Research Tool

Indian Journal of Extension Education
Vol. 61, No. 4 (October–December), 2025, (185-189)

ISSN 0537-1996 (Print)
ISSN 2454-552X (Online)

Development and Standardization of a Scale to Measure Vegetable Growers' Attitude towards Safety Measures in Pesticide Application

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HIGHLIGHTS

- The attitude scale with 52 items was created with 0.82 reliability coefficient value.
- Selection and transportation, storage, precautions during preparation and application, precautions after application, disposal of containers, environmental protection, health and safety, record keeping and monitoring, pesticide regulations, education and training, and first aid and emergency response were included as major dimensions.
- The items were selected on the basis of relevancy percentage, relevancy weightage and mean relevancy score (MRS) for all statements.

ARTICLE INFO

Keywords: Attitude, Disposal of container, Pesticide regulations, First aid, Record keeping and monitoring.

https://doi.org/10.48165/IJEE.2025.614RT06

Citation: Singh, P., Ghadei, K., Roy, S., Halder, J., Kumari, J., & Paliwal, H. (2025). Development and standardization of a scale to measure vegetable growers' attitude towards safety measures in pesticide application. *Indian Journal of Extension Education*, *61*(4), 185-189. https://doi.org/10.48165/IJEE.2025.614RT05

ABSTRACT

The study aimed to develop a scale for assessing the attitude of vegetable growers towards safety measures in pesticide application was conducted during 2024. A total of 110 statements were initially framed under eleven dimensions: Selection and Transportation, Storage, Precautions during Preparation and Application, Precautions after Application, Disposal of Containers, Environmental Protection, Health and Safety, Record Keeping and Monitoring, Pesticide Regulations, Education and Training, and First Aid and Emergency Response. These were evaluated by 60 judges, based on their judgment and subsequent item analysis, 52 statements were retained after calculating the t-values. The scale was constructed using the Likert methodology, yielding an overall mean relevancy score of 2.50. A pilot test was conducted with 60 vegetable growers from a non-sampled area, setting the cut off value for item selection at equal or more than 1.75 t-value. Reliability was assessed using the split-half method, which yielded a coefficient value of 0.82. This result was further verified using the Spearman-Brown formula, producing a value of 0.89, thereby confirming the reliability of the scale. In addition, the Cronbach's alpha value of 0.86 indicated a high level of internal consistency in the developed scale.

INTRODUCTION

Pesticides played a vital role in enhancing crop yields and ensuring food security in India (Arora, 2018; Kumar et al., 2025). In vegetable cultivation, insect pests and diseases remain serious challenges, accounting for 10–30 percent yield losses (Roy et al., 2017). To manage these problems, most Vegetable growers rely heavily on chemical pesticides, making vegetable farming one of the most pesticide-intensive agricultural activities due to the high susceptibility of vegetables to pests and diseases (Meenakshi & Saini, 2022). However, the gap between recommended scientific practices and actual pesticide use by Vegetable growers is considerable. Indiscriminate and unsafe pesticide practices pose serious risks to human health,

Received 16-09-2025; Accepted 28-09-2025

environmental sustainability, and agricultural ecosystems (Mishra et al., 2021; Pathak et al., 2022). Research consistently highlights that while Vegetable growers recognize the necessity of pesticides, their compliance with safety measures–such as the use of personal protective equipment (PPE), safe storage, proper disposal of containers, and adherence to label instructions–remains unsatisfactory (Hossain et al., 2024). Even trace levels of pesticide residues in vegetables may cause long-term health risks to consumers (Gupta et al., 2008; Gupta et al., 2010). Several studies in India have documented this paradox: although Vegetable growers are aware of pesticide hazards, they continue unsafe practices. For instance, in Haryana, more than 77 per cent of vegetable growers acknowledged the harmful effects of pesticides, yet most were unable to interpret toxicity color codes or follow label instructions, which led to frequent cases of acute poisoning (Meenakshi & Saini, 2022). These findings highlight the urgent need for interventions that address not only Vegetable growers knowledge but also their attitudes toward safe pesticide use. Integrated Pest Management (IPM) has emerged as a sustainable alternative to excessive reliance on chemical pesticides. Promoted through national programs, Krishi Vigyan Kendras (KVKs), and state extension agencies, IPM emphasizes biological control, cultural practices, and judicious pesticide application (Meenakshi & Saini, 2022). However, successful adoption of IPM depends largely on Vegetable growers positive attitudes toward safety and sustainability. Studies indicate that while awareness of IPM is gradually improving, adoption remains limited due to entrenched attitudes that favour chemical pesticide use (Gupta et al., 2020). Therefore, a systematic measurement of Vegetable growers attitudes toward pesticide safety–including IPM practices–is crucial for designing targeted interventions. Although several Knowledge, Attitude, and Practice (KAP) studies have explored pesticide use among Indian Vegetable growers, there is still a paucity of standardized instruments to specifically assess vegetable growers attitudes toward safety measures. A rigorously developed and validated attitude scale can fill this gap by capturing multidimensional aspects of pesticide safety, including handling, storage, application, post-application precautions, container disposal, health and environmental protection, and adherence to regulatory norms. Recognizing this need, the present study seeks to develop and standardize an attitude scale to evaluate vegetable growers attitudes toward safety measures in pesticide application.

METHODOLOGY

The developed scale systematically incorporated all dimensions of pesticide safety measures, including Selection and Transportation, Storage, Precautions during Preparation and Application, Precautions after Application, Disposal of Containers, Environmental Protection, Health and Safety, Record Keeping and Monitoring, Pesticide Regulations, Education and Training, and First Aid and Emergency Response. The standardized attitude scale was constructed using the Likert method of summated ratings (Likert, 1932) with a five-point psychological continuum to measure the attitude of vegetable growers towards the safe use of pesticides. A pool of 110 statements was generated from diverse sources such as literature, interactions with scientists, extension professionals, NGO personnel, government officials, Vegetable growers, teachers, senior citizens, and other stakeholders. These items were screened following the 14 informal criteria for attitude statement construction proposed by Likert (1932) and Edwards (1957), resulting in 52 items relevant to the study. The selected statements were arranged in a five-point continuum and compiled into a questionnaire. For expert evaluation, the questionnaire was distributed to 90 professionals, of whom 60 with specialized expertise in extension education responded. Their feedback was used to finalize the tool for the pilot study. Data were collected through interviews with 60 vegetable growers, and t-values were calculated. Items with a t-value $\geq$1.75, as suggested by Edwards (1957), were retained for the final scale. For relevancy testing, statements were rated on a five-point continuum ranging from "Most Relevant" (5) to "Not Relevant" (1). The mean relevancy score was computed, and statements with an average score of $\geq$2.50 were retained. Item analysis was carried out following Edwards' (1957) procedure using the critical ratio (t-test) method to determine the discriminating power of each item. Respondents were divided into high and low groups (top and bottom 25%), and statements with a t-value $\geq$1.75 (Bird, 1940) were selected.

A systematically developed scale was finalized with the support of 60 experts in extension education, who reviewed the revised statements and provided their judgment for selecting the most appropriate items. Ultimately, 52 statements under 11 dimensions were retained to assess the attitude of vegetable growers towards the safe use of pesticides. The Cronbach's alpha coefficient was calculated. The scale was then administered to 60 vegetable growers from non-sampled areas. Reliability was further tested through the split-half method, where the items were divided into two sets based on odd and even numbers, and the reliability coefficient was computed using the prescribed formula.

RESULTS

Table 1 presents the t-value estimation of the selected items, which include statements reflecting the attitude of vegetable growers towards safety measures in pesticide application. To standardize the scale, both reliability and validity were assessed using established techniques, including the split-half method (Spearman-Brown coefficient), Pearson's correlation coefficient, and Cronbach's alpha. Expert judgment was also used to ensure content validity.

Validity and reliability analysis

Reliability testing, the split-half method was employed following the approach of (Shitu et al., 2018; Shelar et al., 2022; Sushree et al., 2024 & Vavilala et al., 2024). The statements were divided into two groups based on odd and even numbered items and administered to 60 respondents. The scores of the two sets were correlated using Pearson's product moment correlation, which yielded a value of 0.82. This was further verified through the Spearman-Brown formula, resulting in a reliability coefficient

Table 1. Selected Statements and t values

Item statements	t-value
Selection and Transportation of pesticides	
Before selection of any pesticides, the causal organism(s) / pest(s) (insects/ diseases/ nematodes) has properly been identified. For the same I consult agricultural officer of our area.	3.82
After identification, I purchase recommended pesticides of its recommended formulations against the said pest.	2.44
I always purchase the required amount of pesticides required for the current cropping season.	3.23
I agree that pesticide shop owners often suggest two or more pesticides for managing any particular pest when seek for management of any pest.	3.43
Proper care has been taken while carrying pesticides. All containers/ packets are tightly closed.	3.52
Storage of pesticides	
I always store the pesticides in their original containers and keep their label intact and legible.	1.80
I never store the pesticides where food, feed, seed, water and medicines can become contaminated or living room or in kitchen.	2.96
I store the pesticides in dry, well- ventilated place which is away from sun light.	3.51
I store the pesticides in separate storage room or cabinets/ cupboards under locked condition so that they are away from reach of children, mentally retarded people, pets etc.	2.79
Before entering the pesticide store room, I open its doors & windows and wait for at least 30 minutes to enter.	1.94
Precautions during preparation &application	
I read carefully the directions given on the labels of package of pesticide containers.	2.66
I apply the doses of pesticides recommended by the Agriculture Officers/University/KVK/CIBRC/Input dealers	2.46
I believe that wearing protective clothing is essential for Vegetable growers health during pesticide application to shield the body from pesticide exposure.	3.34
Wearing full pants, full sleeve shirts, masks, plain goggles etc. are also an effective safety measure to protect skin and body parts from pesticide contact.	3.12
I feel safer when I use a cloth or gamcha to cover my face while spraying pesticides than uncovered / without this.	2.87
Before spraying of any pesticides, all the mature fruits and harvestable products are plucked from the plants.	2.68
I take due care while opening the pesticide containers to avoid splashing of the liquid or puffing up the powder.	2.85
I believe that through mixing of pesticide with water is crucial for the effectiveness of pesticides.	3.67
For mixing of pesticides, separate containers like drums or buckets etc. are used which are further not used for any other purpose. A long-handled rod or even wooden stick are used for stirring.	3.08
I follow the recommended dilution ratio while use pesticides.	3.16
Always spray pesticide in the direction of flow of wind. Never spray against the winds.	3.21
I never smoke or eat or drink during application of pesticides. If very essential, then thoroughly wash the hands and other body parts with soaps before to do so.	3.10
I prefer to spray pesticides during early morning or during afternoon hours only.	3.62
Precaution after application	
I neither leave excess pesticides in the equipment nor pour in irrigation channel or water bodies. I prefer to spray excess pesticides on border or barren land, if needed.	3.87
After spraying, the sprayer was thoroughly washed & rinsed thrice with plenty of water. Decontaminate properly the drums, buckets, long rod, measuring cylinders etc. with soap solution and water repeatedly at least thrice.	4.14
I take proper bath with soap & plenty of water. I wash all the protective clothing with soap water thoroughly & sundry properly.	3.77
I follow proper waiting period of the pesticides. Do not harvest immediately.	3.26
Disposal of empty containers	
I never use empty pesticide containers for any purposes.	2.89
I believe that proper disposal of pesticide waste is important to prevent chemical pollution.	2.79
I do not throw empty pesticide containers in to ponds, water channels, dustbins, crop field or any other places.	3.11
I always crush empty pesticide containers and cut the empty bags to prevent their reuse.	4.05
To decontaminate the empty pesticide containers before burying the minthe waste land, firstly drain out the excess fluid from the containers by keeping them in an inverted position in that area for few minutes, then rinse the container with water 3-4 times & drain out in the similar way.	3.62
The decontaminated empty pesticide containers or bags buried in waste or unused land at about 0.5 to 1 meter depth.	3.96
Environmental Protection	
Integrated pest management (IPM) is a better approach for reducing chemical pesticide use in the field.	3.67
I prefer using environmental friendly alternatives (biological/ cultural/ mechanical/ botanical pesticides etc.) to chemical pesticides whenever possible.	3.41
Health and Safety	
I believe that pesticide exposure poses health risks.	3.77
I believe that pesticide exposure can have long-term effects on health of the applicator.	2.72

Table 1 contd..

Item statements	t-value
It is important to ensure that family member & other persons to stay away from the fields during pesticide application.	3.56
I seek medical attention immediately whenever feel pesticide poisoning symptoms.	3.82
Record Keeping and Monitoring	
I believe that maintaining accurate records can help in reducing unnecessary pesticide use.	2.66
I believe that record keeping helps me to evaluate the cost-effectiveness of the pesticides.	2.87
I document any adverse effects or unusual symptoms in the crop after pesticide use.	3.26
Pesticide Regulations	
I believe that use of banned or restricted or non-label claim pesticides should strictly be avoided.	3.64
I believe that compliance with safety regulations can reduce health risks.	3.68
I think provision of penalty/punishment should be there in case of improper use of pesticides and do not follow the proper waiting period.	2.96
Education and Training	
I believe that attending training on pesticide use is very crucial formy safety.	2.79
I would like attend workshops related to safe application of pesticides.	2.92
Educating Vegetable growers on different pests and their IPM practices can help to reduce pesticide use.	2.36
I believe that proper training on handling of pesticides can minimize ill-effects of pesticides.	3.25
First Aid and Emergency Response	
It is important to value and prioritize first aid training as an essential component of pesticide safety education.	3.05
It is important to educate Vegetable growers family members about what to do in case of pesticide poisoning.	2.64
I recognize nearby health centres/ hospitals are crucial for ensuring timely care during pesticide poisoning.	2.89

of 0.89. In addition, the Cronbach's alpha value, was found to be 0.86, indicating high internal consistency of the instrument.

The validity of a scale reflects its ability to accurately measure the intended construct. Specifically, content validity evaluates whether the items adequately represent the domain of interest (Kumar et al., 2015; Gupta et al., 2022). In this study, content validity was established by reviewing relevant literature and incorporating expert opinions from the field of extension, ensuring that the selected statements were both representative and appropriate.

DISCUSION

Several studies have examined vegetable growers' attitudes toward pesticide use; however, limited attention has been given to their safety measures while handling pesticides. Addressing this gap, the present research aimed to develop and standardize an attitude scale to measure vegetable growers' perceptions regarding the safe use of pesticides. Initially, 110 statements were collected through a review of scientific literature and consultation with experts. These were screened using the 14-point criteria proposed by Edwards (1957), resulting in the retention of 61 statements. In the relevancy test, 61 statements with an overall mean relevancy score of 2.50 were selected and subsequently subjected to item analysis in a non-sampled area. Item analysis, a crucial step in scale development, helps identify statements based on their ability to differentiate respondents. Data were collected from 60 individuals using a five-point continuum. Scores were arranged in ascending order, and following Edwards (1957), the top 25% (15 respondents) and bottom 25% (15 respondents) were used to calculate the t-value. Based on this, 52 statements with a t-value $\geq$1.75 (Bird, 1940) were retained. Reliability and validity tests were then conducted to standardize the scale. Reliability was established using Pearson's correlation coefficient (0.82), further verified by the Spearman-Brown formula (0.89), confirming strong reliability. Additionally, the Cronbach's alpha value of 0.86 indicated a high level of internal consistency (Cronbach, 1951). For validity, content validity was employed to ensure that the items adequately represented the construct. Statements were carefully selected from scientific sources, and expert opinions were sought to refine their relevance. Thus, the scale was successfully developed, standardized, validated, and that can guide future evaluations and strengthen efforts toward improving pesticide safety practices among vegetable growers.

CONCLUSION

The developed attitude scale serves as a valuable tool for assessing vegetable growers' attitudes toward the safe use of pesticides. The scale demonstrated strong reliability, as indicated by the reliability coefficients, and its content validity was ensured through expert judgments and a thorough review of scientific literature during the statement selection process. By fulfilling the essential criteria of reliability and validity, the scale can be regarded as a standardized instrument. It holds significant potential for use by researchers and policymakers, as well as by various stakeholders as an effective intervention tool. Overall, this scale provides an efficient means to evaluate vegetable growers' attitudes toward pesticide safety practices.

DECLARATIONS

Ethics approval and informed consent: The experts to judge the items were well informed regarding the purpose and only the responses of the judges who consented have been included for analysis purposes.

Conflict of interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The authors declare that during the preparation of this work, they thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

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REFERENCES

Arora, N. K., (2018). Agricultural sustainability and food security. *Environmental Sustainability*, *1*(3), 217-219.

Bird, C. (1940). Social psychology. New York: Appleton Century Crofts.

Cronbach, L. J., (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, *16*(3), 297-334.

Edwards, A. L., (1957). Techniques of attitude scale construction. Vakils, Feffer and Simons Inc. New York.

Gupta, B. K., Mishra, B. P., Singh, V., Patel, D., & Singh, M. P., (2020). Constraints faced by vegetable growers in adoption of IPM in Bundelkhand Region of Uttar Pradesh. *Indian Journal of Extension Education*, *56*(4), 92-97.

Gupta, B. K., De, D., & Raha, P., (2008). Consumers perception on pesticide residue and their management in vegetables. *Indian Journal of Extension Education, 26*(4A), 1823-1827.

Gupta, B. K., & Raha, P., (2010). Extent of knowledge of vegetable growers about the side effects of pesticides. *Indian Journal of Extension Education*, *46*(3&4), 38-42.

Gupta, S. K., Nain, M. S., Singh, R., & Mishra, J. R. (2022). Development of scale to measure agripreneurs attitude towards entrepreneurial climate. *Indian Journal of Extension Education*, *58*(2), 153-57.http://doi.org/10.48165/IJEE.2022.58237

Hossain, M. Z., Ferdous, F., & Rayhan, M. I., (2024). Pesticide knowledge and attitude among the potato growing Vegetable growers of Bangladesh and determinant factors. *Frontiers in Public Health*, *12*, 1408096. https://doi.org/10.3389/fpubh.2024.1408096

Kumar, R., Slathia, P. S., Peshin, R., & Nain, M. S. *(2015).* Development of scale to measure attitude of farmers towards rapeseed mustard crop. *Journal of Community Mobilization and Sustainable Development, 10*(2), 221-224.

Kumar, A., Bhople, B. S., & Jeganathan, J., (2025). Balancing food security and environmental health: The dual challenge of pesticide use in India. *Environmental Science and Pollution Research*, *32*(9), 4949-4956. https://doi.org/10.1007/s11356-025-36009-y

Likert, R. A. (1932). A technique for the measurement of attitude. *Archives of Psychology*, *22*(140), 1-55.

Meenakshi, M., & Saini, V. (2022). Risk assessment and health hazards in vegetable growers of Haryana (India) based on their knowledge and attitudes towards pesticide uses. *International Journal of Health Sciences*, *6*(S1), 7443-7455. https://doi.org/10.53730/ijhs.v6nS1.6593

Mishra, A. K., Arya, R., Tyagi, R., Grover, D., Mishra, J., Vimal, S. R., Mishra, S., & Sharma, S. (2021). Non-judicious use of pesticides indicating potential threat to sustainable agriculture. *In:* Kumar, S., Singh, V., Lichtfouse, R. (eds) Sustainable Agriculture Reviews 50. *Sustainable Agriculture Reviews*, *50*(383-400). Springer, Cham. https://doi.org/10.1007/978-3-030-63249-6_14.

Panigrahi, S. P., Ghadei, K., Nikhil, J., Chennamadhava, M., Sethi, K., & Gupta, R. P. (2024). Construction and standardisation of agripreneurial performance scale. *Indian Journal of Extension Education*, *60*(3), 88-92.https://doi.org/10.48165/IJEE.2024.603RT01

Pathak, V. M., Verma, V. K., Rawat, B. S., Kaur, B., Babu, N., Sharma, A., Dewali, S., Yadav, M., Kumari, R., Singh, S.., Mohapatra, A., Pandey, V., Rana, N., & Cunill, J. M., (2022). Current status of pesticide effects on environment, human health and it's eco-friendly management as bioremediation: A comprehensive review. *Frontiers in Microbiology*, *13*, 962619.https://doi.org/10.3389/fmicb.2022.962619

Roy, S., Halder, J., Singh, N., Rai, A. B., Prasad, R. N., & Singh, B., (2017). Do vegetable growers really follow the scientific plant protection measures? An empirical study from eastern Uttar Pradesh and Bihar. *Indian Journal of Agricultural Sciences*, *87*(12), 1668-1672.

Shelar, R., Singh, A. K., & Maji, S. (2022). A measurement tool for the assessment of Vegetable growers perception about impact of changing climate on agriculture in India. *Indian Research Journal of Extension Education*, *22*(1), 123-127.10.54986/irjee/2022/jan_mar/123-127

Shitu, G. A., Nain, M. S., & Kobba, F. (2018). Development of Scale for assessing farmers' attitude towards Precision conservation agricultural practices. *Indian Journal of Agricultural Sciences, 88*(3), 499-504.

Vavilala, P., Singh, V., Singh, D., & Singh, L., (2024). Attitude of the staff towards vegetable growers producers organization - Development and standardization of the scale. *Indian Journal of Extension Education*, *60*(1), 116-119. https://doi.org/10.48165/IJEE.2024.601RT2