

CONSTRUCTION OF A KNOWLEDGE TEST TO ASSESS THE KNOWLEDGE LEVELS OF ORANGE GROWERS ON ORANGE CULTIVATION PRACTICES

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ABSTRACT

The study aimed to develop a standardized knowledge test to assess the knowledge level of orange growers regarding orange cultivation practices. For tool development, a pilot study was conducted in the Mainkhapa village of Chhindwara District. The test construction involved steps item collection, selection, analysis, and evaluating the reliability and validity of test items, culminating in the final item selection. With a reliability coefficient of 0.70, the test proved to be reliable for assessing knowledge. Ultimately, a knowledge tool with 26 items was finalized for data collection. This standardized test provides a valuable resource for researchers and academicians seeking to measure farmers' knowledge in various facets of orange cultivation. Orange cultivation is a significant agricultural activity in Madhya Pradesh, yet productivity and quality remain suboptimal despite government support and improved technologies. By identifying gaps in farmers' understanding, the test provides actionable insights for promoting sustainable agriculture and improving yield quality.

Keywords : *knowledge, orange growers, production.*

INTRODUCTION

India has the unique distinction to grow almost all the varieties of fruits and vegetables. India is second largest producer of fruits in the world 9 per cent after China (Ekhande and Suradkar 2023). Citrus industry in India is the third larger fruit industry of the country after mango and banana. (Tekale and Datir 2022). The main citrus fruits in Madhya Pradesh are mandarin orange (Santra), acid lime and sweet orange. Citrus fruits are grown in 49 out of 51 districts of the state. The area under mandarin orange, sweet orange and acid lime in Madhya Pradesh is 1,15,488 ha with the production of 13,50,278 metric tonnes. The average productivity is estimated to be 11.69 metric tonnes/ha. (Saryam, & Jirli, 2020). The efforts to increase orange production have been made by central and state governments by starting horticulture development programmes. The subsidy on the purchase of fertilizers and plant protection chemicals has also been made available to the orchards. Despite this, the production of orange per hectare is attributed to the non-suitability of technology, lack of knowledge, and characteristics of orange growers, price policy and situational factors. (Deshmukh, et al. 2021).

Knowledge is one of the important components of behaviour and plays an important role in overt and covert behavior of an individual. Knowledge includes those behaviour and test situations which emphasized the remembering either by recognition or recall of ideas, material

or phenomenon (Bloom and others, 1956). Knowledge plays an important role in escalating the production and productivity (Sudha Rani et al., 2014). Adequate knowledge about different recommended cultivation practices is must on the part of growers to increase its productivity (Paul et al 2020; Pratik and Vinaya 2022; Sharma 2023; Saifuddin et al. 2024).

In this regard, there is a need to understand the existing knowledge level of farmers to identify the strong and weak areas. The strong areas need to be exploited and the weak areas need to be developed for further adoption of the technologies (Mukherjee et al. 2019). Therefore, the present study aims to construct a knowledge test for assessing the knowledge level of orange growers regarding orange cultivation practices

OBJECTIVE

To construct a knowledge test for assessing knowledge level of orange growers regarding orange cultivation practices

METHODOLOGY

Locale of the study

To develop the knowledge test, a pilot survey was conducted in Mainkhapa village (21°54 N, 78°34 E),

Mohkhed block, Chhindwara district, Madhya Pradesh (Figure 1). A random sample of 36 non-sample respondents included in the pilot survey, providing valuable insights for the test's development. At the time of final data collection, Mainikhapa

village was not included. The developed knowledge test was further administered to the sample respondents of the two districts of Madhya Pradesh for quantitative analysis.



Fig. 1: Locale map of pilot study area Mainikhapa village of Mohkhed block of Chhindwara District

Construction of knowledge test

To develop a knowledge test for recommended practices in orange cultivation, the methodology outlined by

Mukherjee et al. (2019), Vamshi, et al. (2024) and Bardhan & Bhardwaj (2022) was adopted, with necessary modifications to fit the specific requirements of this study.

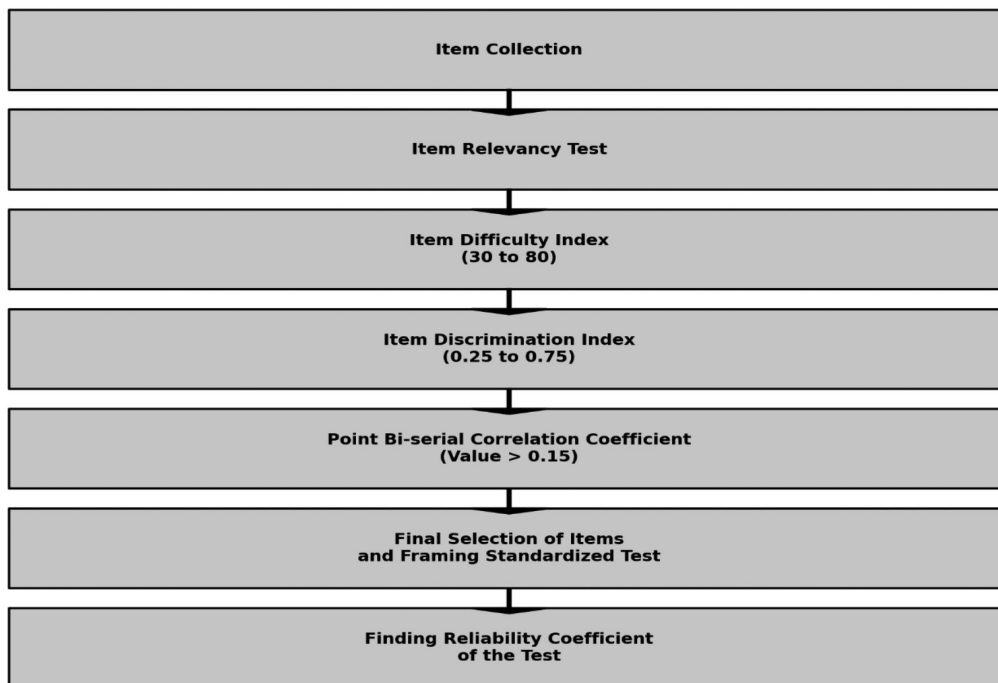


Fig. 2: Steps in item selection and test standardization

Collection of items

The initial phase of constructing the knowledge test involved assembling a set of questions, referred to as “knowledge items,” covering the thematic area of “recommended orange cultivation practices.” Items were gathered from a variety of reputable sources, including research and review papers, popular articles, book chapters, and pilot studies conducted in the target area. Additional insights were derived from expert consultations and the researchers’ own field experiences.

Item selection

Selecting appropriate items is crucial for developing a knowledge test that not only encourages critical thinking but also effectively distinguishes between well-informed and less-informed respondents. This stage demands a deep understanding and critical analysis of the topic by the researcher. Based on these criteria, an initial set of 42 items was constructed, encompassing essential aspects of orange cultivation such as variety selection, soil and climate conditions, planting material, spacing, irrigation, nutrient and weed management, plant protection, pruning and training, intercropping, and harvesting. Each item was designed to be objective and structured in a multiple-choice or binary (yes/no) format to ensure clarity and ease of response.

Expert Validation (Jury Opinion)

The set of 42 items was then subjected to expert review for relevancy assessment. Experts were asked to evaluate whether each item accurately measured respondents’ knowledge of orange cultivation practices. They were encouraged to suggest modifications, additions, or deletions

Table 1: Range of scores obtained by the respondents

Group No.	G1	G2	G3	G4	G5	G6
Range of Scores	34-28	25-27	22-24	21-19	18-15	15-9
Number of Respondents	6	6	6	6	6	6

Item difficulty index

The item difficulty index was defined as the proportion of respondent farmers giving correct answer to that particular item. The basic assumption in this case was that the difficulty in answering any question was linearly related to knowledge level of farmers regarding Conservation Agriculture *i.e.* more the knowledge level, the easier the farmer finds to answer the question and vice-versa. Difficulty Index was calculated using the following formula:

$$P_i = (n_i/N) \times 100$$

Where, P_i = difficulty index in percentage of i th item

to ensure that each item aligned with the test’s objectives. The items were rated on a three-point scale for relevance: 3 for “most relevant,” 2 for “relevant,” and 1 for “irrelevant.” Based on expert feedback, six items were eliminated, resulting in a final selection of 36 items deemed appropriate for the knowledge test.

RESULTS AND DISCUSSION

Item analysis

The item analysis involved three critical metrics: the item difficulty index, the item discrimination index, and the item validity index. These indices together served to ensure that each item in the knowledge test on orange cultivation practices was relevant, effectively discriminated between different knowledge levels, and held validity within the test structure. The 36 items were administered to 36 identical respondents who were not included in sample but they were included in pre-testing. The whole test was consisting of multiple choice question. Each question was having two response categories either correct or wrong. Each correct answer was given ‘1’ score while wrong answer was awarded ‘0’ mark. Thus total score secured by all individual respondents on 36 items for correct answers was the knowledge score. The scores obtained by 36 identical respondents were arranged in descending order and divided into six group’s *i.e.* 6 respondents in each group. The groups were named as G1, G2, G3, G4, G5 and G6. For the purpose of item analysis, the middle two groups G3 and G4 were eliminated keeping four extreme groups with high and low scores. The data containing to the correct response for all the items in respect of these four groups were tabulated for calculating the difficulty and discrimination indices.

n_i = number of farmers who correctly answered i th item

N_i = total number of respondents to whom i th item was administered (for present study it is 36)

Item discrimination index

Calculation of discrimination index results in identifying the extent to which a specific item discriminates the farmers having more knowledge regarding the topic with those having poor knowledge level. The items which are either answered by all correctly or incorrectly are supposed to have no power of discrimination. The item discrimination index is calculate by “E1/ 3” formula given by Mehta (1958).

It is represented as:

$$E1/3 = \{(S1+S2) - (S5+S6)\} / (N/3)$$

Where, S1, S2, S5 and S6 are frequencies of correct answers from groups G1, G2, G5 and G6 respectively and N denotes the total sample size for item analysis. The discrimination index varies from 0 to 1.

Item validity

The assurance of good test validity rests upon good item validity. The methods employed to analyse item validity were expert/jury opinion and point bi-serial correlation. At the beginning content validity was ensured by administering the test items to different experts to assess the exemplification of the universe by the test and approve its face validity.

Point-biserial correlation

The point biserial correlation was used to know the internal consistency of the items i.e. the relationship of the total score to a dichotomized answer to any given item. In a way, the validity power of the item was computed by the correlation of the individual item of preliminary knowledge the test is calculated by using the formula suggested by Garret (1966).

$$r_{pbis} = \frac{MP - MQ}{SD} \times \sqrt{pq}$$

rpbis = Point biserial correlation.

MP = Mean of the total scores of the respondents who answered the item correctly.

$$MP = \frac{\text{Sum total of } XY}{\text{Total Number of correct answer}}$$

MQ = Mean of the total scores of the respondents who answered the item incorrectly.

$$MQ = \frac{\text{Sum total of } X - \text{Sum total of } XY}{\text{Total number of Wrong answers}}$$

SD = Standard deviation of the entire sample.

P = Proportion of the respondents giving the correct answer to the item.

$$P = \frac{\text{Total number of correct answers}}{\text{Total number of respondent}}$$

Q= Proportion of the respondents giving an incorrect answer to the item (or) Q = 1-P

X = Total score of the respondent for all items.

Y = Response of the individual for the items i.e. (Correct = 1; Incorrect = 0)

XY = Total score of the respondent multiplied by the response of the individual to the item. i.e. (Correct =1; Incorrect = 0)

Items having significant point biserial correlation either at 1 percent (or) 5 percent level was selected for the final test of the knowledge.

Table 2: Difficulty index, discrimination index and point-biserial correlation coefficient of knowledge items related to orange cultivation practices

Sr. No.	Knowledge Items	Difficulty Index (P)	Discrimination Index (DI)	Point-Biserial Correlation Coefficient (rpbi)
1*	What is the optimal temperature range for orange tree growth?	75.00	0.33	0.37
2*	Which type of soil is best suited for the orange cultivation?	63.88	0.58	0.57
3*	What is the recommended depth for planting orange tree seedlings?	69.44	0.33	0.40
4*	What is the recommended pH range for soil in orange cultivation?	72.22	0.50	0.58
5	Which soil amendment is commonly used to improve soil structure in orange orchards?	44.44	0.08	0.03 ^{NS}
6*	What is the primary method of propagation used in orange cultivation?	72.22	0.33	0.34
7*	What is the spacing under high-density orange plantation?	72.22	0.42	0.38
8	What is the recommended size of pit for orange plantation?	86.11	0.42	0.47
9	Which is the best time for the application of farm yard manure?	50.00	0.17	0.18
10*	What is the primary method for controlling weeds in orange orchards?	69.44	0.58	0.43
11*	Which irrigation method helps conserve water and minimize weed growth in orange orchards?	61.11	0.67	0.61
12*	Mottled leaf and little leaf are characteristic symptoms of which nutrient deficiency?	75.00	0.42	0.37

Sr. No.	Knowledge Items	Difficulty Index (P)	Discrimination Index (DI)	Point-Biserial Correlation Coefficient (rpbi)
13	What is the composition of copper, lime and water for Boudreaux mixture?	75.00	2.58	0.56
14	Which is recommended micronutrient for Mn deficiency?	38.88	0.17	0.06 ^{NS}
15*	What cause flower drop in orange trees?	69.44	0.50	0.44
16*	Which crop is suitable for intercropping in orange orchard?	66.66	0.67	0.67
17	What is Suitable time for Fruit thinning?	80.55	0.17	0.23
18*	What chemical is used for fruit thinning?	55.55	0.58	0.56
19*	What is the maturity duration after flowering of orange fruits?	0.66	0.50	0.49
20	Which is best harvest time for orange?	83.33	0.08	0.10 ^{NS}
21*	Which insecticide is recommended for control of mealy bug in orange orchard?	50.00	0.75	0.60
22*	Which is most common pest for orange orchard?	61.11	0.42	0.37
23*	Which insecticide is recommended for control of white fly complex in orange orchard?	58.33	0.75	0.67
24*	Which is a suitable time for harvesting?	52.77	0.42	0.30
25*	What is the primary cause of fruit splitting in orange trees?	61.11	0.25	0.31
26	Which pruning practice helps in rejuvenating old orange trees?	30.55	0.17	0.19
27*	Which of the following diseases affects both leaves and fruits of orange trees?	38.88	0.50	0.36
28*	What is the recommended distance between rows in an orange orchard?	47.22	0.25	0.38
29*	What is the main purpose of formative pruning in young orange trees?	36.11	0.58	0.45
30*	What is the primary cause of fruit drop in orange trees?	44.44	0.25	0.26
31*	Which type of fertilizer is commonly used for orange trees during the fruiting stage?	61.11	0.33	0.28
32	What is the recommended time for applying fertilizer to orange trees?	27.77	0.08	0.09 ^{NS}
33	Which nutrient deficiency causes leaf yellowing in orange trees?	50.00	0.08	0.12 ^{NS}
34*	Which treatments is commonly used to manage Phytophthora in orange trees?	52.77	0.42	0.41
35*	What is the main purpose of training orange trees?	52.77	0.25	0.24
36*	Which insecticide is often used to control mite populations in orange trees?	58.33	0.25	0.31

*Selected items; NS: Non-Significant

Reliability of the test

To assess the reliability of the test, the split-half method was used due to its advantages over other methods. This approach allows for the collection of data in a single session, minimizing variations that can occur between two testing situations (Garret, 2007). The test items were randomly

rearranged and divided into two halves, one containing odd-numbered items and the other containing even-numbered items. The correlation coefficient between the two sets of scores was calculated, yielding a significant value of 0.70. This result indicates that the knowledge test is reliable and statistically significant.

Table 3: Reliability of the test

Reliability Statistics			
Cronbach's Alpha	Part 1	Value	.70
		N of Items	18 ^a
	Part 2	Value	.676
		N of Items	18 ^b
	Total N of Items		
Correlation Between Forms			.686
Spearman-Brown Coefficient	Equal Length		.814
	Unequal Length		.814
Guttman Split-Half Coefficient			.813

Table 4: Final list of screened knowledge items which are included in the standardized test

Sr. No.	Knowledge items
1	What is the optimal temperature range for orange tree growth?
2	Which type of soil is best suited for the orange cultivation?
3	What is the recommended depth for planting orange tree seedlings?
4	What is the recommended pH range for soil in orange cultivation?
5	What is the primary method of propagation used in orange cultivation?
6	What is the spacing under high-density orange plantation?
7	What is the primary method for controlling weeds in orange orchards?
8	Which irrigation method helps conserve water and minimize weed growth in orange orchards?
9	Mottled leaf and little leaf are characteristic symptoms of which nutrient deficiency?
10	What causes flower drop in orange trees?
11	Which crop is suitable for intercropping in orange orchard?
12	What chemical is used for fruit thinning?
13	What is the maturity duration after flowering of orange fruits?
14	Which insecticide is recommended for control of mealy bug in orange orchard?
15	Which is most common pest for orange orchard?
16	Which insecticide is recommended for control of white fly complex in orange orchard?
17	Which is a suitable time for harvesting?
18	What is the primary cause of fruit splitting in orange trees?
19	Which of the following diseases affects both leaves and fruits of orange trees?
20	What is the recommended distance between rows in an orange orchard?
21	What is the main purpose of formative pruning in young orange trees?
22	What is the primary cause of fruit drop in orange trees?
23	Which type of fertilizer is commonly used for orange trees during the fruiting stage?
24	Which treatments is commonly used to manage Phytophthora in orange trees?
25	What is the main purpose of training orange trees?
26	Which insecticide is often used to control mite populations in orange trees?

CONCLUSION

The construction of a knowledge test for assessing the knowledge level of orange growers regarding orange cultivation practices is an essential aspect towards enhancing the productivity and sustainability of orange cultivation. The effort has been made to create a knowledge test that can be used to assess the knowledge level of orange growers. The test includes several aspects of orange production, such as planting, Manure and fertilizers, irrigation, Soil, Training, Pruning, pest and disease control, and harvesting. The findings

of this study may be utilised to identify knowledge gaps among orange growers and design focused training programs to increase their proficiency and expertise. Furthermore, the knowledge test can be used by policymakers, researchers, and extension agents to evaluate the effectiveness of their programs and to make informed decisions about orange cultivation practices.

CONFLICT OF INTEREST

All authors declare that they have no conflict of interest.

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