms in livestock production from traditional to commercial farming and beyond” Jan, 2013
2. LLL Prince, G. R. Gowane and Ashish Chopra. 2013. Prolific sheep: A promising tool for enhancing the sheep productivity :Prasad et al. (eds), In the book “New paradigms in livestock production from traditional to commercial farming and beyond” published by Agrotech Publishing Academy, Udaipur, pp 492-511.
3. Soumen Naskar, G. R. Gowane, A.Chopra, C.Paswan, and L. L. L. Prince (2012).Genetic Adaptability of Livestock to Environmental Stresses, book chapter in book titled Environmental Stress and Amelioration in Livestock Production (Eds: Veerasamy Sejian, S.M.K. Naqvi, Thaddeus Ezeji, Jeffrey Lakritz and Rattan Lal), Springer, pp 317-378.

vi. Extension Bulletins

1. G R Gowane, Ashish Chopra, SS Misra and LLL Prince (2013) Folder in Hindi “ekyiqjk HksM+ & jktLFkku dh v)Z'kq"d tyok;q esa vkthfodk dk eq[; L=ksr”, published by CSWRI, Avikanagar

c. Intellectual Property Generation : nil

(Patents - filed/obtained; Copyrights- filed/obtained; Designs- filed/obtained; Registration details of variety/germplasm/accession if any)

d. Presentation in Workshop/Seminars/Symposia/Conferences

(relevant to the project in which scientists have participated)

1. “Evaluation of different selection indices for Malpura sheep of semi-arid area of Rajasthan”; Ashish Chopra, G. R. Gowane, Ved Prakash, S. S. Misra and LLL Prince;

during XII Annual Conference on Indian Society of Animal Genetics & Breeding and National Symposium on Improvement of livestock productivity through conventional breeding and emerging technologies in changing global scenario- challenges, prospects and retrospects; 22-23 Nov 2012, College of veterinary science, Sri Venkateswara university, Hyderabad .

e. Details of technology developed : Pure bred high genetic merit Malpura sheep (Crop-based; Animal-based, including vaccines; Biological – biofertilizer, biopesticide, etc; IT based – database, software; Any other – please specify)

f. Trainings/demonstrations organized

g. Training received

1. Dr. S. S. Misra, Co-PI of the project participated in winter school on “Advanced molecular techniques in Gene regulation and functional genomics “held at NDRI, Karnal from 3-23<sup>rd</sup> December, 2012.

h. Any other relevant information

**9.** Constraints experienced, if any

There is improvement in birth weight and weaning weight of lambs born during the period under report, but lambs were unable to express their full growth potential due to the occurrence of pneumonia infection at about 2½ to 4 months of age. Infection reoccurred in the recovered animals and thus further deteriorated the lamb/hogget’s growth. Cause of infection is still undiagnosed.

**10.** Lessons Learnt

This programme needs more input in terms of funding and technical manpower for successful accomplishment of the objectives.

**11.** Evaluation

(a) Self evaluation of the project for the period under report by the PI with rating in the scale of 1 to 10

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(b) Evaluation by PI on the contribution of the team in the project including self

S.No.	Name	Status in the project (PI/CC-PI/Co-PI)	Rating in the scale of 1 to 10
1	Dr. G. R. Gowane Scientist (AGB)	PI	9
2	Dr. A. L. Arora Head (AGB)	Co-PI	10
3	Dr. S. S. Misra Senior Scientist (AGB)	Co-PI	9
4	Dr. Rajkumar Scientist (TOT&SS)	Co-PI	9
5	Dr. O. P. Koli Technical Officer (LFS)	Co-PI	9

**12. Signature of PI, CC-PI(s), all Co-PIs**

Dr. G. R. Gowane (PI)  
Scientist (AGB)

***Retired on 30.09.2012***  
Dr. A. L. Arora (Co-PI)  
Head (AGB)

Dr. S. S. Misra (Co-PI)  
Senior Scientist (AGB)

Dr. Rajkumar (Co-PI)  
Scientist (TOT&SS)

Dr. O. P. Koli (Co-PI)  
Technical Officer (LFS)

**13. Signature (with specific comments on progress/achievements, shortfall and Constraints along with rating of the project in the scale of 1 to 10) of Head of Division**

**14. Comments of IRC**

**15. Signature (with specific comments on progress/achievements, shortfall and constraints along with rating of the project in the scale of 1 to 10) of JD (R)/ Director**