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CONSTRUCTION OF A TEST TO ASSESS FARMERS' KNOWLEDGE ABOUT PRODUCTION RECOMMENDATIONS OF RAPESEED – MUSTARD

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ABSTRACT

Rapeseed-mustard is a major oilseed crop in the Jammu region of Jammu and Kashmir, contributing significantly to the rural economy and nutritional security. Despite the availability of high-yielding varieties and recommended rapeseed mustard cultivation practices of SKUAST-Jammu, the adoption rate among farmers remains low. This gap in adoption is largely attributed to insufficient knowledge and awareness about improved technologies, which negatively impacts productivity and farm income. Keeping in view the above problem, the present study was undertaken with the objective of developing a standardized knowledge test to assess farmers' knowledge regarding improved rapeseed-mustard production practices. Critical aspects of rapeseed-mustard production were compiled and reviewed with scientists to ensure relevance and accuracy. Indices for item difficulty and discrimination were obtained through item analysis. The respondents were given one mark for each correct and zero for incorrect answer. The reliability of the test was assessed using the split-half method, resulting in a coefficient of 0.79. To estimate the reliability of the full-length test, the Spearman-Brown prophecy formula was applied, producing a coefficient of 0.88, indicating high reliability. Furthermore, the test demonstrated an acceptable degree of content validity as ensured through expert consultation and review. Based on the results, a total of 23 items were selected for the final test.

Keywords: *rapeseed-mustard, knowledge-test, production recommendations, item difficulty, item discrimination*

INTRODUCTION

Cereals constitute a substantial part of the total agricultural production. After cereals, oilseeds rank second among India's agricultural commodities, accounting for, 3% of country's Gross National Product (GNP), 13% of gross cropped area and 10% of total value of agricultural commodities (Kumar *et al.,* 2018). Among the prominent oilseed crops, soybean constitutes 39 per cent, groundnut 26 per cent, and rapeseed-mustard 24 per cent, together comprising over 88% of the overall oilseeds production across country. However, with regard to edible oil production, rapeseed-mustard predominance with 31 per cent, then soybeans at 26 % and groundnuts at 25 % (Nadaf *et al.,* 2021). During the year 2022-23, the total oilseed production in the country was estimated 413.55 lakh tonnes, of this total, the Rapeseed-Mustard production and productivity was 126.43 lakh tonnes and 14.28 q/ha respectively (Indiastat, 2023). Rapeseed-Mustard is a primary oilseed crop of the rabi season in Jammu and Kashmir. More than 41,000 hectares of land in the region are under this crop, with an estimated production of 36,000 tonnes and a productivity rate of 8.79 qt/ha (Indiastat, 2023). This performance indicates a substantial productivity gap when compared to national standards. It is essential for farmers to possess sufficient knowledge of the recommended production practices for rapeseed-mustard in order to enhance its productivity. Improving this knowledge base can contribute significantly to transforming the overall oilseed production scenario, with particular emphasis on rapeseed-mustard (Kumar *et al.,* 2016). Consequently, assessing this knowledge necessitates the use of an appropriate and scientifically sound measurement tool, such as a cognitive scale (Raj kamal, 2001). Empirical studies focusing on farmers' knowledge (Mallappa et al., 2023) of recommended rapeseed-mustard production practices in the Jammu region are limited, indicating a significant gap in the existing literature. This represents a critical research gap. Addressing this gap, the present study administers a standardized knowledge test aimed at quantitatively evaluating farmers' understanding of the recommended practices. To ensure the reliability and scientific credibility of the data collected, a standardized instrument was preferred, as it provides a validated, unbiased, and consistent means of assessment suitable for research purposes.

OBJECTIVE

To develop a tool to measure farmers' knowledge about recommended rapeseed mustard production practices

METHODOLOGY

A test comprises questions referred to as items. The items of the test were selected by systematically investigating the related literature (Kumar *et al.,* 2016) such as research papers, books, SKUAST-J package of practices for rapeseed mustard and through expert consultations within the division. These questions were formulated to assess farmers' knowledge about various recommended rapeseed mustard production practices related. The items emphasized pivotal areas such as sowing times, different varieties of rapeseed-mustard, seed treatments, fertilizer management, along with different plant protection measures.

The design of the instrument test items followed a stringent selection process, emphasizing two primary aspects: critical thinking and discriminatory power. Items were formulated to enhance critical thinking and problem-solving skills, rather than mere mechanical recall, and were determined to differentiate between well-informed and ill-informed farmers, simultaneously ensuring an optimal level of difficulty. To ascertain the effectiveness of the items, those that were poorly understood by farmers or yielded uniform answers were omitted, producing a tentative set of 31 items selected to include essential concepts of improved farming practices. These items were carefully adjusted to correspond with farmers' knowledge levels and the technological context of the region, and a comprehensive schedule featuring these 31 items was developed which was then administered to farmers to enable item analysis and eliminate non-relevant or weak items, following established practices described by Sagar (1983).

The initially prepared 31 items were administered to 30 respondents for analysis. The test's scoring was done in a way that 'one' was given for correct response and 'zero' for in-correct response (Vamshi *et al.,* 2024). Overall score accumulated by each respondent throughout all items in the test determined their overall knowledge score. As a result, possible scores ranged from 0 to 31.

The indices "item difficulty" and "item discrimination" are two key types of information usually obtain by doing item analysis of a test. The item difficulty index indicates number of respondents who answer an item correctly, while the latter determines how efficiently an item discriminates between highly-informed individuals and those who are partially informed. After calculating the scores acquired by 30 respondents, the scores were sorted from highest to lowest in value. The group of 30 respondents was categorized into six equal-sized groups of five respondents each, arranged in descending order based on their total knowledge scores. The groups were labeled G1 to G6, with G1 and G2 representing the highest scorers and G5 and G6 the lowest. The respondents were divided into six equal groups to facilitate accurate discrimination analysis following Mehta's (1958) E1/3 method. Only the top (G1, G2) and bottom (G5, G6) groups were considered for analysis to maximize contrast and capture clear differences in item performance, while the middle groups (G3 and G4) were omitted. The score distribution across these six groups was as follows:

G1 = 22 to 18	G4 = 12 to 10
G2 = 17 to 15	G5 = 9 to 8
G3 = 14 to 13	G6 = 7 to 5

Difficulty index

It is defined as the proportion to which an item is difficult. An item should be neither too simple nor too complex (Manhas, 2022). The difficulty index of an item in the present study is calculated by dividing the number of correct responses given by respondents to the total number of the respondents to whom the item was administered. This can be calculated using the following formula:

$$\text{Pi (difficulty index)} = \frac{n_i}{N_i} \times 100$$

Where,

Pi = ith item's difficulty index (%)

n_i = correct answers from respondents for item ith

Ni = total respondents

The difficulty index for all items covered in the item analysis was calculated.

Discrimination index

It assesses an item's effectiveness in differentiating between highly-informed respondents and those who are partially informed. The method outlined by Mehta (1958) was employed for the calculation of the discrimination index. Discrimination index can be calculated using the formula given below-

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

Where,

Sl, S2, S5 and S6 are frequencies of correct responses in groups Gl, G2, G5 and G6 respectively.

N = total respondents in the sample of item analysis

Using the procedure mentioned earlier, the difficulty and discrimination indices of each item were computed.

For example, if we take the item no. 6 from Table 1 for calculating its difficulty and discrimination indices, the values we get are:

Pi (difficulty index) = $\frac{n_i}{N_i}$ x 100

= $\frac{19}{30}$ x 100 = 63.33

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

= $\frac{(5+4)-(3+2)}{30/3}$

= $\frac{9-4}{10}$ = 0.5

Final selection of items for test

For the final version of the knowledge test, difficulty and discrimination indices of the items were used. According to Coombs (1950), a correct response inferred that an item posed little difficulty than the individual's ability to understand it. The current study included items with a difficulty index from 20-80% and a discrimination index of 0.20 or more (refer to Table 2).

Reliability of the test

Reliability relates to the consistency or reproducibility of measurements. According to Kerlinger (1967), "reliability is the accuracy or precision of a measuring instrument." Every newly developed instrument must be tested for its reliability prior to its use (Singh *et al.,* 2024). For checking the reliability of the test split-half method was employed. The final version of the test was divided into two halves, comprising even items in one half and odd items in the other half, which was then administered to 20 rapeseed-mustard farmers from a non-sampled area. The process resulted in two sets of scores, that were subsequently correlated to each other. The correlation coefficient for the two sets of scores was found to be 0.79.

Table 1: Values for the calculating the reliability

	∑X	∑X²	∑ Y	∑Y²	∑XY
Total	125	1117	108	892	884

Reliability of half test:

(n=30)

$$r_h = \frac{n\sum xy - \sum x.\sum y}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

$$= \frac{30(884)-(125).(108)}{\sqrt{[30(1117)-(125)^2][30(892)-(108)^2]}}$$

= 0.79

Using Spearman-Brown formula-

$$r_{oe} = \frac{2(r_h)}{1+r_h}$$

Where,

r_{oe}= reliability of the original test

r_h= correlation between two halves

Therefore,

$$r_{full} = \frac{2(0.79)}{1+0.79}$$

= 0.88

The value of came to be 0.88, testifying the internal consistency of the knowledge test.

Validity of the test

Content validity was used for evaluating the validity of the test. Lawshe's content validity ratio (CVR) was used to evaluate the content validity of individual items of the knowledge test (Ansari *et. al.,* 2024; Khan *et. al.,* 2024).

Content Validity Ratio (CVR)

The Content Validity Ratio (CVR) was first introduced by Lawshe in 1975 to assess the essentiality of individual test items in relation to the construct being measured. It is particularly suitable for knowledge-based tests, where expert judgment is crucial to ensure that the items represent the intended content domain accurately. In this method, a panel of subject matter experts (SMEs) evaluates each item as "essential" or "not essential." (Ansari and Khan, 2023). This method allows for a quantitative assessment of expert consensus, making it a more objective approach to content validation. Unlike other forms of validity which may rely on external criteria or statistical correlations, CVR focuses on content relevance as judged by experts, thereby enhancing the theoretical soundness and practical applicability of the test items at the development stage.

The Content Validity Ratio (CVR) ranges between -1 and +1. A positive CVR suggests that at least a portion of the experts deemed the item essential. Typically, an item is regarded as essential when its CVR is 0.62 or higher.

The formula for calculating CVR is as follows:

$$CVR = \frac{ne - \frac{N}{2}}{\frac{N}{2}}$$

Where,

n_e = experts rating the item as "essential"

N = total number of experts

For example, the content validity ratio (CVR) of the fourth item is:

$$CVR = \frac{10 - \frac{11}{2}}{\frac{11}{2}} = 0.81$$

Table 2: Minimum value of CVR (Lawshe, 1975)

No. of judges	Minimum value
7	0.99
8	0.78
9	0.75
10	0.62
11	0.59
12	0.58
13	0.56

As per Lawshe, if the number of experts involved in the process of validation is 11 then the minimum value of CVR 0.59 or above is selected and the items having CVR value below 0.59 are discarded.

Table 3: Calculated values of all knowledge test items

Items	Difficulty index (%)	Discrimination index	n_e	Content Validity Ratio (CVR)	Interpretation
1	90	0.3*	8	0.45	Eliminated
2	73.33	0.6	11	1	Remained
3	13.33*	0.2*	7	0.27	Eliminated
4	43.33	0.5	10	0.81	Remained
5	76.67	0.4	11	1	Remained
6	63.33	0.6	11	1	Remained
7	16.6*	0.3*	5	-0.09	Eliminated
8	43.33	0.8	11	1	Remained
9	30	0.7	9	0.63	Remained
10	23.33	0.6	10	0.81	Remained
11	66.67	0.6	11	1	Remained
12	76.66	0.5	11	1	Remained
13	93.33	0.2*	8	0.45	Eliminated
14	23.33	0.7	9	0.63	Remained
15	60	0.6	11	1	Remained
16	76.66	0.5	10	0.81	Remained
17	70	0.4	11	1	Remained
18	76.67	0.5	11	1	Remained
29	60	0.7	11	1	Remained
20	66.66	0.7	11	1	Remained
21	26.67	0.8	9	0.63	Remained
22	6.6*	0.2*	4	-0.27	Eliminated
23	53.33	0.5	10	0.81	Remained
24	76.66	0.5	11	1	Remained
25	30	0.8	11	1	Remained
26	23.33	0.7	9	0.63	Remained
27	26.66	0.5	9	0.63	Remained
28	10*	0.3*	6	0.09	Eliminated
39	6.67*	0.2*	3	-0.72	Eliminated
30	93.33	0.2*	11	1	Remained
31	73.33	0.5	10	0.81	Remained

Note: (*) *represents items that are eliminated,* n_e *= experts rating the item as "essential"*

RESULTS AND DISCUSSION

The knowledge test developed in this study underwent rigorous validation and reliability assessment. Item analysis was performed to determine difficulty and discrimination indices. The reliability of the test was assessed using the split-half method, wherein the coefficient of correlation (Pearson's r) and the Spearman-Brown prophecy formula was applied, yielding a reliability coefficient of 0.88, indicating a high level of internal consistency. Out of 31 items, 23 were selected to determine the farmers' knowledge regarding improved rapeseed mustard cultivation practices. Each correct answer will receive one score, the incorrect responses or don't know answer will receive zero score. The total score accumulated by respondents on all items of the test will be regarded as their knowledge score. The test's scores will fall within the range of 0 to 23. Table 4 presents the finalized knowledge test to be administered to rapeseed-mustard growers in the study region. The methodology adopted is aligned with Kumar *et al*. (2016); Thakur et al. (2024); Jadav et al. (2024); Jadav et al. (2023).

Table 4: Final set of items for the knowledge test

Knowledge test
Land preparation How many ploughings are required in field preparation for Rapeseed Mustard cultivation **a) 2** b) 4 c) 6 d) More than 6
HYV's & Date of sowing Name the hybrid varieties of rapeseed mustard. What is the recommended date of sowing in Rapeseed Mustard? a) 10-15th oct **b) 20-25th oct** c) 25-30th oct d) None
Seed rate & spacing How much seed is required for cultivation of Rapeseed Mustard? (kg/acre) **a) 1.75 – 2** b) 1 - 2 c) 3.5 - 4 d) 2.5 - 3.5 What is the recommended spacing in Rapeseed Mustard?
Seed depth What is the ideal seed depth in Rapeseed Mustard **a) 3 - 4 cm** b) 5 - 6 cm c) 7 - 9 cm d) 10 - 12 cm
Seed treatment Name the chemicals used for seed treatment in Rapeseed Mustard with their dosages.
Intercropping Name the crops that can be intercrop with rapeseed mustard.
Weed management Name the common weeds of mustard crops. Name the recommended herbicides of Rapeseed Mustard crop with their dosage.
Irrigation management How many irrigations are recommended in Rapeseed Mustard?
Thinning What is thinning in rapeseed mustard? What is the ideal time for thinning in Rapeseed-Mustard crop?
Fertilizer management What is the recommended dosage of FYM? What is the recommended dosage of Urea? What is the recommended dosage of DAP? What is the recommended dosage of MOP? How many splits of dosage of urea are recommended in Rapeseed Mustard? a) 1 **b) 2** c) 3 d) 4
Insect and disease management Name most commonly found insect-pests in Rapeseed Mustards. What is the recommended insecticide for Rapeseed-Mustard? What is its recommended dosage? Name the most common diseases of Rapeseed Mustard.
Stacking For how many days harvested crop should be stacked?

CONCLUSION

An attempt was made to develop a knowledge test by applying a standardized measurement procedure. Item analysis, reliability and validity of the test were worked out. The results showed the test items were neither too easy nor too complex to discriminate between well informed and poorly informed individuals. Besides, the standardized knowledge test is reliable and valid for the future usage. Hence, it can be concluded that the statements that are finally chosen have a good statistically fit for measuring knowledge of farmers regarding improved rapeseed mustard technology. Finally, twenty-three knowledge items were selected.

POLICY IMPLICATION

The knowledge test developed through this study provides policymakers and extension agencies with a validated tool to assess the knowledge gaps among rapeseed-mustard growers. This enables evidence-based planning of training and capacity-building programs tailored to actual farmer needs.

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CONFLICT OF INTEREST

Authors have no conflict of interest.

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