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Development of a knowledge assessment tool to measure the knowledge level of farmers about rapeseed-mustard cultivation

Bidyut P Gogoi[1*], Y Sirilakshmi[2], Ashok K Sharma[3] and Dipankar Saikia[4]
[1, 2] *Dairy Extension Division, ICAR - National Dairy Research Institute Karnal, Haryana, India*
[3]*ICAR- Indian Institute of Rapeseed-Mustard Research, Bharatpur, Rajasthan, India*
[4]*Faculty of Agricultural Sciences & Technology, Assam Down Town University, Guwahati, Assam, India*
**Corresponding author: bidyut.p98@gmail.com*
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Abstract

Rapeseed-mustard is a crucial oilseed crop widely cultivated by farmers; however, a noticeable gap exists between scientific recommendations and actual farming practices, leading to suboptimal yields. This study aimed to develop a standardized knowledge test to assess farmers' understanding of rapeseed-mustard cultivation practices, with the ultimate goal of identifying knowledge gaps that hinder optimal crop management. The test construction involved a comprehensive process, including a literature review, expert consultations, and field surveys to determine key practices such as soil preparation, seed treatment, irrigation schedules, pest and disease management, and post-harvest handling. A preliminary test was administered to 60 farmers to ensure clarity, reliability, and validity. Item analysis was conducted using difficulty and discrimination indices, resulting in a refined set of 28 items from an initial 36 statements. Findings revealed that most farmers (55.83%) possessed moderate knowledge, while 26.67% had low knowledge and 17.55% had high knowledge of recommended practices. This knowledge test is a valuable tool for agricultural extension professionals to assess farmers' knowledge and provides insight into specific areas where training and support are needed. By targeting these gaps, extension services can deliver tailored education programs that foster sustainable practices and improve productivity in rapeseed-mustard farming.

Keywords*: Knowledge assessment, rapeseed-mustard, agricultural extension, farming practices*

Introduction

Rapeseed-mustard is the world's third most important source of edible oil, following soybeans and oil palm. After Canada, India is the world's third-largest producer of rapeseed mustard, with China accounting for about 11% of global production. With 33.34% of the nation's oilseed production coming from it, it is the largest oilseed crop in India. Rapeseed mustard covers 9.12 million ha, with a production of 13.16 million tonnes and a productivity of 1499 kg/ha (DA & FW, 2024). In India, rapeseed and mustard crops are cultivated in a variety of agro-climatic environments, including saline soils, early or late sowing, irrigation, rainfed regions, and hills in the northeast and northwest. However, there are differences in production and productivity between states. The average productivity in Assam is much lower than the national average at just 660 kg/ha during 2018-19 (Sharma *et al.* 2021). To increase productivity and eventually improve the state of oilseed production in general and rapeseed mustard production in particular, farmers must be knowledgeable about the various production technologies of the crop. A cognitive test or other suitable measurement instrument is needed for this knowledge assessment. Thus, a knowledge test was developed to evaluate farmers' knowledge of the various production technologies for the rapeseed mustard crop.

Materials and Methods

The Dhemaji district of Assam was the purposeful location of the current study. Three villages were randomly selected from each of the two blocks *viz.* Machkhowa and Sissiborgaon based on the highest area under crop. For the study, ten respondents were randomly chosen from each village, for a total of sixty respondents. The common understanding of knowledge is that it is an individual's close familiarity with facts. The body of comprehended information that a person possesses is referred to as knowledge. One of the key elements of behavior is knowledge, which also has a significant impact on an individual's overt and covert behavior (Chatterjee *et al.* 2020). In this study, knowledge was defined as the farmer's knowledge and comprehension of better ways to cultivate the rapeseed-mustard crop. A standardized knowledge test was created to assess the degree of knowledge. Below are the specifics of how this knowledge test was created and standardized.

Item Collection

Items are the questions that make up the content of a knowledge test. The test items were gathered from a variety of sources, including the researchers' personal experience, field extension staff, literature, and relevant specialists. The items were gathered concerning important field operations such as intercultural operations, field preparation, fertilizer application, soil and seed treatment, sowing time, seed rate and spacing, harvesting, and threshing.

Initial selection of items: Three criteria were used to prepare the knowledge test items.

1) It should encourage critical thinking over mechanical memorization.

2) Items should distinguish between well-informed and poorly-informed farmers and have a difficulty level. This indicates that questions that are difficult for respondents to understand and that all or none of them can correctly answer are inappropriate for use in knowledge tests.

3) All topics pertaining to the practices of rapeseed and mustard cultivation should be covered.

The initial selection of 36 items covered the main areas of cultivation practices for rapeseed and mustard, based on the aforementioned criteria. The items chosen were in accordance with the farmers' level of knowledge and comprehension as well as the area's technological advancements. These 36 items were combined into a schedule that would be given to the farmer in order to analyze the items and eliminate weak and irrelevant ones. The accurate responses to the questions were determined after consulting with experts and specialists, and they were added to the schedule next to each question. The items were multiple choice, yes/no, and in objective form.

Item Analysis

Two types of information are typically obtained from an item analysis: item difficulty and item discrimination. While the index of discrimination shows how much an item separates the well-informed from the poorly-informed, the index of item difficulty shows how difficult an item is (Loukhamv and Bandhyopadhyay, 2014). 60 respondents were given the items for item analysis after they had been reviewed and adjusted based on pre-test results. The respondents who filled out the questionnaires were chosen at random and did not make it into the final study sample. To prevent the testing effect, this was done. However, the community where the final study was carried out was represented by these 60 respondents.

Each of the 60 respondents who administered the test was assigned a score of 1 or 0 for each item, depending on whether the answer was correct or incorrect. A respondent's knowledge score was the total number of correct answers they provided out of 36 questions. Following computation, the scores from 60 respondents were ranked in order of magnitude, highest to lowest. Following that, these 60 respondents were split up into six equal groups, each with ten respondents, and placed in decreasing order of the total scores they had received. These groups were referred to as G1, G2, G3, G4, G5, and G6, respectively. For item analysis, the middle two groups, G3 and G4, were eliminated, keeping only four extreme groups with high and low scores (Bloom *et al.,* 1956).

Calculation of Item difficulty index (P)

A given item's difficulty index is determined by the percentage of respondents who correctly answer it. It is calculated using the following formula:

$$Pi = \frac{ni}{Ni} x100$$

where:

P_i = Difficulty index in percentage for the i^{-th} item,

n_i = Number of respondents who answered the i^{-th} item correctly,

N_i = Total number of respondents to whom the i^{-th} item was administered

Calculation of Item Discrimination Index ($E^{1/3}$)

Each item's discrimination index was calculated using the following formula given by Mehta (1958).

$$E^{1/3} = \frac{(S1+S2)-(S5+S6)}{N/3}$$

where S1, S2, S5, and S6 represent the frequencies of accurate responses in the corresponding groups G1, G2, G5, and G6. "N" denotes the total number of respondents in the sample chosen for the item analysis; in this case, it was sixty. The range of the discrimination index is 0 to 1. For the final test, items with discrimination indices between 0.30 and 0.70 were chosen. The similar procedure was followed by Muyal *et al.* (2022) and Srinivas *et al.* (2014).

Results and Discussion

Total items selected

28 items were ultimately chosen from a total of 36 items using the following criteria. All important aspects of the recommendations have been addressed. The questions were designed in such a way that no important component was overlooked.

- Items with difficulty level indices between 30 and 80.
- Items with a discrimination index between 0.30 and 0.70.

Table 1: Difficulty and Discrimination index for knowledge test items

Sl. No	Frequency of correct answers in four extreme groups				Total frequencies of correct answers by all six groups	Difficulty index P	Discrimination index (E1/3)
	G1	G2	G5	G6	(n=60)		
1. **	8	8	7	6	39	65.00	0.15
2. *	10	9	7	5	42	70.00	0.35
3. *	9	9	6	5	33	55.00	0.35
4. **	5	5	4	3	28	46.67	0.15
5. *	10	10	7	7	40	66.67	0.30
6. *	7	7	4	2	27	45.00	0.40
7. *	5	8	3	3	31	51.67	0.35
8. *	8	6	1	3	22	36.67	0.50
9. *	5	5	2	2	18	30.00	0.30
10. *	9	9	6	3	36	60.00	0.45
11. *	10	9	6	6	42	70.00	0.35
12. *	9	9	8	2	34	56.67	0.40
13. *	10	10	9	4	50	83.33	0.35
14. *	6	10	3	4	30	50.00	0.45
15. *	9	9	6	2	37	61.67	0.50
16. *	6	10	2	2	23	38.33	0.70
17. *	5	9	2	1	26	43.33	0.55
18. **	6	3	4	3	22	36.67	0.10
19. *	9	8	5	4	31	51.67	0.40
20. *	10	9	8	3	44	73.33	0.40
21. **	9	9	6	7	43	71.67	0.25
22. *	8	9	5	5	32	53.33	0.35
23. **	9	3	6	4	33	55.00	0.10
24. *	7	6	5	1	23	38.33	0.35
25. *	6	5	1	1	18	30.00	0.45
26. **	5	3	4	2	16	26.67	0.10
27. *	10	4	4	1	35	58.33	0.45
28. *	8	6	5	2	26	43.33	0.35
29. *	10	10	8	6	45	75.00	0.30
30. **	9	8	7	7	41	68.33	0.15
31. *	6	9	4	4	30	50.00	0.35
32. *	8	5	4	1	27	45.00	0.40
33. *	6	6	3	2	24	40.00	0.35
34. *	9	10	9	3	42	70.00	0.35
35. **	10	10	9	7	51	85.00	0.20
36. *	9	10	5	4	38	63.33	0.50

*Total Selected items=28; **Rejected items=8

Validity of the test

Validity was determined in terms of content validity. According to Kerlinger (2004), content validity refers to the degree of representativeness or adequacy of sampling in relation to the substance, matter, and topics of a measuring instrument. The test's content validity was judged satisfactory because it was based on a variety of literatures and expert opinions (Barman and Kumar, 2010; Devi *et al.,* 2023; Bharti and Sagar, 2022; Nanda *et al.,* 2022). The test was presumed to be valid because it measured the things it was supposed to measure.

Reliability of the test

A measuring device's accuracy or precision is what determines its reliability (Kerlinger, 2004). Only when a test yields consistent results when run on the same sample can it be considered reliable. Although there are other ways to assess a test's reliability, the split-half approach was employed in this case. Thirty respondents took the final exam, which was split into two sections according to the odd and even numbers of statements. The correlation coefficient (r) was calculated using the total score for both odd and even numbered items. Split half reliability is defined as a resultant value of r = 0.78. Using the following spearman Brown's prophecy formula, the reliability was adjusted to full test reliability. The test was deemed reliable since its overall reliability was determined to be 0.87. The similar procedure was followed by Kumar *et al.* (2016) and Samuel *et al.* (2018).

Reliability coefficient of the final test

$$= \frac{2 \text{ x (reliability coefficient of the half test,found experimentally)}}{1+\text{(reliability coefficient of the half}-\text{test,found experimentally)}}$$

Thus, the knowledge test developed in the current study measures farmers' knowledge of rapeseed-mustard cultivation, as it demonstrated a higher level of reliability and validity.

Table 2: Final selected items for knowledge test to measure farmers' knowledge on scientific cultivation of Rapeseed-mustard

Sl. No	Selected Items for Knowledge Test	
	(A) High yielding varieties	
1.	Name 5 HYVs of rapeseed-mustard recommended for your area.	
	(a)	( )
	(b)	( )
	(c)	( )
	(d)	( )
	(e)	( )
2.	Please mention duration and average yield of above HYVs of rapeseed-mustard.	
	Sl.No Duration (days) Yield(q/ha)	
	(a)	( )
	(b)	( )
	(c)	( )
	(d)	( )
	(e)	( )
3.	What are the advantages of HYVs?	
	(a) Short maturity period	( )
	(b) More yield	( )
	(c) More resistant to disease and pest	( )
	(d) Give good response to fertilizers	( )
	(e) Higher oil content	( )
	(f) Non-shattering and synchronous in nature	( )
	(B) Field Preparation (Yes/No)	
4.	Light loam soil best for rapeseed-mustard	( )
5.	Addition of 10-15 tonnes of FYM/ha in the field	( )
6.	One ploughing should be done with MB plough	( )
7.	3-4 ploughing and Planking after every ploughing	( )
	(C) Soil Treatment	
8.	What are the common soil-borne insect pests of rapeseed- mustard?	

(a) Termite ( )
(b) Saw fly ( )
(c) Cut worm ( )

9. Mention the name of chemicals with quantity, which are used as soil treatment.
(a) Name of the chemicals ( )
(b) Quantity (Kg/ha) ( )

(D) Seed Treatment

10. Do you think that seed treatment is necessary for the crops: Yes/No ( )
11. If yes, mention the name and quantity of chemicals, which can be used for the seed treatment of rapeseed-mustard?

Name of chemicals	quantity / kg seed	
(a) Dithane M-45 (Mancozeb)	3-4 gm/kg seed	( )
(b) Thiram / Captan / Carbendazin	2-3 gm/kg seed.	( )

(E) Time of sowing

12. Mention the appropriate time of sowing for rapeseed-mustard in your area.
(a) Mid-October to 1st week of November ( )
(b) Mid-September to Mid-October ( )
13. What are the disadvantages of late sowing?
(a) Less production ( )
(b) More pest and disease attack ( )
14. What are the advantages of timely sowing?
(a) More Yield ( )
(b) Timely available of field for next crop ( )
(c) Less disease and pest attack. ( )

(F) Seed rate and recommended spacing

15. What is the recommended seed rate for rapeseed-mustard per ha?
(a) 4-5 kg/ha ( )
16. What is the recommended P X P and R X R distance for rapeseed-mustard crop?
(a) 10 X 30cm ( )
17. What is the recommended depth of sowing?
(a) 4-5 cm. ( )

(G) Fertilizers Application

18. Mention the name of chemical fertilizers used in rapeseed-mustard crop?
(a) Urea ( )
(b) Single super phosphate (SSP) ( )
(c) Diammonium Phosphate (DAP) ( )
19. Please mention the recommended dose of nitrogen, phosphorus and DAP for rapeseed-mustard crop. ( )

(H) Irrigation Management

20. Please mention the critical stage of irrigation in rapeseed-mustard.
(a) 35-40 DAS (pre-bloom) ( )
(b) 60 – 65 DAS (At the pod development stage) ( )

(I) Weed Management

21. What is the appropriate time for weeding in rapeseed-mustard? (a) 20-25 DAS ( )
22. Do you use weedicide for weed management? Yes/No. If Yes, Please Mention ( )

(J) Plant Protection Measures

23. What are the common insect-pests of rapeseed-mustard?
(a) Painted Bug ( )
(b) Mustard Saw Fly ( )
(c) Aphid ( )
(d) Pea Leaf Minor ( )
(e) Bihar Hairy Caterpillar ( )
(f) Any other ( )

24. What chemicals can be used to control the following insect-pest of rapeseed-mustard crop?

Insect pest	Name of chemicals	Dose /ha	
a) Painted Bug	Endosulphan 4% or	20-25 kg /ha	( )
	Quinalphos 1.5 % dust or	20-25 kg /ha	( )
	Malathion 50 EC	500 ml/ha	( )
(b) Mustard Saw Fly	Malathion 50 EC or	500 ml/ha	( )
	Endosulphan 35 EC	500 ml/ha	( )
(c) Aphid	Monocrotofos or Metasystox	0.1%	( )
(d) Pea Leaf Minor	Monocrotofos or Metasystox	0.1%	( )
(e) Bihar Hairy Caterpillar	Malathion 50 EC or	1000 ml/ha	( )

25. What are the common diseases of rapeseed-mustard crop?
    (a) White rust ( )
    (b) Leaf Spot (Alternaria blight) ( )
    (c) Downey Mildew ( )
    (d) Powdery mildew ( )
    (e) Stem rot ( )

26. What chemicals can be used for controlling these diseases?

Diseases	Name of Chemicals	Quantity	
(a) White rust	Ridomil MZ 72 WP	0.25 %	( )
(b) Downey mildew	-do-	-do-	( )
(c) Leaf spot	Mancozeb	0.2 %	( )
(d) Powdery mildew	Dinocap	0.1 %	( )
(e) Stem rot	Carbendazim	0.05 %	( )

(I) Harvesting and storage

27. What should be the appropriate time of harvesting?
    (a) Morning time when 75% siliqua turning yellow. ( )

28. What should be the optimum moisture content of seed for storage?
    (a) 8 % ( )

Administration of the test

The chosen knowledge test items were divided into three categories: multiple choice, fill in the blank, and correct/ incorrect. Each test item carried a score: "one" for a correct response and "zero" for an incorrect response. The respondent's knowledge score was calculated by adding the scores of all test items that were answered correctly. The range of possible knowledge scores was 0 to 28. The final knowledge test, which included 28 items, was given to 120 farmers. The answers, whether right or incorrect, were noted in the responses.

Categorization

The respondents were divided into three categories low, medium, and high based on the knowledge scores obtained. The groups are categorized using mean and standard deviation with the following formula

$$x \pm \sigma$$

Where:

· (x) represents the mean (average) of the data.
· σ\sigma represents the standard deviation.

Table 3: Categorisation of farmers based on knowledge test

Sl. No	Category	Frequency (n=120)	Percentage (%)
1.	Low	32	26.67
2.	Medium	67	55.83
3.	High	23	17.55

Conclusion

Professionals in Agricultural Extension use knowledge tests as a vital tool to assess farmers' comprehension of rapeseed-mustard cultivation. Assessing farmers' level of knowledge regarding the production of rapeseed-mustard can aid in identifying knowledge gaps and improving the quality of extension services to enhance crop management. It serves as a foundation for training and support programs, thus promoting sustainable farming practices and enhancing productivity. Thus, a knowledge test was developed from an initial pool of 36 items, 28 were selected and included in the final version of the knowledge test. The resulting test demonstrated robustness and reliability in assessing knowledge of rapeseed and mustard cultivation.

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