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TEST TO MEASURE THE KNOWLEDGE LEVEL OF FARMERS REGARDING SAFE USE OF PESTICIDES

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ABSTRACT

A study was designed to develop a standardized test to measure the knowledge of vegetable growers. A preliminary test of Sixty Five knowledge items were initially administered to 30 vegetable growers for item analysis. Finally 39 knowledge items were included in the final format of the knowledge test based on difficulty index (30 to 80), discrimination index (0.30 to 0.75). The reliability of the knowledge test was measured with the help of test-retest method and the reliability coefficient was found to be 0.841, which indicates that the knowledge test is reliable. Meanwhile, the correlation between odd and even set was found positive. The validity of the test was established on account of both "content validity" as well as "construct validity". Point bi-serial correlation coefficient was used to test the construct validity of the test. Content validity essentially involves the systematic examination of the test content to determine whether it covers a representative sample of the behaviour domain to be measured which is knowledge here. Accordingly, all possible statements, covering wide aspects of safe use of pesticides were collected.

Keywords : *knowledge test, vegetable growers, pesticides, item analysis*

INTRODUCTION

In Punjab state the vegetables are grown in an area of 30.06 lac hectares producing 61.09 lac tonnes with average productivity of 20.0 tonne per hectare and the consumption of pesticides in the Punjab has reached 5,270 metric tonnes in 2024 and around 4,930 metric tonnes in 2019-20. Punjab is the third leading Indian state in pesticide consumption, however, safe use of the pesticides is the most ignored in modern day agriculture. Further studies revealed that only 28.9 per cent of farmers of Punjab surveyed thought it was crucial to mix and apply pesticides according to the right instructions, and 26.8% said it was important to store pesticides safely both before and after use. (MAFW, GOI-2024) Pesticides are applied to crops both before and after a campaign to raise awareness. Several activities, such as training sessions, street performances, literature distribution, school quizzes, etc., significantly raised farmers' understanding of various elements of safe pesticide usage (11.4–27.3%). Nonetheless, a mission mode plan is necessary to improve farmers' understanding of pesticide safety and to alter their mind set toward sanitation and hygiene practices. (Pandher 2018)

It was very common among farmers of Punjab that as they carried the leaking backpack pumps on their backs, their bodies and clothes got wet. Before spraying, workers frequently handled pesticides with their bare hands and other body parts while opening, pouring, mixing, and loading them. Inappropriate practices like tearing or cutting packets with teeth also increased worker exposure to pesticides. Most farmers did not know that pesticides could be absorbed through the skin or inhaled; instead, they believed that washing would remove the chemical pollution from the body. It is necessary to raise applicators' understanding and influence their attitudes regarding their traditional practices. (Jallow *et al,* 2014)

Bloom et al. (1956) defined knowledge as those behaviour and test situation, which emphasized the remembering, by either recognition or recall, of ideas, materials and phenomenon. Knowledge test measures the level of relevant knowledge possessed by a farmer in a particular area. Knowledge is one of the important components of behaviour and as such plays an important role in the covert and overt behaviour of an individual (Mallappa et al., 2023). Knowledge test score is also used as a variable to test its relationship with other variables. Therefore, a study was designed to develop a standardized test to measure the knowledge of farmers. Keeping in view the importance of knowledge as one of the basic components that greatly affect the extent of adoption of the recommended practices the present

study entitled "Construction of a Test for Measuring the Knowledge level of Vegetable Growers Regarding Safe Use of Pesticides in Punjab".

OBJECTIVE

To construct a knowledge test for assessing knowledge level of vegetable growers regarding safe use of pesticides.

METHODOLOGY

The study was conducted during the year 2025 in Punjab state of India. Thirty non- sample vegetable growers from district Amritsar were taken. Later, for calculating reliability of the developed knowledge test thirty fresh non-sample respondents from District Mansa were taken. Further, the developed knowledge test will be administered to test the knowledge level and gain in knowledge of 120 respondents of the main study area. Following steps were followed in the process of knowledge test construction.

Collection of items

The content of the knowledge test is composed of questions called items. Items for the test were collected from different sources, such as Directorate of plant protection, Quarantine and storage, Department of Agriculture and Farmer's welfare Punjab. Package of practices regarding vegetable crops by Punjab Agriculture University The knowledge test included closed end items (Yes/No type questions) (Vegad *et al.,* 2021). The test was developed for determining he knowledge of the vegetable growers. A set of "65" raw items were selected covering most of the areas related to pesticide sprays and application.

Pre-testing and item analysis

The preliminary knowledge test battery was administered to the respondents of non-sampling area *i.e.* Amritsar. The scores were assigned 1 and 0 for correct and incorrect answers, respectively; and, then, the total score for each respondent was calculated by summing up his/her scores for all the items. Later on, the "Difficulty Index" and "Discrimination Index" for each of the item were calculated, separately. Point bi-serial correlation was also calculated for item analysis, as there were genuine dichotomous items in the knowledge test. (Ray and Mondal, 2014).

(1) Difficulty index

It indicates about how much a statement is difficult and is expressed in terms of correct response obtained from a particular question and worked as below:

$$P = \frac{\text{No. of respondents giving correct answer}}{\text{Total No. of respondents}} \times 100$$

For the present study, the items with 'P' value ranging from 30 to 80 were retained finally.

Discrimination index

It indicates the ability of an item to differentiate the well informed respondents from poorly informed ones and is calculated by:

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

Where,

S_1, S_2, S_5, S_6 = Frequencies of the correct answer.

N = Total number of respondents in the item analysis.

The items with discrimination index value above 0.30 to 0.75 were retained for inclusion in the final test.

All the 65 items were administered to each one of the thirty respondents. The responses were collected and quantified by assigning a score of 1 to correct answer and 0 to incorrect answer. A respondent's total score was attained by summation of the score for all questions. After calculating the scores obtained by 30 respondents, the scores were arranged from the highest to the lowest according to magnitude. Then the respondents were divided into six equal groups of five members each and were labeled as G1, G2, G3, G4, G5 and G6. S_1, S_2, S_5, S_6 are the frequencies of the correct answers in the group, G1, G_2, G_5 and G_6 respectively. Middle two groups (G_3 and G_4) were eliminated thus keeping four extreme groups (G_1, G_2, G_5 and G_6) with high and low score.

Group no.	G1	G2	G3	G4	G5	G6
Range of scores	50-47	46-44	42-36	35-28	27-18	17-8
No. of respondents	5	5	5	5	5	5

Point biserial correlation

Point biserial correlation (rpbis) is used to measure the degree of association between total scores with dichotomized response to any given item. By this test the criterion of validity of test is considered to be internally consistent. Point biserial correlation was calculated by using the following formula.

Where,

Rpbis = Point biserial correlation coefficient

Mp = Mean of the total scores of the respondents who answered the item correctly

Mq = Mean of the total scores of the respondents who answered the item incorrectly

S.D = Standard deviation of entire sample

p = Proportion of respondents giving correct answer to the Item

q = Proportion of respondents giving incorrect answer to the Item

Items with significant point biserial correlation coefficient at 0.01 % and 0.05 % of probability level were selected for inclusion in final knowledge test (Table 1).

Final selection of Items

Those items, which met all the following conditions, were finally selected for the knowledge test: Difficulty index (DI) between 30 and 80 Discrimination index value between 0.30 and 0.75 and correlation coefficient at five and one per cent level of significance. Thus, a total of 39 items from a total 65 items were retained finally, for the final knowledge test.

Reliability of the test

Test-retest method was used to find out the reliability. In this method, the knowledge test was administered to 30 respondents with 15 days interval to same group of respondents in non-sample study. The scores obtained two times were correlated and the coefficient was found to be significant (r=0.841) indicating the reliability of the test to measure the knowledge of knowledge level of farmers regarding safe use of pesticides. Chavda et al. (2021) also employed standardized knowledge tests in their respective studies.

Validity of the test

The items with highly significant point biserial correlation (rpbis) at 0.01 level of probability indicated the validity of the items in relation to the knowledge test designed to measure the knowledge regarding safe use of pesticides. However, content validity was tested through jury opinion. As the test included all the contents as indicated by experts in the field, it could be said as being content valid. Rufaida et al. (2018) and Vegad and Chauhan (2019) also employed standardized knowledge tests in their respective studies.

Table-1: Difficulty index, discrimination index of selected set of knowledge items (n= 30)

Sr. No.	Statements	Difficulty index (30-80)	Discrimination index (0.30-0.75)	Point biserial correlation coefficient (rpbis)	S= item Selected R=item Rejected
1	Do you know about registered and non registered pesticide dealers?	23.40	-0.7	-0.438 NS	R
2	Do you know about the quantity of pesticide to be purchased for single operation in a specified area?	23.30	-0.11	-0.02 NS	R
3	Do you purchase pesticides without bill?	82.40	0.26	-0.229 NS	R
4	Do you know whether to purchase labeled or non-labeled pesticides?	78.3	0.57	0.349**	S
5	Is it recommended to check batch no, registration number and expiry date on the labels?	71.2	0.51	0.613**	S
6	Is the proper packaging of containers or packets of pesticides necessary or not?	61.6	0.35	0.456**	S

Sr. No.	Statements	Difficulty index (30-80)	Discrimination index (0.30-0.75)	Point biserial correlation coefficient (rpbis)	S= item Selected R=item Rejected
7	Do you know about the color codes of pesticides?	45.7	0.32	0.352**	S
8	Do you know about instructions mentioned on containers or packets?	0	0	0.118 NS	R
9	Do you know about banned pesticides?	0	0	0.022NS	R
10	Do you know where to store pesticides?	35.4	0.50	0.532**	S
11	Do you know about the appropriate storage materials for storing left over pesticides?	21	-0.3	-0.088NS	R
12	Is it recommended to keep the pesticides away from children?	55.3	0.45	0.513**	S
13	Do you know that pesticides and weedicides should be stored separately?	46.6	0.37	0.600**	S
14	Do you know that marking of pesticide bottles is necessary before storage?	21	-0.3	-0.081NS	R
15	Do you know pesticides should be stored in cool and dry places?	46.8	0.37	0.601**	S
16	Is it necessary to store pesticides in separate room?	23	0	-0.02NS	R
17	Do you store pesticides inside animal shed?	84	-0.4	-0.229 NS	R
18	Is it recommended not to store pesticides around living area in your house?	53.30	0.45	0.613**	S
19	Is it recommended to carry pesticides along with food or other eatable items?	0	0	-0.05 NS	R
20	Is it recommended to carry bulk pesticides on head, shoulder or on back?	63.30	0.35	0.456**	S
21	Do you know about personal protective equipment (PPE)?	46.67	0.71	0.352**	S
22	Do you know that mixing or applying pesticides near water drains or water bodies is prohibited?	0.35	0.35	0.352**	S
23	Is it recommended to wear full sleeves shirt while spraying?	46.67	0.35	0.568**	S
24	Is it recommended to wear mask while handling pesticides?	51.20	0.60	0.465**	S
25	Is it recommended to wear boots/shoes while spraying?	46.67	0.35	0.576**	S
26	Do you know that washing hands after pesticide application is necessary?	46.67	0.35	0.665**	S
27	Is it recommended to wash clothes after spray?	36.16	0.33	0.649**	S
28	Is it recommended to take bath after pesticide spray?	63.30	0.35	0.565**	S
29	Is it necessary to change your clothes after applying pesticides?	0	0	-0.07 NS	R
30	Do you know about water to be used for preparing spray solution?	0	0	-0.02 NS	R
31	Do you know about granular pesticides?	20	0	-0.03 NS	R
32	Do you use only clean water for preparing spray solution?	0	0	0.01NS	R
33	Is it necessary to use granular pesticides?	0	0	0.08 NS	R
34	Is it recommended to protect your nose, eyes, ears, hands etc. from spill of spray solution?	34.52	0.55	0.623**	S

Sr. No.	Statements	Difficulty index (30-80)	Discrimination index (0.30-0.75)	Point biserial correlation coefficient (rpbis)	S= item Selected R=item Rejected
35	Is it recommended to prepare the solution as per requirement?	46.67	0.35	0.616**	S
36	Do you know that eating or drinking during preparation of spray solution is harmful?	46.67	0.69	0.548**	S
37	Do you know that smoking is harmful while preparation of spray solution?	84	-0.4	0.0911 NS	R
38	Do you know when to prepare spray solutions?	87	-0.9	0.072 NS	R
39	Do you know that overdose of pesticides may affect plant health and environment?	46.67	0.67	0.623**	S
40	Is it recommended to smell the spray tank to check its contents?	0.35	0.35	0.616**	S
41	Do you know that leaky spraying equipment should not be used?	62.31	0.39	0.456**	S
42	Is it recommended to use separate sprayer for insecticides and weedicides?	46.03	0.67	0.456**	S
43	Is it recommended to clean a clogged nozzle using your mouth?	0.35	0.35	0.456**	S
44	Is it necessary to use a tooth brush tied with a sprayer for cleaning?	46.67	0.39	0.629**	S
45	Is it recommended to apply only recommended dose of pesticides?	63.30	0.35	0.601**	S
46	Is it recommended to spray pesticides during rainy or windy weather conditions?	44.12	0.72	0.557**	S
47	Is it recommended to spray pesticides during hot sunny day conditions?	0.35	0.35	0.349**	S
48	Is it necessary to use recommended sprayer for each spray?	0	0	-0.072 NS	R
49	Do you know about ultra-low volume sprayer for spray?	0	0	-0.035 NS	R
50	Do you know about appropriate time to spray the pesticides?	45.07	0.68	0.352**	S
51	Do you know spraying in the evening is more effective than in the morning or afternoon?	0	0	-0.012 NS	R
52	Is it necessary to wash sprayer and buckets with clean water after spray operation?	46.03	0.34	0.465**	S
53	Is it recommended to use detergent or soap for clean the sprayer and buckets?	52.12	0.35	0.576**	S
54	Is it necessary to use empty pesticides containers and buckets for domestic purposes?	16	0	-0.046 NS	R
55	Do you know that entry of animals should be restricted after pesticide spraying?	63.30	0.35	0.649**	S
56	Do you know that protective clothes should be wore before entering the field after pesticide application?	0	0	-0.071 NS	R
57	Is it recommended to spray pesticides only after diseases development?	63.30	0.35	0.623**	S
58	Is it recommended to spray pesticide before the incidence of disease pest?	28	-0.18	0.061 NS	R

Sr. No.	Statements	Difficulty index (30-80)	Discrimination index (0.30-0.75)	Point biserial correlation coefficient (rpbis)	S= item Selected R=item Rejected
59	Is it recommended to check the wind direction before starting spraying application?	53.30	0.45	0.548**	S
60	Do you know about the disposal of leftover pesticides spray solution, containers and packets?	51.20	0.60	0.532**	S
61	Is it recommended to drain the leftover pesticides in ponds or other water bodies?	46.67	0.35	0.613**	S
62	Is it recommended to bury or burn the waste pesticides and empty container?	15	-0.8	-0.02 NS	R
63	Is it recommended to wash hands and face with clean water while eating the food after spray operation?	23	-0.2	-0.092NS	R
64	Is it recommended to wash hands and face after spray operation?	63.30	0.35	0.456**	S
65	Is it necessary to attend awareness programs regarding poisoning due to pesticides and first aid?	53.30	0.45	0.648**	S

RESULTS AND DISCUSSION

From 65 knowledge items, 39 items having difficulty index ranging from 30-80, discrimination index above 0.3 to 0.75 and significant point biserial correlation coefficient were selected as shown in the Table 1. Similar findings were also reported by Singh et al. (2025), Digarse et al. (2025), Khatri and Patel (2018); Jha *et al.,* (2025); Meghnathi *et al.,* (2025); Mishra *et al.,* (2025) and Singh et al. (2025) who employed standardized knowledge tests in their respective studies.

CONCLUSION

The effort have been made to create a knowledge test that can be used to assess the knowledge level of farmers. The test includes several aspects regarding safe use of pesticides, such as purchasing, transportation, handling, preparation and application of pesticides. The findings of this study may be utilised to identify knowledge gaps among farmers 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 safe pesticide application practices.

POLICY IMPLICATIONS

The test developed was scientifically tested for its validity and hence, it can be very well used to measure the knowledge level of vegetable growers regarding safe use of pesticides in similar conditions with necessary modification. The result obtained would help to derive appropriate strategy for technology innovation, refinement and dissemination with respect to scientific technologies and adoption of measures regarding safe use of pesticides in vegetable cultivation.

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CONFLICT OF INTEREST

All authors declare that they have no conflict of interest.

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