

Construction and standardization of knowledge test for assessing scientific sheep farming practices

H. Verma^{1*}, M. Singh¹, Shruti¹, M. Chander¹, H. R. Meena¹, V. Saran¹ and S. Prabex¹

¹Division of Extension Education, ICAR- Indian Veterinary Research Institute, Bareilly- 243 122, Uttar Pradesh, India

Abstract

This study focuses on the construction and standardization of a knowledge test regarding scientific sheep farming practices in northern plains and hills zone of India. The test aims to evaluate farmers' knowledge across key areas viz. feeding, breeding, housing, health care, and other managerial practices. Initially, 80 items were collected, among which 66 were selected according to standard criteria. After relevancy testing, 50 items were found to be most relevant by the experts. In item analysis, 40 items lie between the difficulty index range of 20 to 80 and the discrimination index range of 0.20 to 0.70. The reliability test was done using the Spearman-Brown formula (0.87) and Cronbach's alpha formula (0.83), and also the content validity (S-CVI) worked out as 0.91. Hence, a standardized knowledge test was developed consisting of 40 items, which can be used by researchers and academicians to assess the knowledge of farmers towards scientific sheep husbandry. This test is suitable for assessing the knowledge level of the stakeholders about sheep farming practices, and awareness and training programs can be planned accordingly.

Keywords: Cronbach's alpha, Difficulty index, Discrimination index, Relevancy testing, Split-half reliability

Highlights

- The respondents' potential knowledge scores on scientific sheep farming range from 0 to 40.
- The reliability coefficient of the complete test was 0.87, which is deemed highly reliable.

INTRODUCTION

Small ruminant farming is frequently associated with crop production, mainly because of its buffer function for crop failure and crop surpluses (Slingerland, 2000) and as a provider of manure (Johnson, 1984). Small ruminants have unique benefits over big ruminants, such as greater production efficiency, better marketability and reduced risks, more environmental adaptation, and fewer absolute feed needs per animal (Peters, 1988). The contribution of the agriculture sector to national GDP is 20.20 percent (2020–21), and the share of livestock in agricultural GDP is 30.87 percent, wherein small ruminants account for around 10 percent of the livestock sector's overall worth. At the national level, small ruminants account for 29.96 percent of the meat output and 2.93 percent of the milk output in the country (BAHS, 2022). Sheep husbandry is an integral component of agriculture, providing essential resources such as wool, meat, and milk while contributing to rural economies worldwide. In recent years, advancements in scientific knowledge and technology have revolutionized the sheep farming industry, offering opportunities to enhance

productivity, improve animal welfare, and mitigate environmental impact. As a result, several techniques have been developed to increase the efficiency of producing meat, with the selection of animals being dependent on the rate of growth and feed use efficiency of the animals (Ghafouri-Kesbi *et al.*, 2011). The faster growth rate is an important component of flock productivity and also a serious limiting factor in improving the productivity of indigenous breeds of sheep. Almhdhy and Metawi (2000) show that economic efficiency expressed as the yearly net income per ewe is significantly correlated to the ewe body weight and the age of marketing of lambs. However, the successful implementation of scientific principles and techniques in sheep husbandry depends on farmers' knowledge and proficiency in applying these practices. The standardized knowledge test will help in assessing the effectiveness of training in sheep husbandry through pre- and post-administration of knowledge tests, which will help in determining the knowledge level of farmers. Therefore, there is a pressing need to develop a comprehensive knowledge test specifically tailored to scientific sheep farming practices. Hence, the test was

*Corresponding Author, E-mail: harideep0507@gmail.com

carefully designed, considering various aspects of sheep husbandry viz. feeding, breeding, housing, health care, and general managerial practices.

MATERIALS AND METHODS

Collection and edition of items: A comprehensive review of literature was conducted to identify the core areas of scientific sheep farming practices, and the items were collected from various sources, including books, field extension workers, experts in the area, scientists, professional associates, and the researcher's personal experience with scientific sheep farming. Initially,

80 items were collected, among which 66 were selected according to criteria given by Edwards (1957), encompassing various aspects of scientific sheep husbandry standards.

RESULTS

The relevancy testing of items was done by the method described below, and items with a mean relevancy score of 2.44 or higher and a relevancy weightage greater than 0.80 were retained for item analysis (Table 1). In this way, a total 50 items were found to be most relevant by the experts and selected

Table 1. Items with relevancy weightage and mean relevancy score

Sl. No.	Items	RW	MRS	Remarks
A. Feeding Practices				
1.	Are you aware that concentrate rations are required at all stages of sheep production, apart from pasture grazing?	0.89	2.67	Retained
2.	Do you know that colostrum should be given to newborns within one hour?	0.92	2.76	Retained
3.	Do you know that common salt supplementation is necessary for your animals?	0.90	2.70	Retained
4.	Ewes should be provided an extra concentrate ration during pregnancy and lactation.	0.91	2.73	Retained
5.	Are you aware that the lambs should be allowed to graze separately from adults?	0.78	2.35	Eliminated
6.	The total dry matter requirement of sheep is around 2-3% of their body weight.	0.84	2.52	Retained
7.	The optimal grazing duration for sheep is 7-9 hours.	0.83	2.50	Retained
8.	Do you know some forages make sheep more prone to bloating?	0.86	2.58	Retained
9.	Do you know the age of lamb at which green fodder is given?	0.85	2.55	Retained
10.	Do you know the feeding behaviour of sheep?	0.764	2.29	Eliminated
11.	Do you know the age of the lamb up to which milk is being fed to it?	0.89	2.67	Retained
12.	Do you know that feeding concentrate, grains, or lush pasture to ewes prior to the onset of breeding would increase the number of twins or triplets?	0.79	2.38	Eliminated
13.	Do you know that feeding creep ration is required for proper lamb growth?	0.84	2.52	Retained
B. Breeding Practices				
14.	Are you aware that conception in ewes is most successful when breeding occurs in the late heat period?	0.87	2.61	Retained
15.	The initial breeding age for male sheep is 12 months.	0.85	2.55	Retained
16.	What is the average duration of the estrous cycle in sheep?	0.85	2.55	Retained
17.	Do you know the age of first heat in ewes?	0.86	2.58	
18.	Do you know how many days after lambing, ewes usually come to heat?	0.78	2.35	Eliminated
19.	The average length of pregnancy in sheep is 151 days.	0.91	2.73	Retained
20.	Do you know that maintaining a pedigree record for animals is essential?	0.85	2.55	Retained

Cont. Table 1.

Table 1., Cont. ...

Sl. No.	Items	RW	MRS	Remarks
21.	Do you know sheep are short-day breeders, and they become sexually active with a decrease in day length?	0.79	2.38	Eliminated
22.	Do you know that the recommended ram and ewe ratio in the flock should be 1:40?	0.87	2.61	Retained
23.	Do you know that in the flock, the males should be replaced or exchanged once every two years to avoid inbreeding?	0.86	2.58	Retained
24.	Do you know ewes generally do not show visible signs of estrous if ram is not present?	0.86	2.58	Retained
25.	Do you know that breeding too young ewes results in more weaklings and thus, higher lamb loss?	0.75	2.24	Eliminated
26.	Do you know teaser ram detects the ewes in heat?	0.83	2.50	
27.	Do you know that AI is also available for inseminating ewes?	0.75	2.26	Eliminated
C. Housing Practices				
28.	Do you know the North-South orientation of the shed causes greater stress on the animals because the sunlight falling on the shed lasts longer in a hot, arid climate?	0.85	2.55	Retained
29.	Do you know that the orientation of the farmhouse should be east-west?	0.79	2.38	Eliminated
30.	The height of the shed at the center should be 3–3.5 m.	0.82	2.47	Retained
31.	The mud-type floor is most suitable for sheep.	0.81	2.44	Retained
32.	Do you know that floor space for sheep should be slightly larger in hot weather conditions in comparison to cool weather?	0.82	2.47	Retained
33.	Do you know what kinds of roofing options are available for sheep houses?	0.78	2.35	Eliminated
34.	Do you know the average floor space required for sheep?	0.85	2.55	Retained
35.	Do you know any cleaning agents for animal houses?	0.90	2.70	Retained
36.	Do you know proper ventilation is required to reduce the risk of airborne disease?	0.86	2.58	Retained
37.	Do you know the weaning age of the lamb?	0.83	2.50	Retained
38.	Do you know that grouping sheep of different ages is necessary for proper management?	0.75	2.24	Eliminated
39.	Do you know that lambing ewes should be separated (1-2 weeks before) from the rest of the flock?	0.87	2.61	Retained
40.	Are you aware of sheep culling practices?	0.85	2.55	Retained
D. Health-Care Practices				
41.	Are you aware that a foot bath is required at the entrance of the farm?	0.88	2.64	Retained
42.	Are you aware of the practice of naval cord ligation and disinfection after the birth of a lamb?	0.90	2.70	Retained
43.	Do you know about the use of dipping in sheep to prevent ectoparasitic infestation?	0.90	2.70	Retained
44.	Do you know the initial deworming age of sheep?	0.78	2.35	Eliminated
45.	Are you aware of isolation of sick animals from healthy ones?	0.84	2.52	Retained
46.	Are you aware of the deworming schedule for sheep?	0.88	2.64	Retained
47.	Do you know important symptoms of the PPR in sheep?	0.89	2.67	Retained
48.	Do you know about quarantine before introducing new animals into the herd?	0.85	2.55	Retained

Cont. Table 1.

Table 1., Cont. ...

Sl. No.	Items	RW	MRS	Remarks
49.	Do you know the age at which the ET vaccine should be given to sheep?	0.79	2.38	Eliminated
50.	Do you know the important symptoms of ET in sheep?	0.87	2.61	Retained
51.	Are you aware of the vaccination schedule for sheep?	0.92	2.76	Retained
52.	Do you know that overgrown wool must be sheared to prevent flea, tick, and lice infestations?	0.83	2.50	Retained
53.	Do you know about the feeding of sheep in diseased conditions?	0.77	2.32	Eliminated
E. General Management Practices				
54.	Are you aware of the conservation of fodder in the form of silage or hay for the lean period?	0.91	2.73	Retained
55.	Do you know about rotational grazing?	0.85	2.55	Retained
56.	Do you know how to prepare artificial colostrum in case natural colostrum is not available?	0.85	2.55	Retained
57.	Do you know about the preparation of milk replacer for lamb feeding?	0.83	2.50	Retained
58.	Are you aware that sheep should not be grazed in the early morning and late evening?	0.79	2.38	Eliminated
59.	Do you know the proper method of disposing of dead stock?	0.85	2.55	Retained
60.	Are you aware that hoof problems are very common in sheep, especially during the rainy season?	0.84	2.52	Retained
61.	Do you know about the scientific means of pregnancy diagnosis in ewes?	0.70	2.18	Eliminated
62.	The age of castration in sheep is 6 months.	0.88	2.64	Retained
63.	Best method of identification of sheep is Ear Tagging?	0.90	2.70	Retained
64.	The normal body temperature of sheep is 102.4°F.	0.89	2.67	Retained
65.	Do you know about pen mating?	0.76	2.29	Eliminated
66.	Do you know that maintaining necessary records is essential to ensuring the scientific means of sheep farming?	0.87	2.61	Retained

Table 2. List of knowledge test items with their difficulty and discrimination indices

Sl. No.	Items	Difficulty index	Discrimination index	Remarks
A. Feeding Practices				
1.	Are you aware that concentrate rations are required at all stages of sheep production, apart from pasture grazing?	0.77	0.2	Retained
2.	Do you know that colostrum should be given to newborns within one hour?	0.77	0.3	Retained
3.	Do you know that common salt supplementation is necessary for your animals?	0.87	0.4	Retained
4.	Ewes should be provided an extra concentrate ration during pregnancy and lactation.	0.73	0.4	Retained
5.	The total dry matter requirement of sheep is around 2-3% of their body weight.	0.80	0.5	Retained
6.	The optimal grazing duration for sheep is 7-9 hours.	0.60	0.3	Retained
7.	Do you know some forages make sheep more prone to bloating?	0.50	0.7	Retained
8.	Do you know the age of lamb at which green fodder is given?	0.93	0.2	Eliminated
9.	Do you know the age of the lamb up to which milk is being fed to it?	0.27	0.1	Eliminated
10.	Do you know that feeding creep ration is required for proper lamb growth?	0.70	0.5	Retained

Cont. Table 2.

Table 2., Cont. ...

Sl. No.	Items	Difficulty index	Discrimination index	Remarks
B. Breeding Practices				
11.	Are you aware that conception in ewes is most successful when breeding occurs in the late heat period?	0.77	0.4	Retained
12.	The initial breeding age for male sheep is 12 months.	0.67	0.5	Retained
13.	What is the average duration of the estrous cycle in sheep?	0.93	0.1	Eliminated
14.	Do you know the age of first heat in ewes?	0.87	0.3	Retained
15.	The average length of pregnancy in sheep is 151 days.	0.70	0.3	Retained
16.	Do you know that maintaining a pedigree record for animals is essential?	0.63	0.3	Retained
17.	Do you know that the recommended ram and ewe ratio in the flock should be 1:40?	0.47	0.2	Retained
18.	Do you know that in the flock, the males should be replaced or exchanged once every two years to avoid inbreeding?	0.67	0.3	Retained
19.	Do you know ewes generally do not show visible signs of estrous if ram is not present?	0.70	0.4	Retained
20.	Do you know teaser ram detects the ewes in heat?	0.93	0.1	Eliminated
C. Housing Practices				
21.	Do you know the North-South orientation of the shed causes greater stress on the animals because the sunlight falling on the shed lasts longer in a hot, arid climate?	0.50	0.4	Retained
22.	The height of the shed at the center should be 3–3.5 m.	0.57	0.6	Retained
23.	The mud-type floor is most suitable for sheep.	0.73	0.3	Retained
24.	Do you know that floor space for sheep should be slightly larger in hot weather conditions in comparison to cool weather?	0.73	0.2	Retained
25.	Do you know the average floor space required for sheep?	0.93	0.0	Eliminated
26.	Do you know any cleaning agents for animal houses?	0.87	0.3	Retained
27.	Do you know proper ventilation is required to reduce the risk of airborne disease?	0.70	0.2	Retained
28.	Do you know the weaning age of the lamb?	0.40	0.2	Retained
29.	Do you know that lambing ewes should be separated (1-2 weeks before) from the rest of the flock?	0.77	0.1	Eliminated
30.	Are you aware of sheep culling practices?	0.27	0.3	Retained
D. Health-Care Practices				
31.	Are you aware that a foot bath is required at the entrance of the farm?	0.50	0.5	Retained
32.	Are you aware of the practice of naval cord ligation and disinfection after the birth of a lamb?	0.43	0.5	Retained
33.	Do you know about the use of dipping in sheep to prevent ectoparasitic infestation?	0.93	0.2	Eliminated
34.	Are you aware of isolation of sick animals from healthy ones?	0.73	0.2	Retained
35.	Are you aware of the deworming schedule for sheep?	0.73	0.3	Retained
36.	Do you know important symptoms of the PPR in sheep?	0.73	0.3	Retained
37.	Do you know about quarantine before introducing new animals into the herd?	0.53	0.5	Retained
38.	Do you know the important symptoms of ET in sheep?	0.97	0.1	Eliminated
39.	Are you aware of the vaccination schedule for sheep?	0.87	0.2	Retained
40.	Do you know that overgrown wool must be sheared to prevent flea, tick, and lice infestations?	0.80	0.3	Retained

Cont. Table 2.

Table 2., Cont. ...

Sl. No.	Items	Difficulty index	Discrimination index	Remarks
E.	General Management Practices			
41.	Are you aware of the conservation of fodder in the form of silage or hay for the lean period?	0.50	0.5	Retained
42.	Do you know about rotational grazing?	0.37	0.6	Retained
43.	Do you know how to prepare artificial colostrum in case natural colostrum is not available?	0.67	0.1	Eliminated
44.	Do you know about the preparation of milk replacer for lamb feeding?	0.67	0.6	Retained
45.	Do you know the proper method of disposing of dead stock?	0.67	0.2	Retained
46.	Are you aware that hoof problems are very common in sheep, especially during the rainy season?	0.67	0.3	Retained
47.	The age of castration in sheep is 6 months.	0.53	0.4	Retained
48.	Best method of identification of sheep is Ear Tagging?	0.47	0.4	Retained
49.	The normal body temperature of sheep is 102.4°F.	0.80	0.3	Retained
50.	Do you know that maintaining necessary records is essential to ensuring the scientific means of sheep farming?	0.93	0.2	Eliminated

for further analysis. In item analysis difficulty and discrimination index are crucial for evaluating the quality of items in knowledge test. The item difficulty and discrimination indices for all 50 items were determined; 40 items with a difficulty index between 0.20 and 0.80 and a discrimination index ranging from 0.20 to 0.70 were included in the final knowledge test. Table 2 reveals that items number 8, 33, and 50 were eliminated based on difficulty index, items number 9, 29, and 43 were eliminated due to discrimination index, and items number 13, 20, 25, and 38 were eliminated based on both indices. Thus, final knowledge test retained only 40 of the 66 initially selected items. Therefore, the overall possible knowledge score of the individual respondent towards scientific sheep farming practices ranges from 0 to 40. The high score of the tests will represent the farmer's higher knowledge of scientific sheep farming practices. The reliability coefficient of the complete test was calculated to be 0.87, which is deemed highly reliable due to its reliability coefficient above 0.70. The overall content validity (S-CVI) of the test was calculated to be 0.91, which falls under the excellent content validity criteria.

DISCUSSION

Relevancy testing of items: Relevance pertains to the degree to which the test items accurately measure the specific knowledge, ensuring they are appropriate and meaningful within the context of the test's objectives. After editing, 66 selected items were sent to various (50) experts from veterinary universities, deemed institutes, and state agricultural universities through a

Google Form survey via email and WhatsApp for relevancy testing to screen out non-relevant and weak statements. The responses were received from 34 experts with scores of 3, 2, and 1 for most relevant, relevant, and not relevant items, respectively (Subrahmanyeswari and Chander 2008). Following that, relevancy weightage (RW) and mean relevance score (MRS) were calculated (Table 1) for each of the selected items using the following formula:

Relevancy Weightage =

$$\frac{(\text{Most relevant} \times 3) + (\text{Relevant} \times 2) + (\text{Not relevant} \times 1)}{\text{Maximum possible score}}$$

Mean Relevancy Score =

$$\frac{(\text{Most relevant} \times 3) + (\text{Relevant} \times 2) + (\text{Not relevant} \times 1)}{\text{Number of judges responded}}$$

Finally, items with a mean relevancy score of 2.44 or higher and a relevancy weightage greater than 0.80 were retained for item analysis. In this way, a total 50 items were found to be most relevant by the experts and selected for further analysis.

Item analysis: After relevancy testing, the 50 items were retained and administered randomly to 30 sheep farmers from non-sample areas for item analysis. Respondents were asked to indicate their responses to each item in the test, and replies were scored as one (1)

for accurate and zero (0) for wrong or unknown answers. Thus, the total knowledge score obtained by farmers ranges from 0 to 50. And accordingly, the difficulty and discrimination indices were calculated.

Difficulty index: The difficulty index is a measure used in educational assessment to determine how easy or difficult an item is for a respondent. It is typically calculated as the proportion of respondents who answer the item correctly. The formula for calculating the difficulty index is:

Difficulty Index (P) =

$$\frac{\text{Number of Correct Responses (R)}}{\text{Total Number of Responses (T)}}$$

Difficulty index values range from 0 to 1, where 0 indicates that no one answered the item correctly and 1 indicates that everyone answered the item correctly. The higher the value, the easier is the item. Items with difficulty index values around 0.5 are considered to be appropriately balanced in terms of difficulty, meaning they are neither too easy nor too difficult for the intended population of respondents. If the P-value is multiplied by 100, then the P-value is the percentage of respondents who got the correct answers. Items with P-value between 20 and 90 percent are considered good and acceptable (Shruti *et al.*, 2022).

Discrimination index: Discrimination index indicates how effectively an item can distinguish between high and low performers on the overall test. It is typically calculated by comparing the performance of the upper and lower groups of respondents. The scores obtained by the respondents were arranged in descending order and were divided into six equal groups, each consisting of five respondents. These groups were named G1, G2, G3, G4, G5, and G6, respectively. To calculate the discrimination index, the middle two groups (G3 and G4) were excluded (Johnson *et al.*, 2023). Only the four groups with high and low scores were used to calculate the item discrimination index. It was calculated by the following formula:

$$E^{1/3} = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/3}$$

Where,

$E^{1/3}$ = Discrimination index of an item

S_1, S_2, S_5 and S_6 = Frequencies of correct answers in G1, G2, G5 and G6 groups, respectively

N = Total number of sheep farmers in the sample of

item analysis

A high discrimination index indicates that the item effectively separates the high and low performers, while a low discrimination index suggests that the item may not be differentiating well between these groups. Items that were accurately answered by everyone or not answered by anybody in the sample had no discriminatory value. The items with a discrimination index of 0.20 to 0.70 were retained for calculating reliability and validity.

Reliability of test: The reliability of a knowledge test refers to the consistency and stability of the test scores over time and across different administrations. In other words, it is the precision or accuracy of the measurement or score. Using the split-half method, test reliability was assessed, in which the 40 test items were divided into two halves depending on the even and odd number of items (Vijayan *et al.*, 2023). This split-half test was administered to a new group of 30 farmers from outside the locale of data collection. After obtaining the scores, the two sets were correlated using correlation (r) between forms and found to be 0.77 at the 1% level of significance. This product-moment correlation coefficient acts as the reliability coefficient for half of the tests. The Spearman-Brown prophecy formula was used to obtain the full-length reliability coefficient, and the correction factors are as follows:

$$R = \frac{2r}{1+r} = \frac{2 \times 0.77}{1+0.77} = 0.87$$

Where,

R = Reliability coefficient of complete test

r = Reliability coefficient of half test

The reliability coefficient of the complete test was calculated to be 0.87, deemed highly reliable due to its reliability coefficient above 0.70. The Cronbach's alpha helps to evaluate the consistency of responses across different items in the test and was computed by the formula:

$$\alpha_{\text{standardized}} = \frac{K\bar{r}}{[1 + (K-1)\bar{r}]}$$

Where,

K = Number of items in scale

$\bar{r}$ = Is mean of the $K(K-1)/2$ non-redundant correlation coefficients

The Cronbach's alpha was computed to be 0.83, indicating better measurement consistency. The general rule of thumb is that a Cronbach's alpha of

0.70 and above is good, 0.80 and above is better, and 0.90 and above is best (Kumar *et al.*, 2021). A high alpha value indicates that the items in the test are measuring the same underlying construct or content domain consistently. If the alpha value is low, it suggests that the items may not be sufficiently related to each other, and further examination or revision of the test items may be needed.

Validity of test: The test's validity refers to the extent to which it measures what it is intended to measure (Kerlinger, 1987). In other words, it assesses whether the test accurately captures the knowledge, skills, or abilities that it claims to evaluate. Content validity assesses the extent to which the test adequately covers the content or subject matter it is intended to measure

(Subrahmanyeswari and Chander, 2008). This involves ensuring that the test items represent the breadth and depth of the content domain and they are relevant to the learning objectives. This is typically established through expert review and alignment with established curriculum standards. In the present study, content validity was used, in which items were sent to a panel of six experts and rated on a four-point continuum: 1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, and 4 = highly relevant. The content validity index (I-CVI) of each item was computed (Table 3). The overall content validity (S-CVI), which means the average of the I-CVIs for all the items was calculated as 0.91. Thus, 91 per cent of items were judged content validity as per the Lynn's criteria for excellent content validity. A similar method was used by Shruti *et al.* (2022).

Table 3. List of knowledge test items for assessing scientific sheep farming practices with their respective 'I-CVI'

Sl.No.	Items	Agreement	I-CVI*
A. Feeding Practices			
1.	Are you aware that concentrate rations are required at all stages of sheep production, apart from pasture grazing?	6	1
2.	Do you know that colostrum should be given to newborns within one hour?	5	0.83
3.	Do you know that common salt supplementation is necessary for your animals?	5	0.83
4.	Ewes should be provided an extra concentrate ration during pregnancy and lactation.	6	1
5.	The total dry matter requirement of sheep is around 2-3% of their body weight.	6	1
6.	The optimal grazing duration for sheep is 7-9 hours.	5	0.83
7.	Do you know some forages make sheep more prone to bloat?	6	1
8.	Do you know that feeding creep ration is required for proper lamb growth?	5	0.83
B. Breeding Practices			
9.	Are you aware that conception in ewes is most successful when breeding occurs in the late heat period?	5	0.83
10.	The initial breeding age for male sheep is 12 months.	6	1
11.	Do you know the age of first heat in ewes?	5	0.83
12.	The average length of pregnancy in sheep is 151 days.	6	1
13.	Do you know that maintaining a pedigree record for animals is essential?	6	1
14.	Do you know that the recommended ram and ewe ratio in the flock should be 1:40?	5	0.83
15.	Do you know that in the flock, the males should be replaced or exchanged once every two years to avoid inbreeding?	5	0.83
16.	Do you know ewes generally do not show visible signs of estrous if ram is not present?	5	0.83
C. Housing Practices			
17.	Do you know the North-South orientation of the shed causes greater stress on the animals because the sunlight falling on the shed lasts longer in a hot, arid climate?	6	1
18.	The height of the shed at the center should be 3–3.5 m.	6	1
19.	The mud-type floor is most suitable for sheep.	5	0.83
20.	Do you know that floor space for sheep should be slightly larger in hot weather conditions in comparison to cool weather?	6	1

Cont. Table 3.

Table 3., Cont. ...

Sl.No.	Items	Agreement	I-CVI*
21.	Do you know any cleaning agents for animal houses?	5	0.83
22.	Do you know proper ventilation is required to reduce the risk of airborne disease?	5	0.83
23.	Do you know the weaning age of the lamb?	6	1
24.	Are you aware of sheep culling practices?	5	0.83
D.	Health-Care Practices		
25.	Are you aware that a foot bath is required at the entrance of the farm?	6	1
26.	Are you aware of the practice of naval cord ligation and disinfection after the birth of a lamb?	5	0.83
27.	Are you aware of isolation of sick animals from healthy ones?	6	1
28.	Are you aware of the deworming schedule for sheep?	5	0.83
29.	Do you know important symptoms of the PPR in sheep?	5	0.83
30.	Do you know about quarantine before introducing new animals into the herd?	6	1
31.	Are you aware of the vaccination schedule for sheep?	5	0.83
32.	Do you know that overgrown wool must be sheared to prevent flea, tick, and lice infestations?	6	1
E.	General Management Practices		
33.	Are you aware of the conservation of fodder in the form of silage or hay for the lean period?	6	1
34.	Do you know about rotational grazing?	5	0.83
35.	Do you know about the preparation of milk replacer for lamb feeding?	6	1
36.	Do you know the proper method of disposing of dead stock?	5	0.83
37.	Are you aware that hoof problems are very common in sheep, especially during the rainy season?	6	1
38.	The age of castration in sheep is 6 months.	6	1
39.	The best method of identification of sheep is Ear Tagging.	5	0.83
40.	The normal body temperature of sheep is 102.4°F.	5	0.83
	S-CVI/avg.		0.91

*I-CVI means content validity index for each item

According to this study regarding knowledge test for scientific sheep farming practices, it was found that the developed knowledge test showed strong reliability (0.87) and validity (0.91) in assessing farmers knowledge level. The Cronbach's alpha was computed to be 0.83, which further underscores better measurement consistency. It was also found that the internal consistency analysis revealed high reliability coefficient, indicating consistent performance across test items. This strong validity of the test items represents the breadth and depth of the content domain and they are relevant to the learning objectives.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: HV: Participated in the investigation, data collection and preparation of the original draft; MS, S: Involved in conceptualization,

supervision and preparing interview schedule; MC, HRM: Helped in proof reading and editing; VS, SP: Involved in statistical analyses, methodology and final editing.

Data availability statement: All the data supporting the research findings have been presented in this paper. The corresponding author is willing to provide the raw data upon reasonable request.

ACKNOWLEDGEMENTS

The authors are thankful and extend their gratitude to the esteemed Director, ICAR-IVRI, for the invaluable support provided throughout. Additionally, we would like to express our appreciation to the Head of the Division of Extension Education of ICAR-IVRI, Izatnagar, Bareilly (UP)-243122, as this work would not have been accomplished without their assistance.

REFERENCES

- Almhdy H, and Metawi HR, 2000. Efficiency of sheep production system under arid conditions of Sinai: effects of ewe body weights, lamb marketing age and annual range availability. In Proc. 3rd All Africa Conference on Animal Agriculture and 11th Conference Egyptian Society of Animal Production, pp 643-647
- BAHS, 2022. Basic Animal Husbandry Statistics, Department of Animal Husbandry, Ministry of Agriculture, Government of India
- Brown W, 1910. Some experimental results in the correlation of mental abilities. *Br J Psychol*, 3(3): 296-322, doi: 10.1111/j.2044-8295.1910.tb00207.x
- Cronbach LJ, 1946. A case study of the split half reliability coefficient. *J Educ Psychol*, 37(8): 473-480, doi: 10.1037/h0054328
- Edwards AL, 1957. Techniques of Attitude Scale Construction. Vakils, Feffer and Simons Inc, New York
- Ghafouri-Kesbi F, Abbasi MA, Afraz F, Babaei M, Baneh H *et al.*, 2011. Genetic analysis of growth rate and Kleiber ratio in Zandi sheep. *Trop Anim Health Prod*, 43: 1153-1159, doi: 10.1007/s11250-011-9816-2
- Johnson DC, Chander M, Sagar MP, Verma MR and Patil AP, 2023. Assessing organic poultry farming knowledge among tribal farmers: A Tailored Knowledge Test. *Indian J Ext Educ*, 59(4): 141-144. doi: 10.48165/IJEE.2023.59428
- Johnson WL, 1984. Strategies for improving the nutritional status of small ruminants in tropical ecosystems. *Prev Vet Med*, 2: 589-601, doi: 10.1016/0167-5877(84)90105-3
- Kerlinger FN, 1987. Foundations of Behavioural Research. 3rd edition. Holt, Rinehart and Winston, New York
- Kumar P, Prahlad Singh S, Peshin R and Singh A, 2021. Development And Standardization of Knowledge Test on Organic Dairy Farming (odf) Practices in Sub Tropics of Jammu Region of Jammu and Kashmir State (India). Paper at: Organic World Congress 2021, Science Forum: 6th ISOFAR Conference co-organised with INRA, FiBL, Agroecology Europe, TP Organics and ITAB, Rennes, France, 8-10 September, 2021
- Peters N, 1988. Laminar flamelet concepts in turbulent combustion. *Symp (Int) Combust*, 21(1): 1231-1250, doi: 10.1016/S0082-0784(88)80355-2
- Shruti, Singh M, Singh BP, Shyamkumar TS, Aneesha VA *et al.*, 2022. Construction and validation of knowledge test regarding plant toxicity in dairy animals: A methodological approach. *J Community Mobilization Sustain Dev*, 17(2): 507-514
- Slingerland M, 2000. Mixed farming: scope and constraints in West African savanna. PhD thesis: Wageningen University and Research
- Spearman C, 1910. Correlation calculated from faulty data. *Br J Psychol*, 3: 271-295, doi: 10.1111/j.2044-8295.1910.tb00206.x
- Subrahmanyeswari B and Chander M, 2008. A scale to measure attitude of registered organic farmers towards organic livestock farming. *Livest Res Rural Dev*, 20(2): 20026
- Vijayan B, Nain MS, Singh R, Kumbhare NV and Kademani SB, 2023. Knowledge test for extension personnel on Rashtriya Krishi Vikas Yojana. *Indian J Ext Educ*, 59(1): 131-134, doi: 10.48165/IJEE.2023.59127