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Comparative assessment of adoption of scientific sheep husbandry practices among beneficiary and non-beneficiary farmers

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Abstract

The present study assessed the adoption of scientific sheep husbandry practices among beneficiary and non-beneficiary sheep farmers under the Farmer FIRST Programme implemented by ICAR-IVRI, Izatnagar, Uttar Pradesh. An ex-post facto research design with a with-without approach was employed. A total of 120 respondents, comprising 60 beneficiary and 60 non-beneficiary sheep farmers, were selected from Bareilly district. Adoption was measured across five dimensions: feeding, breeding, housing, healthcare, and general management practices using a structured interview schedule. The findings revealed that beneficiary farmers exhibited significantly higher adoption levels than non-beneficiary farmers across all dimensions. Beneficiary farmers recorded a higher overall adoption score (51.92%) compared to non-beneficiary farmers (36.93%), with significant differences confirmed through the Mann-Whitney U-test ($p < 0.01$). The study highlights the positive role of participatory extension interventions, training, demonstrations, and farmer-scientist interactions in promoting scientific sheep husbandry practices and improving livestock-based livelihoods.

Keywords: Farmer FIRST programme, rural livelihoods, scientific sheep husbandry, technology adoption

1. Introduction

Livestock plays a pivotal role in the rural economy of India by providing employment, income, nutritional security, and risk mitigation to millions of small and marginal farmers. Among the various livestock enterprises, sheep husbandry occupies a significant position owing to its adaptability to diverse agro-climatic conditions, low initial investment requirement, and ability to thrive on marginal lands and crop residues. Sheep contribute substantially to the livelihoods of resource-poor households through the production of meat, wool, manure, and additional income during periods of agricultural distress (Javaid *et al.*, 2026) ^[4]. The enterprise serves as an important source of livelihood security, particularly in rainfed, arid, and semi-arid regions where crop production is often constrained by environmental uncertainties.

India possesses one of the largest sheep populations in the world and ranks among the leading producers of mutton. Despite the substantial sheep population, productivity levels remain comparatively low due to poor genetic potential of local breeds, inadequate feeding and breeding management, poor housing conditions, prevalence of diseases, and limited

adoption of scientific sheep husbandry practices. The productivity gap between potential and actual performance is largely attributed to the inadequate dissemination and adoption of improved technologies at the farm level. Therefore, enhancing the adoption of scientific sheep husbandry practices is crucial for improving flock productivity, profitability, and livelihood security of sheep farmers (Verma *et al.*, 2025) ^[11].

Scientific sheep husbandry encompasses a range of recommended practices related to feeding, breeding, housing, healthcare, and general management. These practices include balanced feeding, mineral supplementation, timely colostrum feeding, selection of superior breeding rams, proper housing and sanitation, vaccination, deworming, record keeping, and scientific flock management. Adoption of these practices has been reported to improve growth performance (Verma *et al.*, 2026a) ^[10], reproductive efficiency (Sahu *et al.*, 2026) ^[7] disease resistance, and overall productivity of sheep. However, adoption levels often vary among farmers due to differences in socio-economic conditions, access to extension services, awareness, resource availability, and exposure to training

programmes.

Extension interventions play a crucial role in bridging the gap between research and practice by facilitating the transfer of improved technologies to farming communities. In this context, the Farmer FIRST (Farm, Innovations, Resources, Science and Technology) Programme, initiated by the Indian Council of Agricultural Research (ICAR), represents an innovative approach aimed at strengthening the farmer–scientist interface and promoting participatory technology development and dissemination. Unlike conventional extension approaches, the Farmer FIRST Programme emphasizes farmer-centric research, participatory experimentation, capacity building, and continuous feedback mechanisms to address location-specific farming challenges.

The ICAR-Indian Veterinary Research Institute (ICAR-IVRI), Izatnagar, has been implementing the Farmer FIRST Programme in selected villages of Bareilly district, Uttar Pradesh, since 2016. One of the major interventions under the programme was the introduction of improved germplasm of Muzaffarnagari rams among resource-poor sheep farmers. Muzaffarnagari sheep is one of the largest and most productive mutton breeds of northern India, known for its superior growth performance, adaptability, and higher meat production potential. Along with germplasm dissemination, beneficiary farmers were provided with training programmes, demonstrations, advisory services, and exposure visits to enhance their knowledge and skills regarding scientific sheep husbandry practices.

Prior to programme implementation, participatory rural appraisal and field interactions revealed several constraints faced by sheep farmers, including poor awareness of scientific management practices, high disease incidence, inadequate breeding management, and the absence of systematic genetic improvement efforts. These challenges contributed to low productivity and reduced economic returns from sheep farming. The Farmer FIRST intervention sought to address these constraints through technological, educational, and capacity-building measures aimed at improving sheep production and farmer livelihoods.

Although various interventions have been implemented to improve sheep production systems, empirical evidence regarding their effectiveness in promoting the adoption of scientific sheep husbandry practices remains limited. Assessing the extent of adoption among beneficiary and non-beneficiary farmers is essential for understanding the effectiveness of extension programmes and identifying areas requiring further intervention. Such assessments provide valuable insights into the behavioural changes induced by developmental programmes and help policymakers and extension agencies formulate strategies for improving technology dissemination and adoption (Bihari *et al.* 2020) [3].

Against this backdrop, the present study was undertaken to comparatively assess the adoption of scientific sheep husbandry practices among beneficiary and non-beneficiary sheep farmers under the Farmer FIRST Programme in Bareilly district of Uttar Pradesh. The study aimed to evaluate the extent of adoption of recommended practices across major dimensions of sheep husbandry and to examine the effectiveness of programme interventions in promoting

scientific sheep farming among rural households.

2. Methodology

2.1 Study Area and Research Design

The present study was conducted in Bareilly district of Uttar Pradesh, India, under the Farmer FIRST Programme implemented by the ICAR–Indian Veterinary Research Institute (ICAR-IVRI), Izatnagar. The programme has been operational since 2016 with the objective of enhancing livestock-based livelihoods through farmer-centric interventions, including the introduction of improved germplasm of Muzaffarnagari rams and dissemination of scientific sheep husbandry practices.

An ex-post facto research design was employed for the study, as the intervention had already been implemented and the researcher had no control over the independent variables. A with-without comparative design was adopted to compare beneficiary and non-beneficiary sheep farmers with respect to the adoption of scientific sheep husbandry practices. This design was considered appropriate for assessing the effectiveness of programme interventions under field conditions.

2.2 Sampling Procedure

Bareilly district was purposively selected for the study because improved germplasm of Muzaffarnagari rams had been distributed to sheep farmers through the Farmer FIRST Programme. Among the fifteen development blocks of the district, Majhgawan block was selected purposively as the treatment area since it was one of the primary intervention sites of the programme. For comparison, Fatehganj West block was selected as the control area owing to its comparable socio-economic conditions, sheep production system, and flock characteristics.

Both purposive and random sampling techniques were employed for the selection of respondents. Beneficiary sheep farmers who had received improved Muzaffarnagari rams and participated in programme activities such as training programmes, demonstrations, and advisory services were included in the beneficiary group. A total of 60 beneficiary farmers were selected from Majhgawan block. Similarly, 60 non-beneficiary sheep farmers were randomly selected from Fatehganj West block to constitute the comparison group. Thus, the final sample comprised 120 respondents, including 60 beneficiary and 60 non-beneficiary sheep farmers.

2.3 Measurement of Adoption of Scientific Sheep Husbandry Practices

The extent of adoption of scientific sheep husbandry practices served as the principal variable of the study. Adoption was operationally defined as the degree to which respondents practiced the recommended scientific sheep husbandry technologies. The concept of adoption was based on the definition proposed by Rogers (2003) [6], who described adoption as the decision to make full use of an innovation as the best available course of action.

A structured interview schedule was developed to assess the adoption behaviour of sheep farmers. The schedule comprised recommended practices under five major dimensions of sheep husbandry, namely feeding practices, breeding practices, housing practices, healthcare practices,

and general management practices. Respondents were asked to indicate the extent to which they adopted each recommended practice.

A three-point continuum was used for measuring adoption. A score of 2 was assigned for complete adoption of a recommended practice, 1 for partial adoption, and 0 for non-adoption. The total adoption score for each respondent was obtained by summing the scores across all items included in the schedule. Based on the total score obtained, respondents were categorized into low, medium, and high adoption groups using the split-range method.

2.4 Data Collection

Primary data were collected through personal interviews using a pre-tested structured interview schedule. Prior to final data collection, the interview schedule was pilot tested in a non-sample area to assess its clarity, relevance, and suitability under field conditions. Necessary modifications in wording, sequencing, and presentation of questions were made based on the feedback obtained during pre-testing. Data were collected through direct interaction with respondents at their farms and residences. In addition to the interview method, field observations were also undertaken to verify selected management practices wherever feasible. The respondents were assured of confidentiality, and information was collected only after obtaining their informed consent.

2.5 Statistical Analysis

The collected data were coded, classified, tabulated, and analysed using the Statistical Package for Social Sciences (SPSS). Descriptive statistical tools such as frequency, percentage, mean, standard error, and adoption scores were used to summarize the data. To compare the adoption levels of beneficiary and non-beneficiary farmers, the Mann–Whitney U-test was employed. The significance of differences between the two groups was tested at appropriate probability levels. The results were interpreted to assess the effectiveness of the Farmer FIRST Programme in promoting the adoption of scientific sheep husbandry practices among sheep farmers.

3. Results

Adoption of Scientific Sheep Husbandry Practices among Beneficiary and Non-Beneficiary Sheep Farmers

3.1 Feeding Practices

The results presented in Table 1 revealed that beneficiary farmers had a significantly higher level of adoption of scientific feeding practices than non-beneficiary farmers. Among beneficiary farmers, the highest adoption scores were recorded for timely feeding of colostrum to newborn lambs (95.00%), optimum grazing hours (91.67%), and feeding of mineral mixture and salt supplementation (78.33%). The adoption of starter feed to young ones (68.33%) and recommended concentrate ration (76.67%) was also comparatively high. However, practices such as conservation of green fodder in the form of silage or hay (9.17%), use of scientific feeders (22.50%), and rotational grazing (21.67%) recorded low adoption scores.

Among non-beneficiary farmers, optimum grazing hours showed the highest adoption score (83.33%), followed by timely feeding of colostrum (55.83%). The adoption of scientific feeder use (15.00%), concentrate feeding (25.00%), fodder conservation (30.83%), and mineral supplementation (35.00%) was comparatively low. The pooled results indicated that grazing hours (87.50%) and timely feeding of colostrum (75.42%) were the most widely adopted feeding practices, whereas fodder conservation (20.00%) and rotational grazing (24.17%) remained poorly adopted.

The distribution of respondents according to adoption level (Table 2) indicated that 76.67 per cent of beneficiary farmers belonged to the medium adoption category, whereas 65.00 per cent of non-beneficiary farmers were in the low adoption category. The mean adoption score of beneficiary farmers (11.03 ± 0.28) was significantly higher than that of non-beneficiary farmers (7.85 ± 0.25), as confirmed by the Mann–Whitney U-test (519.00; $p < 0.01$). These findings suggest that beneficiary farmers had better awareness and adoption of scientific feeding technologies due to greater exposure to extension programmes and technical guidance.

3.2 Breeding Practices

The adoption of scientific breeding practices differed considerably between beneficiary and non-beneficiary farmers (Table 3). Among beneficiary farmers, the highest adoption was observed for selection of high genetic merit rams (81.67%), maintenance of recommended ram-to-ewe ratio (80.00%), and flushing ration before breeding (69.17%). Moderate adoption was recorded for care during pregnancy and after kidding (63.33%), heat detection (60.00%), and replacement or exchange of breeding rams (58.33%).

In contrast, the adoption of control mating (26.67%), pedigree record maintenance (25.83%), and artificial insemination (0.00%) was very low. Similar trends were observed among non-beneficiary farmers, although adoption levels were substantially lower. The pooled analysis revealed that recommended ram-to-ewe ratio (64.58%) and selection of superior breeding rams (60.00%) were the most widely adopted breeding practices. Artificial insemination was not adopted by any respondent, indicating poor accessibility and limited awareness regarding advanced breeding technologies.

The adoption-level distribution (Table 2) showed that 73.33 per cent of beneficiary farmers belonged to the medium adoption category, whereas 73.33 per cent of non-beneficiary farmers were classified under the low adoption category. The mean adoption score was significantly higher among beneficiary farmers (10.33 ± 0.27) compared to non-beneficiary farmers (6.92 ± 0.34). The Mann–Whitney U-test further confirmed a significant difference between the two groups (570.50; $p < 0.01$). These findings indicate that beneficiary farmers possessed better knowledge and adoption of scientific breeding practices than non-beneficiaries.

Table 1: Adoption score of different subareas of feeding practices

Feeding practices	BF (n=60)								NBF (n=60)								Pooled (N=60)							
	Always / Complete		Occasionally / Partial		Never				Always / Complete		Occasionally / Partial		Never				Always / Complete		Occasionally / Partial		Never			
	f	%	f	%	f	%	AS	%	f	%	f	%	f	%	AS	%	f	%	f	%	f	%	AS	%
Grazing hours	50	83.33	10	16.67	0	0.00	110	91.67	40	66.67	20	33.33	0	0.00	100	83.33	90	75.00	30	25.00	0	0.00	210	87.50
Scientific feeder	3	5.00	21	35.00	36	60.00	27	22.50	0	0.00	18	30.00	42	70.00	18	15.00	3	2.50	39	32.50	78	65.00	45	18.75
Starter feed to young ones	24	40.00	34	56.67	2	3.33	82	68.33	7	11.67	23	38.33	30	50.00	37	30.83	31	25.83	57	47.50	32	26.67	119	49.58
Amount of concentrate ration	34	56.67	24	40.00	4	6.67	92	76.67	6	10.00	18	30.00	36	60.00	30	25.00	40	33.33	42	35.00	40	33.33	122	50.83
Timely feeding of Colostrum to new born	54	90.00	6	10.00	0	0.00	114	95.00	18	30.00	31	51.67	11	18.33	67	55.83	72	60.00	37	30.83	11	9.17	181	75.42
Feeding of pelleted feed	20	33.33	18	30.00	22	36.67	58	48.33	7	11.67	43	71.67	10	16.67	57	47.50	27	22.50	61	50.83	32	26.67	115	47.92
Conserve green fodder in the form of silage or hay	0	0.00	11	18.33	49	81.67	11	9.17	3	5.00	31	51.67	26	43.33	37	30.83	3	2.50	42	35.00	75	62.50	48	20.00
Practice of rotational grazing	2	3.33	22	36.67	36	60.00	26	21.67	3	5.00	26	43.33	31	51.67	32	26.67	5	4.17	48	40.00	67	55.83	58	24.17
Feeding of mineral mixture and salt supplementation	34	56.67	26	43.33	0	0.00	94	78.33	6	10.00	30	50.00	24	40.00	42	35.00	40	33.33	56	46.67	24	20.00	136	56.67
Feeding of moringa / fodder leaves	12	20.00	26	43.33	22	36.67	50	41.67	9	15.00	33	55.00	18	30.00	51	42.50	21	17.5	59	49.17	40	33.33	101	42.08

f- Frequency, %- Percentage, BF- Beneficiary Farmers, NBF- Non-beneficiary Farmers, AS- Adoption Score

Table 2: Distribution of respondents according to their adoption score on different dimensions

Feeding practices	BF (n=60)	NBF (n=60)	Pooled (N=120)
Low (<8)	7 (11.67)	39 (65.00)	46 (38.33)
Medium (8-14)	46 (76.67)	21 (35.00)	67 (55.83)
High (15-21)	7 (11.67)	0 (0.00)	7 (5.83)
Adoption Score	662 (55.17)	471 (39.25)	1133 (47.21)
Mean $\pm$ SE	11.03 $\pm$ 0.28	7.85 $\pm$ 0.25	9.44 $\pm$ 0.24
Mann Whitney U-test	519.00**		
Breeding practices			
Low (<8)	11 (18.33)	44 (73.33)	55 (45.83)
Medium (8-14)	44 (73.33)	14 (23.33)	58 (48.33)
High (15-21)	5 (8.33)	2 (3.33)	7 (5.83)
Adoption Score	620 (51.67)	415 (34.58)	1035 (43.13)
Mean $\pm$ SE	10.33 $\pm$ 0.27	6.92 $\pm$ 0.34	8.63 $\pm$ 0.27
Mann Whitney U-test	570.50**		
Housing practices			
Low (<8)	16 (26.67)	47 (78.33)	63 (52.50)
Medium (8-14)	41 (68.33)	13 (21.67)	54 (45.00)
High (15-21)	3 (5.00)	0 (0.00)	3 (2.50)
Adoption Score	655 (54.58)	435 (36.25)	1090 (45.42)
Mean $\pm$ SE	10.92 $\pm$ 0.29	7.25 $\pm$ 0.23	9.08 $\pm$ 0.25
Mann Whitney U-test	336.00**		
Healthcare practices			
Low (<8)	12 (20.00)	43 (71.67)	55 (45.83)
Medium (8-14)	47 (78.33)	16 (26.67)	63 (52.50)
High (15-21)	1 (1.67)	1 (1.67)	2 (1.67)
Adoption Score	579 (48.25)	434 (36.17)	1013 (42.21)
Mean $\pm$ SE	9.65 $\pm$ 0.29	7.23 $\pm$ 0.30	8.44 $\pm$ 0.24
Mann Whitney U-test	841.50**		
General management practices			
Low (<8)	13 (21.67)	38 (63.33)	51 (42.50)
Medium (8-14)	43 (71.67)	21 (35.00)	64 (53.33)
High (15-21)	4 (6.67)	1 (1.67)	5 (4.17)
Adoption Score	599 (49.92)	461 (38.42)	1060 (44.17)
Mean $\pm$ SE	9.98 $\pm$ 0.28	7.68 $\pm$ 0.30	8.83 $\pm$ 0.23
Mann Whitney U-test	791.00**		
Overall Adoption level			
Low (<34)	4 (6.67)	27 (45.00)	31 (25.83)
Medium (34-66)	54 (90.00)	32 (53.33)	86 (71.67)
High (66-100)	2 (3.33)	1 (1.67)	3 (2.50)
Adoption Score	3115 (51.92)	2216 (36.93)	5331 (44.43)
Mean $\pm$ SE	51.92 $\pm$ 0.72	36.93 $\pm$ 0.72	44.43 $\pm$ 0.85
Mann Whitney U-test	128.00**		

Figures in parenthesis indicate percentage, **Significant at 1% level ($p < 0.01$), SE- Standard Error

BF= Beneficiary Farmers, NBF= Non-beneficiary Farmers

Table 3: Adoption score of different subareas of breeding practices

Breeding practices	BF (n=60)								NBF (n=60)								Pooled (N=60)							
	Always / Complete				Occasional / Partial				Never				Always / Complete				Occasional / Partial				Never			
	f	%	f	%	f	%	AS	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	AS	%
Breeding time	13	21.67	36	60.00	11	18.33	62	51.67	6	10.00	36	60.00	18	30.00	48	40.00	19	15.83	72	60.00	29	24.17	110	45.83
Selection of high genetic merit ram	40	66.67	18	30.00	2	3.33	98	81.67	13	21.67	20	33.33	27	45.00	46	38.33	53	44.17	38	31.67	29	24.17	144	60.00
Control mating	4	6.67	24	40.00	32	53.33	32	26.67	0	0.00	36	60.00	24	40.00	36	30.00	4	3.33	60	50.00	56	46.67	68	28.33
Flushing ration	24	40.00	35	58.33	1	1.67	83	69.17	15	25.00	25	41.67	20	33.33	55	45.83	39	32.50	60	50.00	21	17.50	138	57.50
Care during pregnancy and after kidding	24	40.00	28	46.67	8	13.33	76	63.33	14	23.33	15	25.00	31	51.67	43	35.83	38	31.67	43	35.83	39	32.50	119	49.58
Heat detection or mating of sheep	20	33.33	32	53.33	8	13.33	72	60.00	0	0.00	42	70.00	18	30.00	42	35.00	20	16.67	74	61.67	26	21.67	114	47.50
Replacement or exchange the ram	18	30.00	34	56.67	8	13.33	70	58.33	18	30.00	26	43.33	16	26.67	62	51.67	36	30.00	60	50.00	24	20.00	132	55.00
Recommended ram and ewe's ratio	36	60.00	24	40.00	0	0.00	96	80.00	16	26.67	27	45.00	17	28.33	59	49.17	52	43.33	51	42.50	17	14.17	155	64.58
Practice of AI	0	0.00	0	0.00	60	100.00	0	0.00	0	0.00	0	0.00	60	100.00	0	0.00	0	0.00	0	0.00	120	100.00	0	0.00
Maintenance of pedigree records	0	0.00	31	51.67	29	48.33	31	25.83	0	0.00	24	40.00	36	60.00	24	20.00	0	0.00	55	45.83	65	54.17	55	22.92

f- Frequency, %- Percentage, BF- Beneficiary Farmers, NBF- Non-beneficiary Farmers, AS- Adoption Score

3.3 Housing Practices

The adoption of scientific housing practices was generally moderate among the respondents. Beneficiary farmers recorded higher adoption scores than non-beneficiary farmers for most housing-related practices. Among beneficiary farmers (Table 4), the highest adoption scores were observed for suitable flooring (75.00%), disposal of manure and fodder waste (70.00%), ventilation in the shed (59.17%), and proper location of the farm shed (58.33%). However, practices such as rearing sheep according to age and sex groups (27.50%) and provision of adequate floor space (47.50%) showed comparatively lower adoption. Among non-beneficiary farmers, suitable flooring (65.00%) and ventilation (41.67%) recorded relatively higher adoption levels. However, most housing practices exhibited lower adoption scores than those observed among beneficiary

farmers. The pooled analysis indicated that type of flooring (70.00%), disposal of manure and fodder waste (55.00%), and ventilation (50.42%) were relatively better adopted than other housing practices.

The distribution of respondents according to housing adoption levels (Table 2) revealed that 68.33 per cent of beneficiary farmers belonged to the medium adoption category, while 78.33 per cent of non-beneficiary farmers fell under the low adoption category. The mean adoption score was significantly higher among beneficiary farmers (10.92 ± 0.29) than non-beneficiary farmers (7.25 ± 0.23). The significant Mann–Whitney U value (336.00; $p < 0.01$) further indicated the effectiveness of beneficiary-oriented interventions in improving scientific housing management practices.

Table 4: Adoption score of different subareas of housing practices

Housing practices	BF (n=60)								NBF (n=60)								Pooled (N=60)							
	Always / Complete		Occasionally / Partial		Never		AS		Always / Complete		Occasionally / Partial		Never		AS		Always / Complete		Occasionally / Partial		Never		AS	
	f	%	f	%	f	%			f	%	f	%	f	%			f	%	f	%	f	%		
Orientation farm house	14	23.33	40	66.67	6	10.00	68	56.67	9	15.00	17	28.33	34	56.67	35	29.17	23	19.17	57	47.50	40	33.33	103	42.92
Location of your farm house/shed	12	20.00	46	76.67	2	3.33	70	58.33	5	8.33	24	40.00	31	51.67	34	28.33	17	14.17	70	58.33	33	27.50	104	43.33
Height of shed at the center	13	21.67	34	56.67	13	21.67	60	50.00	4	6.67	19	31.67	37	61.67	27	22.50	17	14.17	53	44.17	50	41.67	87	36.25
Ventilation in the shed	17	28.33	37	61.67	6	10.00	71	59.17	12	20.00	26	43.33	22	36.67	50	41.67	29	24.17	63	52.50	28	23.33	121	50.42
Type of flooring	36	60.00	18	30.00	6	10.00	90	75.00	33	55.00	12	20.00	15	25.00	78	65.00	69	57.50	30	25.00	21	17.50	168	70.00
Required floor space	12	20.00	33	55.00	15	25.00	57	47.50	1	1.67	31	51.67	28	46.67	33	27.50	13	10.83	64	53.33	43	35.83	90	37.50
Cleaning of shed	15	25.00	39	65.00	6	10.00	69	57.50	9	15.00	29	48.33	22	36.67	47	39.17	24	20.00	68	56.67	28	23.33	116	48.33
Location of shelter apart from your home	14	23.33	25	41.67	21	35.00	53	44.17	12	20.00	31	51.67	17	28.33	55	45.83	26	21.67	56	46.67	38	31.67	108	45.00
Rearing as per age group and sex	4	6.67	25	41.67	31	51.67	33	27.50	2	3.33	24	40.00	34	56.67	28	23.33	6	5.00	49	40.83	65	54.17	61	25.42
Disposal of manure and fodder waste	24	40.00	36	60.00	0	0.00	84	70.00	7	11.67	34	56.67	19	31.67	48	40.00	31	25.83	70	58.33	19	15.83	132	55.00

f- Frequency, %- Percentage, BF- Beneficiary Farmers, NBF- Non-beneficiary Farmers, AS- Adoption Score

3.4 Healthcare Practices

The findings regarding healthcare practices (Table 5) revealed moderate adoption among both groups, with beneficiary farmers demonstrating relatively higher adoption. Among beneficiary farmers, the highest adoption scores were observed for vaccination of lambs (71.67%), disposal of dead stock (71.67%), deworming (70.00%), and ligation and disinfection of the naval cord (61.67%). Moderate adoption was recorded for regular observation of animal health (55.00%) and treatment of diseased animals (55.00%).

The adoption of quarantine (15.00%), footbath at the entrance of the yard (9.17%), and dipping practices (20.83%) was relatively poor among beneficiary farmers. Similar trends were observed among non-beneficiary

farmers, with particularly low adoption of footbath practices and dipping. The pooled data showed that deworming (61.25%), vaccination (58.33%), disposal of dead stock (57.50%), and treatment of diseased animals (53.75%) were the most commonly adopted healthcare practices.

The distribution pattern (Table 2) revealed that 78.33 per cent of beneficiary farmers belonged to the medium adoption category, whereas 71.67 per cent of non-beneficiary farmers were classified under the low adoption category. The mean adoption score was significantly higher among beneficiary farmers (9.65 ± 0.29) than non-beneficiary farmers (7.23 ± 0.30). The significant Mann–Whitney U value (841.50; $p < 0.01$) indicated a substantial difference in healthcare adoption between the two groups.

Table 5: Adoption score of different subareas of healthcare practices

Health care practices	BF (n=60)								NBF (n=60)								Pooled (N=60)							
	Always / Complete		Occasionally / Partial		Never		AS		Always / Complete		Occasionally / Partial		Never		AS		Always / Complete		Occasionally / Partial		Never		AS	
	f	%	f	%	f	%			f	%	f	%	f	%			f	%	f	%	f	%		
Isolation of diseased/ sick animal	16	26.67	31	51.67	13	21.67	63	52.50	12	20.00	33	55.00	15	25.00	57	47.50	28	23.33	64	53.33	28	23.33	120	50.00
Observation of health of animals regularly	13	21.67	40	66.67	7	11.67	66	55.00	13	21.67	32	53.33	15	25.00	58	48.33	26	21.67	72	60.00	22	18.33	124	51.67
Vaccination of the lambs	29	48.33	28	46.67	3	5.00	86	71.67	6	10.00	42	70.00	2	3.33	45	37.50	35	29.17	70	58.33	15	12.50	140	58.33
Treatment of diseased animal	20	33.33	26	43.33	14	23.33	66	55.00	16	26.67	31	51.67	13	21.67	63	52.50	36	30.00	57	47.50	27	22.50	129	53.75
Disposal the dead stock	31	51.67	24	40.00	5	8.33	86	71.67	17	28.33	18	30.00	25	41.67	52	43.33	48	40.00	42	35.00	30	25.00	138	57.50
Practice of dipping	1	1.67	23	38.33	36	60.00	25	20.83	1	1.67	11	18.33	48	80.00	13	10.83	2	1.67	34	28.33	84	70.00	38	15.83
Deworming	28	46.67	28	46.67	4	6.67	84	70.00	17	28.33	29	48.33	1	1.67	52	43.33	45	37.50	57	47.50	18	15.00	147	61.25
Quarantine	3	5.00	12	20.00	45	75.00	18	15.00	5	8.33	19	31.67	36	60.00	29	24.17	8	6.67	31	25.83	81	67.50	47	19.58
Footbath at the entrance to the yard	1	1.67	9	15.00	50	83.33	11	9.17	0	0.00	0	0.00	60	100.00	0	0.00	1	0.83	9	7.50	110	91.67	11	4.58
Ligation of and disinfection of naval cord	21	35.00	32	53.33	7	11.67	74	61.67	8	13.33	29	48.33	2	3.33	45	37.50	29	24.17	61	50.83	30	25.00	119	49.58

f- Frequency, %- Percentage, BF- Beneficiary Farmers, NBF- Non-beneficiary Farmers, AS- Adoption Score

3.5 General Management Practices

The results relating to general management practices (Table 6) showed that beneficiary farmers had higher adoption levels than non-beneficiary farmers. Among beneficiary farmers, the use of chaff cutters (91.67%) recorded the highest adoption score, followed by shearing of sheep (86.67%) and provision of balanced diet to rams (75.00%). Moderate adoption was observed for separation of old rams (50.00%) and regular hoof trimming (45.83%).

The adoption of productive and reproductive record keeping (16.67%), routine cleaning of water troughs (18.33%), and animal identification (33.33%) was relatively poor among beneficiary farmers. Similar trends were observed among non-beneficiary farmers, where shearing (66.67%) and use of chaff cutters (58.33%) were the most commonly adopted practices. The pooled analysis revealed that chaff cutter use

(75.00%), shearing (76.67%), and balanced feeding of breeding rams (57.92%) were relatively well adopted compared to other management practices.

The adoption-level distribution (Table 2) indicated that 71.67 per cent of beneficiary farmers belonged to the medium adoption category, whereas 63.33 per cent of non-beneficiary farmers were classified under the low adoption category. The mean adoption score of beneficiary farmers (9.98 ± 0.28) was significantly higher than that of non-beneficiary farmers (7.68 ± 0.30). The Mann-Whitney U-test value (791.00; $p < 0.01$) confirmed a significant difference between the two groups. These findings indicate that extension interventions have played a significant role in improving the adoption of scientific management practices among beneficiary sheep farmers.

Table 6: Adoption score of different subareas of general management practices

General management practices	BF (n=60)								NBF (n=60)								Pooled (N=60)							
	Always / Complete		Occasionally / Partial		Never		AS		Always / Complete		Occasionally / Partial		Never		AS		Always / Complete		Occasionally / Partial		Never		AS	
	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%	f	%
Shearing of sheep	46	76.67	12	20.00	2	3.33	1	1.67	24	40.00	32	53.33	4	6.67	8	13.33	70	58.33	44	36.67	6	5.00	1	1.67
Castration of male	8	13.33	35	58.33	1	1.67	5	8.33	6	10.00	22	36.67	3	5.00	3	5.00	14	11.67	57	47.50	4	4.00	8	13.33
Regular hoof trimming	9	15.00	37	61.67	1	1.67	5	8.33	7	11.67	13	21.67	4	6.67	2	3.33	16	13.33	50	41.67	5	4.00	8	13.33
Productive and reproductive records	2	3.33	16	26.67	4	6.67	2	3.33	1	1.67	17	28.33	4	6.67	1	1.67	3	2.50	33	27.50	8	7.00	3	5.00
Practice of identification	4	6.67	32	53.33	2	3.33	4	6.67	6	10.00	30	50.00	2	3.33	4	6.67	10	8.33	62	51.67	4	4.00	8	13.33
Use of chaff cutter to cut the fodder	50	83.33	10	16.67	0	0.00	1	1.67	16	26.67	38	63.33	6	10.00	7	11.67	66	55.00	48	40.00	6	5.00	1	1.67
Separation of old rams	12	20.00	36	60.00	1	1.67	6	10.00	12	20.00	33	55.00	1	1.67	5	8.33	24	20.00	69	57.50	2	2.00	1	1.67
Balance diet for ram	31	51.67	28	46.67	1	1.67	9	15.00	6	10.00	37	61.67	1	1.67	4	6.67	37	30.83	65	54.17	1	1.67	3	5.00
Provision of clean/fresh water	8	13.33	31	51.67	2	3.33	4	6.67	9	15.00	17	28.33	3	5.00	3	5.00	17	14.17	48	40.00	5	4.00	8	13.33
Cleaning of water trough routinely	5	8.33	12	20.00	4	6.67	2	3.33	6	10.00	36	60.00	1	1.67	4	6.67	11	9.17	48	40.00	6	5.00	7	11.67

f- Frequency, %- Percentage, BF- Beneficiary Farmers, NBF- Non-beneficiary Farmers, AS- Adoption Score

4. Discussion

The present study demonstrated a significantly higher level of adoption of scientific sheep husbandry practices among beneficiary farmers compared with non-beneficiary farmers. Beneficiary farmers recorded a higher overall adoption score and a greater proportion of respondents in the medium and high adoption categories, whereas the majority of non-beneficiary farmers were concentrated in the low adoption category. These findings indicate that participation in the Farmer FIRST Programme positively influenced farmers' adoption behaviour and facilitated the uptake of scientific sheep husbandry practices.

The observed differences may be attributed to the integrated nature of the Farmer FIRST Programme, which combines technology dissemination with capacity building, farmer–scientist interaction, exposure visits, demonstrations, and continuous technical backstopping. Such interventions reduce information asymmetry, improve farmers' understanding of recommended practices, and increase their confidence in adopting innovations. Similar findings were reported by Bihari *et al.* (2020) ^[3], who observed that participation in the Farmer FIRST Project significantly enhanced farmers' awareness, decision-making behaviour, marketing behaviour, crop productivity, income, and employment opportunities compared to non-beneficiary farmers. The authors concluded that continuous scientist–farmer interaction and extension support played a crucial role in improving farmers' livelihood outcomes. Previous studies (Verma *et al.*, 2026b) ^[12] have also shown that extension support, training, and access to information are

among the most important determinants of livestock technology adoption. Farmers who regularly interact with extension personnel and participate in training programmes are more likely to adopt improved management practices than those with limited institutional exposure.

The findings are also consistent with the theoretical propositions of the Diffusion of Innovations framework developed by Rogers. According to the theory, adoption is influenced by communication channels, social interactions, observability of benefits, and perceived relative advantage of an innovation. Innovations that provide visible economic returns and are compatible with existing production systems are generally adopted more rapidly than complex practices requiring substantial behavioural or infrastructural change.

An important pattern emerging from the study was the differential adoption across practice categories. Beneficiary farmers exhibited relatively high adoption of practices such as timely colostrum feeding, vaccination, deworming, mineral supplementation, selection of superior breeding rams, shearing, and use of chaff cutters. These practices provide immediate and observable benefits in terms of animal survival, health, feed utilization, growth, and productivity. Similar improvements in livestock productivity and farm performance associated with the adoption of improved management practices have been reported among sheep and goat farmers by Ajala *et al.* (2025) ^[1]. Studies conducted in European sheep production systems have also highlighted that the application of best management practices and innovations contributes to enhanced farm efficiency and productivity (Theodoridis *et*

al., 2021; Theodoridis *et al.*, 2022)^[8,9].

Conversely, comparatively low adoption was observed for practices such as fodder conservation, rotational grazing, pedigree record maintenance, quarantine, footbath management, and artificial insemination. These technologies generally require additional investment, technical expertise, labour, infrastructure, or long-term planning. The lower adoption of such practices may be attributed to resource limitations and management complexities faced by farmers. Similar constraints have been documented in sheep production systems where feed shortages, disease challenges, management requirements, and limited resources influenced the implementation of improved husbandry practices (Kenfo *et al.*, 2018)^[5]. Likewise, Aouina *et al.* (2025)^[2] emphasized that variations in sheep farming systems are strongly influenced by socio-economic conditions, resource availability, and management capacity, which ultimately affect the adoption of recommended practices.

The complete absence of artificial insemination adoption among both beneficiary and non-beneficiary farmers deserves particular attention. This finding suggests that technological availability alone is insufficient to ensure adoption. Accessibility of breeding services, technical competency, infrastructure, and farmer awareness are equally important. Similar observations have been reported in livestock development studies where adoption of advanced reproductive technologies remained constrained despite awareness of their potential benefits (Yadav *et al.*, 2026)^[13].

The significant differences observed between beneficiary and non-beneficiary farmers further highlight the role of participatory extension approaches in promoting behavioural change. Contemporary livestock extension literature increasingly emphasizes that technology transfer should move beyond the traditional top-down model and focus on knowledge sharing, co-learning, and farmer participation. Farmer-centric programmes strengthen social learning processes and facilitate the adaptation of technologies to local production environments, thereby improving adoption outcomes.

From a policy perspective, the findings suggest that improving adoption of scientific sheep husbandry practices requires a combination of technological interventions and institutional support mechanisms. While the introduction of improved germplasm can enhance genetic potential, sustained improvements in productivity (Verma *et al.*, 2026a) depend on farmers' adoption of complementary management practices related to feeding, breeding, housing, healthcare, and general flock management. Therefore, future livestock development programmes should prioritize regular training, field demonstrations, advisory services, and farmer–scientist interactions to enhance adoption and ensure long-term sustainability of interventions.

5. Conclusion

The study revealed that beneficiary sheep farmers under the Farmer FIRST Programme exhibited significantly higher adoption of scientific sheep husbandry practices than non-beneficiary farmers. Higher adoption was observed in feeding, breeding, housing, healthcare, and general management practices, reflecting the positive impact of

programme interventions such as training, demonstrations, farmer–scientist interactions, and dissemination of improved germplasm. Practices providing immediate economic and productive benefits showed greater adoption, whereas technically complex practices recorded lower adoption levels. The findings highlight the effectiveness of participatory extension approaches in enhancing technology adoption and emphasize the need for continued capacity building and extension support to improve sheep productivity and livelihoods.

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