

Original Research Article

Construction of Knowledge Test to Measure Knowledge Level of Apple Growers of Arunachal Pradesh on Package of Practices of Apple

ABSTRACT

The knowledge test was developed to measure the knowledge level of apple growers. 32 items were primarily fabricated on the basis of ratifying rational rather than root memorization and to classify the sound erudite apple growers from the ailing erudite ones. The scores obtained from sample respondents were exposed to item analysis, embracing of item difficulty index & item discrimination index. In the ultimate selection, the scale consisted of 22 items with difficulty index ranging from 30-80 and discrimination index ranging from 0.30 to 0.55. To check the reliability of knowledge test being developed Split-Half method was employed and it was found to be 0.701.

Keywords: Knowledge test; Apple growers; Difficulty index; Discrimination index; Reliability

INTRODUCTION

Apple (*Malus domestica*; family-Rosaceace) is a deciduous fruit mainly grown in the north western mountainous states like Himachal Pradesh, Uttarakhand, Jammu and Kashmir. In the north eastern region it is grown in few hilly states like Arunachal Pradesh, Nagaland, Sikkim on a limited scale. Two leading apple producing states in India are Jammu and Kashmir and Himachal Pradesh, known for their distinctive and popular varieties and are also branded as the apple state of India. Uttarakhand and Arunachal Pradesh has of late started producing apple for commercial purposes. Apple is one of the most widely grown fruit crops in Arunachal Pradesh. The apple fruit of the state has already attained commercial identity not only in the local markets but also in the national as well as international markets. The total area and production under apple cultivation during the year 2015-16 was reported to be 4682 Ha and 7281 MT as well as productivity of 1.55 MT/Ha respectively [1]. The supply chain of apples in the state is laden with inadequacies across the entire chain leading to deprived price realization of growers on one hand and inflated prices paid by consumers on the other. In the world, India is the 4th largest producer of apple. The total production and area under apple cultivation in India is 2.51 MT and 0.31 MH respectively in the year 2015. India exports 21085. 23 MT of apple in 2016-17 [2]. Owing to dearth of post harvesting infrastructure such as transportation, cold chains, storage as well as processing facilities, postharvest losses in apple in the year 2015 was reported to be 10.39 per cent [3]. India's apple area falls under the North Western Hills region, covering two major producing districts of H.P. (Shimla and Kullu), four major producing districts of Jammu and Kashmir (Baramullah, Kupwara, Shopian and Kulgam) and four major producing districts of Uttarakhand (Uttarkashi, Almora, Nainital Dehradun.). In case of North-eastern Hills region, good quality apple is grown in the West Kameng district of Arunachal Pradesh. West Kameng district produces the highest amount of apple in the state [4]. During 1960s, apple was introduced in the district. But with the instigation of Horticulture Technology Mission Scheme, the people of the district start cultivation of apple on commercial basis expressly in the areas viz. Zimthung, Dirang, Shergaon, Morching, Wangho, Chillipam, and Jigaon. The infestation of pest and diseases was the most austere problem reported by the s farmers. The farmers also reported problems of maintenance of orchard, lack of technical knowledge, problem of marketing, training and know-how, non-availability of labour, problem of storage, risk factor and failure of extension service, lack of sufficient finance, erratic supply of seeds and intermittent supply of seeds and derisory availability, road connectivity etc. [5] Though multidimensional efforts had been made to upsurge the production of apple in the state of Jammu and Kashmir but appropriate consideration to marketing, ignorance from government side, lack of research, infrastructure and development had led to negative effects [6]. Measures should be taken up to attend major problems identified, which include spurious pesticide peril, enormous number of intermediaries, lack of apt grading, lack of trademark and labelling, dual inter-state taxation and high shipping charges [7]. Farmers would momentarily benefit from outreach in addition to existing training plans, refining their access to valuable knowledge regarding both caring for crops and storing

Comment [H1]: Include the country India somewhere here for readers to know the exact country where the study was conducted

Comment [H2]: You have mentioned two states but you are listing three

Comment [H3]: Repetition. Rebuild the sentence

Comment [H4]: Give the country's name. Don't assume readers will imagine it is India

Comment [H5]: Give reference of this information

Comment [H6]: List the area you have mentioned. You have just given the overall production

Comment [H7]: Read again and improve what you want to express

Comment [H8]: This information is irrelevant and does not show any progress in the introduction you have written

Comment [H9]: Reorganise information in this introduction. You are repeating what you've mentioned previously

Comment [H10]: Refine this information to show why it is relevant to have it in your introduction. Make it add value in your introduction

Comment [H11]: What are these. If they are areas producing apple revise you punctuation

Comment [H12]: It might be interesting to give the amount of cash attracted by apple from exportation or the rate of apple contribution in the national economy of India. This expresses much better the contribution of the fruit in the country

Comment [H13]: If you think this information is relevant thus, you have to redefine your title. There is a disconnection between the title and this introduction. Work on both and bring out why you have chosen to research on apple in **Arunachal Pradesh**

Comment [H14]: From the sentence before this, you could have written another paragraph because you are introducing biotic factors as pests and diseases and skills needed in apple farming

Comment [H15]: What do you mean here?

Comment [H16]: Here you can say: insufficient finance

Comment [H17]: It is better to cite all the shortcomings hindering apple production in this area

Comment [H18]: Why are you talking of these two areas while they are not mentioned in the research topic

Comment [H19]: Are you still in your topic?

53 them until they can be sold for higher profit. Inappropriately, a chief impediment to farmers is their
54 relative scarcity of funds. If farmers were to find a way to organize and act as a cooperative, they
55 would be able to have grander power over market prices and enhanced skill to store and sell their
56 crops when it is most advantageous to them [8]. Malpractices by market functionaries, lack of market
57 intelligence, poor connectivity of farm to main road, problem of storage, high cost of packing
58 materials, high cost and non-availability of transportation facility etc. are the problems which are being
59 faced by the farmers. Meanwhile market functionaries are facing with the problems viz. breach of
60 contract from farmer's side, problem of credit recovery, poor grading of apples etc. in the market [9].
61 The apple orchardists in Kullu district were facing an array of marketing problems which need to be
62 addressed on priority [10]. One of the chief hitches that most apple growers in West Azerbaijan faced
63 was the stage after harvest. This stage was comprising of issues related to storage and marketing of
64 products. Results was indicative of the fact that knowledge of apple cultivators were in medium level
65 regarding principles of apples storage. Privation of knowledge about pests and diseases in storage
66 stage, causes numerous hitches for cultivators. The findings was further indicative of the fact that only
67 an insignificant per cent (2.10 per cent) of the respondents had adequate knowledge vis-à-vis
68 recognition of pests [11].

69 Knowledge is an essential tool, which enables farmers in decision making to embrace the endorsed
70 practices to make apple farming more lucrative and viable. The knowledge test of apple may also
71 craft the understanding about prominence of promoting scientific cultivation practices by the growers
72 as well as help to bond the knowledge gap between the farmer and researcher and harvest gap
73 between farmer's field and research station. Thus, it may also accelerate the growers to upsurge the
74 turnover and have amended livelihood security, competence to educate their children, tenable source
75 of income and abridged vulnerability. On this background, an effort was made to develop a knowledge
76 test on cultivation practices of apple for its application to the farmers in Arunachal Pradesh.

78 MATERIALS AND METHODS

79 Item collection: The content of knowledge test was composed of queries called items. Items for the
80 test were amassed from diverse sources, such as field extension personnel, subject matter specialists
81 in horticulture, literature, and the investigator's own experiences. The queries were designed to
82 measure the knowledge level of apple growers about package of practices of apple.

83 Preliminary medley of items: The hotchpotch of items was done on the basis of the following
84 standards:

85 (i) It should approve logical rather than rote-memorization, and

86 (ii) It should disengage the well-informed apple growers from the ill-informed ones and have a
87 convinced difficulty value. Based on these two means 32 items were initially collected for formation of
88 the knowledge test which were in objectives form i.e. dichotomous or multiple choice format. A
89 schedule was thus prepared with these 32 items for administering it to the apple growers for item
90 analysis and screen out additional items.

92 RESULTS & DISCUSSION

93 **Preliminary administration of test:** Items were pretested and modified by administering to 30
94 randomly selected apple growers. Score was given as '1' for right and 0 for wrong answer for each of
95 the 32 items. The total accurate response was the knowledge score obtained by an individual farmer.
96 The farmers were then distributed into 6 groups (G1 to G6) each consisting of 5 farmers. The farmers
97 in each group were arranged in plummeting order according to the scores obtained by them. Only four
98 extreme groups with high and low scores were ruminated for calculation of item difficulty and item
99 discrimination indices.

100 **Item analysis:** The item analysis of a test provides two types of information: item difficulty and item
101 discrimination as informed by [12]. The index of item difficulty exposed how challenging an item was
102 whereas the index of discrimination quantified the extent to which an item discriminates to well
103 inform individuals from the ill-informed ones.

104 **Item difficulty index (Pi):** The difficulty index of an item was defined as the proportions of apple
105 growers giving precise responses to that particular item. This was calculated by the formula:

Comment [H20]: Repetition. Let them be altogether

Comment [H21]: This can be the starting of another paragraph

Comment [H22]: Revise your introduction. Repetition. Do the same for all repetitions

Comment [H23]: This confuses the reader

Comment [H24]: Read other articles to see how others have reported the facts from other scientists in their works

Comment [H25]: Improve the quality of this sentence

Comment [H26]: You could present what is the meaning of knowledge test and how it will contribute to the progress of science. You could have presented the tool in order to have it adopted by other scientists not only in apples farming but also in other assessments. Your introduction will not support your topic if you have not made clear the concept of knowledge test. Is it a new tool you have designed or it had been used by other scientists previously

Comment [H27]: What does this mean in details. Find a way to say it in a way lay persons can understand

Comment [H28]: Express it in details

Comment [H29]: Include the area where your knowledge test was pretested

Comment [H30]: In such a case, you can give the author's name without the date of publication before the brackets. Read other articles

106 $P_i = n_i/N_i \times 100$

107 Where, P_i = Difficulty index in percentage of the i^{th} item.

108 n_i = Number of apple growers giving correct response to i^{th} item.

109 N_i = Total number of apple growers to whom i^{th} item was administered

110 **Item discrimination index:** The discrimination index was calculated by administering the method
 111 given by [13]. Item discrimination index was calculated by the formula given below:

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

112

113 Where, S1, S2, S5 and S6 were the respective frequencies of correct answers in G1, G2, G5 and G6
 114 groups respectively, and N = Total number of apple growers in the sample of item analysis.

115 **Selection of items for test:** Two criterions *i.e.* item difficulty index and item discrimination index
 116 were calculated for throng of items in the final set-up of the knowledge test. In the current study, items
 117 with difficulty index faltering from 30 to 80 and discrimination index faltering from 0.30 to 0.55 were
 118 included in the final format of the knowledge test. Item difficulty index and item discrimination index of
 119 all the 32 items were calculated and 22 items which fulfilled both the gauges were selected for the
 120 final format of knowledge test as shown in Table-1.

121 **Table 1:** Difficulty Index (DI) and Discrimination Index (Disc. Index) for Knowledge Test Items

Item No.	Statements	DI	Disc. Index	S= Selected item and R = Rejected item
1.	Which of the following variety of apple is/are recommended for your area? Kindly suggest any other variety if you know.	63.33	0.7	R
2.	Do you know the most suitable time/month for plantation of apple and its follow-up?	66.67	0.8	R
3.	Do you know the optimum temperature during the growing season for apple cultivation?	80	0.3	S
4.	Which of the following is/are the soil recommended for improved apple cultivation?	76.67	0.3	S
5.	Do you seed treatment of apple for improved cultivation? If Yes, kindly share your knowledge/skill.	23.33	0.5	R
6.	Which of the following is/are the recommended pit size for apple transplantation?	76.67	0.4	S
7.	What is/are the recommended spacing for apple cultivation?	80	0.3	S
8.	Which of the following is/are the number of apple plants that you can grow in 1ha of land?	73.33	0.4	S
9.	What do you understand by the term training of apple?	76.67	0.4	S
10.	What do you understand by the term pruning of apple?	73.33	0.4	S
11.	What is/are the quantity of farm yard manure to be incorporated during planting?	73.33	0.3	S
12.	What is/are the total recommended fertilizer dozes for improved apple cultivation?	66.67	0.2	R
13.	Which of the following is/are the recommended time period for irrigation?	56.67	0.7	R
14.	Which of the following irrigation system is/are the recommended for large commercial plantation of apple?	76.67	0.3	S
15.	Do you know about weeding schedule in apple? If yes, how do you follow the recommended schedule of	20	0.4	R

Comment [H31]: Apply the same procedure. Author's name and number in brackets

Comment [H32]: This could be a section as statistical analysis. I don't find it convenient in results and discussion

Item No.	Statements	DI	Disc. Index	S= Selected item and R = Rejected item
	weeding to control the weed?			
16.	Do you know what kind of material is used for mulching an apple tree?	73.33	0.4	S
17.	Are you aware about the important pests of apple?	80	0.5	S
18.	Are you aware about the diseases of apple?	73.33	0.4	S
19.	Do you know IPM on improved apple cultivation? Please share important IPM techniques on improved apple cultivation.	10	0.1	R
20.	Which method of propagation of apple yields early maturing of fruits?	63.33	0.1	R
21.	What do you understand by the term Hybrid? If yes, mention hybrid varieties of apple.	26.67	0.2	R
22.	In which of the following year/years apple starts bearing fruits?	76.67	0.3	S
23.	Which of the following is/are the indication for harvesting of apple?	66.67	0.2	R
24.	Which of the following is/are relative humidity during storage of apple?	56.67	0.3	S
25.	Which of the following is/are the optimum temperature during the storage of apple?	76.67	0.5	S
26.	Which of the following is/are the reason apple fruits are placed in a cool and ventilated place?	56.67	0.3	S
27.	What are the consequences of keeping bee colonies in apple orchard?	80	0.3	S
28.	Which of the following is/are the storage life of apple fruits after harvesting?	56.67	0.3	S
29.	What do you understand by the term grading of apple. If you know, please mention grading of apple fruits is done on what basis?	53.33	0.5	S
30.	Which of the following is/are the materials used for packing apple fruits?	70	0.4	S
31.	Which types of planting method is used in valleys/slopes?	50	0.3	S
32.	Do you know and visit nearby market where apple auction is held to market the produce?	60	0.3	S

122 **Reliability:** The reliability of knowledge test being developed was tested by using Split-Half method:
123 The coefficient of correlation between two sets of scores was calculated and found to be 0.701 was
124 significant at 1% level thus indicating that the internal consistency of the knowledge test developed for
125 the study was relatively high. Knowledge test developed for cotton farmers on health hazards of
126 pesticides usage included 26 item statements as indicated by [14]. Knowledge test constructed on
127 package of practices of paddy comprised of 35 item statements as reported by [15]. Knowledge test
128 developed for farmers on chickpea demonstration consisted of 15 item statements in the final
129 selection as signposted by [16]. Knowledge test constructed for agricultural extension personnel on
130 m-tools contained 14 item statements in final selection as stated by [17]. Knowledge test constructed
131 for farmers on SRI technology encompassed of 33 item statements as indicated by [18]. Knowledge
132 test on vegetable farming (cauliflower and carrot) comprised of 11 items as stated by [19]. Out of
133 aggregate 55 items, 20 items were finally selected where 8 items represented knowledge on
134 mitigation practices and 12 items on adaptation practices of climate change [20]. Knowledge test on
135 natural resource management practices comprised of 30 items as stated by [21]. Out of 46 items on
136 knowledge test developed for IPM, INM and IWM Practices, 28 items were selected in the final format
137 as stated by [22].

Comment [H33]: This could be displayed under statistical analysis and before results and discussion

138 **Content validity of knowledge Test:** In the final selection of items, caution was taken to contain
139 items covering the whole universe of apposite behavioral aspects of the respondents with respect to
140 knowledge growing practices of apple. Items were collected through innumerable sources including
141 boffins and henceforth it was presumed that the scores obtained by administrating this test had
142 measured the knowledge of the respondents as anticipated.

Comment [H34]: Where are you discussing the results and what have you found?

143

144 CONCLUSION

145 For entrepreneurship expansion precise knowledge of growing apple is of prime importance. It is also
146 pivotal for evaluation and framing need based planning for the socio economic progression of apple
147 growers. Barely there is any such standard technique for measuring the knowledge level of apple
148 growers. With this anecdotal a knowledge test scale was developed to envision the knowledge level
149 of the apple growers. Knowledge test fabricated was found to be extremely firm and unswerving for
150 measurement of the knowledge level of the apple growers. So, out of the cumulative 32 item
151 statements only 22 item statements were integrated in the final knowledge test.

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