



# Development of a Test to Measure the Knowledge Level of Growers on Recommended Cultivation Practices of Major Vegetables

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## **Authors' contributions**

*This work was carried out in collaboration among all authors. Authors KB and PKD designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Authors KB, PKD and IB managed the analyses of the study. Authors SP and SS managed the literature searches. All authors read and approved the final manuscript.*

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## **ABSTRACT**

The present study was conducted to construct and standardize a test to measure the knowledge level growers on recommended cultivation practices of major vegetable crops. The major steps followed for developing the test were construction of items, primary and final selection of items through difficulty index, discrimination index and biserial correlation. The final test comprised of 25 objective questions, referred to as items. The procedure adopted in the study can also be followed for developing knowledge test on any other aspect.

**Keywords:** Knowledge; vegetable; recommended cultivation practices; difficulty index; discrimination index; biserial correlation co-efficient.

## 1. INTRODUCTION

Vegetables are important constituents of Indian agriculture and nutritional security due to their short duration, high yield, nutritional richness, economic viability and ability to generate on-farm and off-farm employment. The country has witnessed tremendous progress in vegetable production, especially during the post green revolution period. Development of improved vegetable varieties/hybrids/ technologies through systematic research coupled with their adoption by the farmers and developmental policies of the government culminated in tremendous increase in area under vegetables (9.575 million ha), production (167.1 million t) and productivity (17.6 t/ha) in the country. Vegetables are good sources of nutrients, dietary fibre, phyto-chemicals and vitamins. Vegetables with shorter duration, higher productivity have resulted in greater economic returns to farmers. Vegetables are reported to be rich source of carbohydrates (sweet potato, potato, onion, garlic and methi), proteins (leguminous vegetables, leafy vegetables and garlic), vitamin A (tomato, carrot, drumstick, leafy vegetables), Vitamin B (garlic, tomato and peas), Vitamin C (drumstick leaves, Cole crops, leafy vegetables, green chillies and leaves of radish), minerals (leafy vegetables, drumstick pods). The country is blessed with diverse agro-climates zones with distinct seasons, making it possible to grow wide array of vegetables. An analysis of the knowledge level of growers on scientific vegetable cultivation practices is considered important to the subject of development of the growers as well as improving the productivity of vegetables in different agro-climatic situation.

It is also expected that the findings on knowledge level of farmers on recommended package of practices of vegetable cultivation would be of some help to planners, policy makers, research workers and extension functionaries in preparation of blue print for developing knowledge of vegetable growers on scientific vegetable cultivation practices leading to improved productivity of vegetable. A study conducted on the knowledge level of farmers about climate change in arid ecosystem of India revealed that most of the respondent (73%) knew that maturity period of major crop is reducing due to climate change. Similarly majority of farmers (61%) knew about the impact of global warming

on sea level and 86% respondents had knowledge about the impact of climate change in arid ecosystem [1]. A study conducted on knowledge of small tea growers regarding scientific tea cultivation practices revealed that majority of respondents (72.00%) had medium level of knowledge, whereas 15.00 per cent and 13.00 per cent of growers had low and high level of knowledge about scientific tea cultivation practices, respectively [2]. Knowledge was considered to be one of the important components of behaviour playing an important role in the covert and overt behaviour of an individual [3]. A study on knowledge of apple growers helped in understanding about prominence of promoting scientific cultivation practices of apple by the growers as well as helped to bond the knowledge gap between the farmers and researchers [4]. Agricultural knowledge was defined as the set of concepts, meanings and skill developed over time by individuals or group through the processing of information [5]. Knowledge was conceptualized as a body of understood information possessed by an individual or by a culture [6]. Knowledge was also defined as those behaviour and test situations which emphasized the remembering either by recognition or by recall of ideas, material or phenomena [7]. In this study, the ideas, material or phenomena were the items or questions included in the test used for measuring the knowledge level of the respondents on recommended package of practices of vegetable cultivation.

## 2. MATERIALS AND METHODS

The study was carried out in Lakhimpur district where out of three agricultural sub-divisions (Dhakuakhana, North Lakhimpur and Narayanpur), one sub-division, namely, Narayanpur was selected at random. A list of villages under the sub-division was prepared with the help of concerned extension functionaries from which two villages were selected at random for the study. From each of the two selected villages, 30 vegetable growers were selected randomly. Thus, 60 vegetable growers constituted the sample of the study.

An attempt was made to develop and standardize a test to measure the knowledge level growers on recommended cultivation practices of major vegetable crops. The

procedure followed in construction of the knowledge test is described in the following paragraphs [8].

### 2.1 Preliminary Selection of Items for Knowledge Test

A total of 54 numbers of objective questions, referred to as an items, were collected by consulting the package of practices for vegetable crops and bulletins published by Assam Agricultural University. A few research workers of the Department of Horticulture and Extension Education of the university were also consulted during collection of items pertaining to improved practices of vegetable cultivation. The important factor considered in collecting in the items for the knowledge test was to determine and classify the object to be measure by it. After collection of items, these were subjected to scrutiny by a panel of experts. The preliminary selection of items was then made for the raw knowledge test on the basis of following criteria [9].

- i) Response to the items should promote thinking rather than rote memorizing.
- ii) The items should differentiate the well informed farmers from less informed ones.
- iii) The items should cover all the important areas of knowledge about recommended package of practices of vegetable cultivation.
- iv) The items should have fairly difficulty values [10].

In light of the above criteria, 42 items were selected to include in the raw knowledge test battery. Before editing of items, they were framed in the form of objective type questions having correct or incorrect type of answers.

### 2.2 Item-analysis

To analyse 42 items included in the raw knowledge test, they were administered to a sample of 60 farmers selected for the study. Their responses were quantified by giving a score of one to correct answer and zero to an incorrect answer. After computing the total scores obtained by the farmers on the raw test, they were divided into six equal groups arranged in descending order of total scores. These six groups were labelled as G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub>, G<sub>4</sub>, G<sub>5</sub> and G<sub>6</sub> respectively with ten respondents in each group. For the purpose of item analysis, the middle two groups were eliminated keeping four extreme groups with high and low scores. The items for

the final knowledge test battery were selected on the basis of the following three indices.

- i) Item Difficulty Index(P)
- ii) Item Discrimination (E1/3)
- iii) Biserial correlation co-efficient (r<sub>b</sub>)

#### 2.2.1 Item difficulty index (P)

This index was used to find out the extent to which an item was difficult to answer by the respondent. The value of P was expressed in terms of percentage of correct responses obtained for a particular item and worked out as follows:

$$P = \frac{\text{number of respondents giving correct answer}}{\text{total number of respondents}} \times 100$$

The items with P values ranging from 20 to 85 were considered for the final knowledge test.

#### 2.2.2 Item discrimination index (E1/3)

The function of item discrimination index, E<sub>1/3</sub> was to find out whether an item really discriminates a well-informed farmer from a poorly-informed one. To calculate the values of E<sub>1/3</sub>, the following formula was used.

$$E1/3 = \frac{(S_1 + S_2) - (S_5 + S_6)}{N/3}$$

Where,

S<sub>1</sub>, S<sub>2</sub>, S<sub>5</sub>, S<sub>6</sub> = frequencies of correct answers in groups G<sub>1</sub>, G<sub>2</sub>, G<sub>3</sub> and G<sub>6</sub> respectively.

N= total number of respondents in the item analysis.

The items with discrimination index values ranging from 0.20 to 0.80 were included in the final knowledge test.

#### 2.2.3 Biserial correlation

The biserial correlation was used for the test of item validation when the criterion of validity was regarded as internal consistency, that is, relationship of the total score to a given item. The co-efficient of biserial correlation (r<sub>b</sub>) was calculated for each item by using the following formula [11].

$$r_b = \frac{\bar{X}_p - \bar{X}_q}{S_t} \times \frac{pq}{Z}$$

Where,

- $r_b$  = biserial correlation co-efficient
- $\bar{X}_p$  = mean of x values for the higher group in the dichotomized variable.
- $\bar{X}_q$  = mean of x values for the lower group in the dichotomized variable.
- P = proportion of cases in the higher group.
- Q = proportion of cases in the lower group.
- Z = Ordinate of the unit normal curve at the point of division between segments containing p and q proportion of the cases.
- $S_t$  = standard deviation of the total sample in the continuously measured variable.

The items with biserial correlation co-efficients ( $r_b$ ) significant at 5 per cent probability level were selected for the final knowledge test.

On the basis of the values of P, E1/3 and  $r_b$ , out of 42 items, 25 items were retained for the final knowledge test battery.

### 2.3 Reliability and Validity of the Test

The reliability of the test was estimated with the help of split-half method (odd-even design) by applying the following formula [12].

$$r_{tt} = 1 - \frac{S_d^2}{S_t^2}$$

Where,  $r_{tt}$  stands for reliability coefficient of the total test scores, d is the difference between two half scores,  $S_d$  is the standard deviation of those

differences and  $S_t$  is the standard deviation of total test scores.

The intrinsic validity of the test was estimated by taking the square root of the reliability coefficient [13].

### 2.4 Method of Administration

The knowledge level of a respondent on recommended cultivation practices of major vegetable crops was indicated by the total score received by him/her on the test. The answers for the questions in the knowledge test were in dichotomous categories. In computing the knowledge scores of the respondents, correct answer to a question was given one score and incorrect answer was given zero score. The total score on the test had a theoretical range of 0 to 25.

## 3. RESULTS AND DISCUSSION

Based on the results of item analysis, 25 items were retained for inclusion in the final knowledge test. The final version of the test with values of P, E1/3 and  $r_b$  for different items are presented in Table 1. An examination of the items included in the final knowledge test reveals that they pertain to different aspects of recommended cultivation practices of major vegetable crops. This indicates good representativeness of the test items. The coefficient of reliability and coefficient of intrinsic validity of the instrument were found to be 0.80 and 0.92 respectively, which indicated that test was dependable or stable as the measuring instrument.

**Table 1. Final Knowledge test with values of Difficulty Index, Discrimination Index and Co-efficients of Biserial correlation**

SI no	Items	Difficulty index (P)	Discrimination index (E1/3)	Biserial correlation co-efficients ( $r_b$ )
1	Name at least one recommended variety of cauliflower.	73.33	0.40	0.69
2	Name at least one recommended variety of cabbage.	63.33	0.30	0.57
3	Name at least one recommended variety of potato.	66.66	0.50	0.43
4	Name at least one recommended variety of tomato.	76.66	0.60	0.81
5	How much quantity of seed is required for 1 ha of land for cauliflower cultivation?	83.30	0.30	0.83
6	How much quantity of seed is required for 1 ha of land for cabbage cultivation?	46.60	0.70	0.58

Sl no	Items	Difficulty index (P)	Discrimination index (E1/3)	Biserial correlation coefficients ( $r_b$ )
7	How much quantity of potato tuber is required for 1 ha of land for potato cultivation?	80.00	0.20	0.66
8	How much quantity of seed is required for 1 ha of land for tomato cultivation?	83.30	0.30	0.86
9	How can you treat the potato tubers before planting?	63.33	0.40	0.61
10	What should be the row to row and plan to plant spacing in cauliflower cultivation?	73.33	0.30	0.69
11	What should be the row to row and plan to plant spacing in cabbage cultivation?	76.60	0.70	0.77
12	What should be the row to row and plan to plant spacing in tomato cultivation?	73.30	0.60	0.48
13	What should be the row to row and plan to plant spacing in potato cultivation?	23.30	0.50	0.59
14	Name at least one Nitrogenous fertilizer that can be applied for cauliflower / cabbage/ potato / tomato cultivation.	46.60	0.60	0.83
15	Name at least one Phosphatic fertilizer that can be applied for cauliflower / cabbage/ potato / tomato cultivation.	80.00	0.30	0.59
16	Name at least one Potassic fertilizer that can be applied for cauliflower / cabbage/ potato / tomato cultivation.	46.66	0.30	0.57
17	What should be the doses of NPK or Fertilizers for potato crop?	33.33	0.20	0.49
18	Why Borax is important for cauliflower and cabbage cultivation?	50.00	0.30	0.46
19	Name at least one major disease of cauliflower / cabbage.	66.66	0.40	0.43
20	Name at least one major disease of potato crop.	73.30	0.50	0.89
21	Name at least one major disease of tomato crop.	84.30	0.30	0.58
22	What control measure should be taken against late blight in potato cultivation?	43.33	0.30	0.84
23	Name at least one major insect pest of cauliflower/cabbage crop.	70.00	0.70	0.68
24	Name at least one major insect pest of potato crop.	76.66	0.60	0.77
25	Name at least one major insect pest of tomato crop.	83.33	0.40	0.65

The values of difficulty index (P) of items of the final knowledge test ranged from 23.30 to 84.30 per cent. Similarly, the values of discrimination index (E1/3) of items of the final knowledge test ranged from 0.30 to 0.70. The magnitudes of coefficient of biserial correlation ( $r_b$ ) of items of the test ranged between 0.43 and 0.89. It was observed that items constructed to test the farmers' knowledge on recommended cultivation

practices of major vegetable crops were reasonably stable and dependable for measurement of knowledge level of small tea growers. In addition, the findings of item analysis revealed that majority of respondents owned moderate level of knowledge on recommended cultivation practices of major vegetable crops. The findings of the study are supported by the findings of a number of earlier studies [14,15,16].

#### 4. CONCLUSION

The knowledge test developed in the study can be readily used by researchers as well as extension functionaries dealing with scientific cultivation of vegetable crops. The test can be suitably translated into vernacular and administered accordingly. The procedure adopted in the study can also be followed for developing knowledge test on other aspects.

#### CONSENT

As per international standard or university standard, participant's written consent has been collected and preserved by the authors.

#### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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