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Shashank L Reddy
Ph.D. Scholar, Department of
Agricultural Extension,
University of Agricultural
Sciences Bangalore (UASB),
GKVK, Bengaluru, Karnataka,
India

K Shivaramu
Training Coordinator, Staff
Training Unit, Directorate of
Extension at UASB, GKVK,
Bengaluru, Karnataka, India

MT Lakshminarayan
Professor, Department of
Agricultural Extension, UASB,
GKVK, Bengaluru, Karnataka,
India

Savitha CM
Associate Professor, Department
of Agricultural Extension,
UASB, GKVK, Bengaluru,
Karnataka, India

Prahlad P Bhat
Ph.D. Scholar, Department of
Agricultural Extension,
University of Agricultural
Sciences Bangalore (UASB),
GKVK, Bengaluru, Karnataka,
India

Corresponding Author:
Shashank L Reddy
Ph.D. Scholar, Department of
Agricultural Extension,
University of Agricultural
Sciences Bangalore (UASB),
GKVK, Bengaluru, Karnataka,
India

A scale to analyse the perception of vegetable and flower growers towards protected cultivation

Shashank L Reddy, K Shivaramu, MT Lakshminarayan, Savitha CM and Prahlad P Bhat

Abstract
An attempt is made in the present study to develop and standardize scale to analyze the perception of vegetable and flower growers towards protected cultivation. The developed perception scale was found to be highly reliable and valid. The perception scale consists of 38 statements classified as perception towards: (a) improvement in crop yield, (b) crop produce quality, (c) economic viability, (d) efficient resource management, (e) market demand and consumer preference and (f) skill and social development. The developed perception scale was administered to 36 farmers in Bengaluru Rural District of Karnataka state during 2023-24. The results revealed that a vast majority of the vegetable and flower growers (80.56%) had good to better perception towards protected cultivation, while less than 20.00 percent of the vegetable and flower growers had poor perception towards protected cultivation.

Keywords: Protected cultivation, vegetable-growers, flower-growers, perception, reliability, validity

Introduction
Protected cultivation is a hi-tech capital-intensive technique of growing crops as compared to the traditional open cultivation. It makes use of innovative structures (green houses, net house, tunnels etc.,) for cultivating crops under controlled environment and allows farmers to grow crops during off-season and fetch higher returns. Protected cultivation is more sustainable in terms of inputs such as fertilizers, pesticides and water as they are utilized more efficiently than open cultivation (Mehta *et al.* 2020) [3]. The yield obtained under protected cultivation is three to five times greater than open method of cultivation depending on the crops (Negi *et al.* 2013) [5]. It was found that protected cultivation of vegetables and flowers was very lucrative venture (Punera *et al.* 2017) [7]. The choice of vegetable crop to be raised in greenhouse is made on the basis of the size of the structure, the economics of the crop production and income generation (profit). It may be possible to raise any crop at any time in a high-cost greenhouse, selection of crops is more critical in case of ordinary low-cost greenhouse. The high value vegetable crops *viz.*, tomato, capsicum, cucumber, brinjal and chilli have been more popular for cultivation in greenhouse. The labour and other input requirement per unit area in greenhouse is more than that of open field conditions. There is always a large and sustained demand of fresh vegetables round the year in big cities.

Protected cultivation in India is at a very nascent stage as compared to the many other developed and developing countries. The leading states in the area of protected cultivation are Maharashtra, Karnataka, Himachal Pradesh, North-eastern states, Uttarakhand, Tamil Nadu and Punjab. Karnataka State is considered as Horticulture State in the country owing to its excellent soil and climatic conditions and multifaceted expertise in the sector. Total farming families in Karnataka are 78.2 lakh, of which nearly 20 lakh farming families are dependent on horticulture sector. The production of vegetables mainly capsicum, European cucumber have increased by almost five times. Further, different flower crops such as gerbera, carnation, roses etc., are also grown resulting in higher productivity and supply of flowers throughout the year (Shashikala *et al.* 2022) [8].

The Government of India has initiated a number of programmes such as National Horticulture Mission (NHM), Rashtriya Krishi Vikas Yojana (RKVY) and Horticulture Mission for Northeast and Himalayan States (HMNEH) for the promotion and development of protected cultivation apart from establishing National Horticulture Board (NHB). The major programme NHM, which offers a 50 percent subsidy for setting up of protected cultivation structures and also provides 50 percent subsidy for purchase of planting materials and cultivation of

vegetables and flowers under polyhouse/shade net house. With these interventions, the area achieved under protected cultivation by NHM in India was 14136 ha during 2005-06 to 2017-18 (Prakash *et al.* 2019) [6]

There is no scale to analyze the perception of vegetable and flower growers towards protected cultivation, hence the present research study was carried out to develop and standardize a scale to analyze the perception of vegetable and flower growers towards protected cultivation, and to analyze the perception of vegetable and flower growers towards protected cultivation.

Methodology

The present study was carried out during 2023-24 for developing and standardizing a scale to analyse the perception of vegetable and flower growers towards protected cultivation. The developed scale was used to analyze the perception of vegetable and flower growers towards protected cultivation in Bengaluru Rural District of Karnataka state. Thirty-six vegetable and flower growers under protected cultivation were interviewed for the purpose. Based on the cumulated score, the respondents were categorized as poor, good and better levels of perception considering mean (132.00) and half standard deviation (09.24) as a measure of check.

Results and Discussion

A) Development of scale to analyse the perception of vegetable and flower growers towards protected cultivation

Perception of vegetable and flower growers towards protected cultivation is operationally defined in the present study 'as the extent of mental awareness of vegetable and flower growers regarding protected cultivation encompassing its influence on improvement in crop yield, produce quality, economic viability, resource efficiency, market demand and consumer preference and its role in skill and social development of growers'. The method of summated rating scale suggested by Likert (1932) [2] and Edwards (1969) [1] were followed in the development of the perception scale following six stages *viz.,* (1) identification of components, (2) collection and editing of perception statements, (3) relevancy test, (4) item analysis, (5) reliability and (6) validity. (Naveen *et al.*, 2018) [4]

1. Identification of components: Six components related to perception of vegetable and flower growers towards protected cultivation were identified based on review of literature and discussion with horticulturists and extensionists. The identified six components include perception towards: (1) improvement in crop yield, (2) crop produce quality, (3) economic viability, (4) efficient resource management, (5) market demand and consumer preference, and (6) skill and social development.

2. Collection and editing of perception statements: The first step in the construction of perception scale was to collect statements pertaining to the perception of vegetable and flower growers towards protected cultivation. A tentative list of 85 statements pertaining to the perception of vegetable and flower growers towards protected cultivation were collected through extensive review of literature and by consulting horticulturists and extensionists. These 85 statements were

edited as per the 14 criteria enunciated by Edwards (1969) [1] and Thurstone and Chave (1929) [9]. As a consequence, 27 statements were eliminated. The remaining 58 perception statements were included for the study.

3. Relevancy test: Fifty-eight statements were sent to 90 experts/judges in the field of biological and social sciences working in State Agricultural Universities, Indian Council of Agricultural Research Institutes and Development Departments, to critically evaluate the relevancy of each statement *viz.,* Most Relevant (MR), Relevant (R), Somewhat Relevant (SWR), Less Relevant (LR) and Not Relevant (NR) with the score of 5,4,3,2 and 1, respectively. The experts/judges were also requested to make necessary modifications and additions or deletion of perception statements if they desired to. A total of 65 judges/experts returned the questionnaires duly completed and the perception statements were considered for further processing. From the data gathered, 'relevancy percentage (RP)' and 'mean relevancy score (MRS)' were worked out for all the 58 statements. Using these criteria, individual perception statements were screened for relevancies using the following formulae.

i) Relevancy Percentage (RP): It was obtained by using the following formula

$$RP = \frac{MR \times 5 + R \times 4 + SWR \times 3 + LR \times 2 + NR \times 1}{\text{Maximum possible score}} \times 100$$

ii) Mean Relevancy Score (MRS): It was worked out using the following formula

$$MRS = \frac{MR \times 5 + R \times 4 + SWR \times 3 + LR \times 2 + NR \times 1}{\text{Number of judges/experts responded}}$$

Accordingly, statements having 'relevancy percentage' of 75 percent and above and mean relevancy score of 3.75 and above were considered for final selection. Accordingly, Fourty-six perception statements were retained after relevancy test and these statements were suitably modified and written as per the comments of the judges wherever applicable.

4. Item analysis: Fourty-six perception statements were subjected to item analysis to delineate the items based on the extent to which they can differentiate the respondent having better perception from the respondent with poor perception regarding protected cultivation. A sample of 36 vegetable and flower growers under protected cultivation in Bengaluru Rural District of Karnataka state were selected for the study. The respondents were asked to indicate their degree of agreement or disagreement with each of the 46 perception statements on a five-point continuum ranging from 'strongly agree' to 'strongly disagree'. Based upon the total scores, the respondents were arranged in descending order. The top 25 percent of the respondents with their total scores were considered as the high group and the bottom 25 percent as the low group. These two groups provided criterion groups in terms of evaluating the individual statements. Thus, out of 36 vegetable and flower growers under protected cultivation to

whom the perception statements were administered for item analysis, nine growers with highest and nine growers with lowest perception scores were used as criterion groups to evaluate individual items. The critical ratio, that is, the 't' value which analyses the extent to which a given statement differentiates between the better and poor groups of respondents for each statement, was calculated by using the following formula:

$$t = \frac{\bar{X}_H - \bar{X}_L}{\sqrt{\frac{\sum X_H^2 - \frac{(\sum x_H)^2}{n} \times \sum X_L^2 - \frac{(\sum x_L)^2}{n}}{n(n-1)}}}$$

Where,

$\bar{X}_H$ = The mean score on given statement of the high group
$\bar{X}_L$ = The mean score on given statement of the low group
$\sum X_H^2$ = Sum of squares of the individual score on a given statement for high group
$\sum X_L^2$ = Sum of squares of the individual score on a given statement for low group
n = Number of respondents in each group
$\sum$ = Summation
t = The extent to which a given statement differentiates between the high and low groups.

After computing the 't' value for all the 46 items, thirty-eight perception statements with 't' value equal to or greater than 1.692 were finally selected and included in the final perception scale.

5. Reliability: Reliability refers to precision of the scale constructed for any purpose. A reliability test will be *reliable* when it gives the same repeated result under the same conditions. In any social science research, a newly constructed scale has to be tested for its reliability before it is used. The split-half method was employed to test the reliability of the perception scale. The value of correlation coefficient was 0.713 and this was further corrected by using Spearman Brown formula to obtain the reliability coefficient of the whole set. The 'r' value of the scale was 0.770, which was significant at one percent level indicating the high reliability of the scale. It was concluded that the perception scale constructed was reliable.
a) Half test reliability formula

$$r_{1/2} = \frac{N(\sum XY) - (\sum X)(\sum Y)}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)}}$$

Where,

$\sum X$ = Sum of the scores of the odd number items
$\sum Y$ = Sum of the scores of the even number items
$\sum X^2$ = Sum of the squares of the odd number items
$\sum Y^2$ = Sum of the squares of the even number items
b) Whole test reliability formula

$$r_{1/1} = \frac{2_{r1/2}}{1 + r_{1/2}}$$

Where,
$r_{1/2}$ = Half test reliability

6. Validity: It refers to how well a scale analyses what it is purported to measure. The data was subjected to statistical validity, which was found to be 0.870 for scale which is greater than the standard requirement of 0.700. Hence, the validity coefficient was also found to be appropriate and suitable for the tool developed. Thus, the developed scale to analyze the perception of vegetable and flower growers towards protected cultivation was feasible and appropriate.

Administration of perception scale and method of scoring:
The final scale consists of 38 statements (Table 1) for determining the perception of vegetable and flower growers towards protected cultivation. The response could be collected on a five-point continuum, namely, strongly agree, agree, undecided, disagree and strongly disagree with assigned score of 5,4,3,2 and 1, respectively. The perception score of a respondent could be calculated by adding up the scores obtained by him/her on all the 38 statements. The perception score of this scale ranges from a minimum of 38 score to a maximum of 190 score. Based on the mean and half standard deviation the respondents could be categorized into three perception categories, *viz.*, poor, good and better. Higher score on this scale indicates that the respondent has better perception towards protected cultivation and the lower perception score indicates that the respondent has poor perception towards protected cultivation.

B) Perception of vegetable and flower growers towards protected cultivation.
The perception scale developed was administered to 36 vegetable and flower growers under protected cultivation in Bengaluru rural district of Karnataka state during 2023-24. The results (Table 2) revealed that a larger proportion of the vegetable and flower growers had better perception towards protected cultivation (41.67%), whereas 38.89 percent of the vegetable and flower growers had good perception towards protected cultivation and the remaining less than twenty percent (19.44%) of the vegetable and flower growers had poor perception towards protected cultivation, It could be inferred that a vast majority of the vegetable and flower growers under protected cultivation (80.56%) had good to better perception towards protected cultivation. Though protected cultivation being a capital-intensive technique of growing crops as compared to the traditional open cultivation, it enables the vegetable and flower grower to grow crops during off-season with higher yield and superior quality leading to earn higher price in the market, hence a vast majority of the vegetable and flower growers (80.56%) under protected cultivation had good to better perception towards protected cultivation.

Table 1: Scale to analyse the perception of vegetable and flower growers towards protected cultivation

Sl. No	Perception statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
A.	**Perception towards improvement in crop yield**					
1	Cultivating vegetables and flowers under protected cultivation has the potential to significantly increase crop yields.					
2	Protected cultivation technology optimizes factors like light, temperature, and irrigation.					
3	The protective structures shields crops from adverse weather conditions, minimizing yield losses and ensuring consistent production.					
4	Protective structures offer protection against pests and diseases.					
5	The ability to monitor and manage growing conditions closely in protected cultivation helps farmers to identify and address crop stress factors promptly.					
6	Protected cultivation allows farmers to extend the growing season, enabling multiple harvests.					
B	**Perception towards crop produce quality**					
1	Protected cultivation technology ensures higher crop quality by minimizing exposure to external contaminants, pollutants, and pests.					
2	The controlled environment within protected cultivation helps to maintain flavor, texture, and appearance of vegetables and flowers					
3	By reducing reliance on synthetic pesticides, protected cultivation allows farmers to produce crops with lower chemical residues.					
4	Protected cultivation techniques like shade nets and greenhouse structures protect crops from excessive sunlight, preventing sunburn and maintaining the desirable color and quality of vegetables and flowers					
5	Protected cultivation minimizes post-harvest losses by providing a controlled environment.					
6	The ability to harvest crops at the peak of maturity within protected cultivation ensures optimal flavor, nutritional content, and overall quality of vegetables and flowers.					
C	**Perception towards economic viability**					
1	Protected cultivation can lead to higher profit margins due to increased yields, better product quality, and reduced crop losses.					
2	Protected cultivation minimizes the need for expensive inputs like pesticides and fertilizers.					
3	Protected cultivation can provide a more stable and predictable income stream.					
4	Protected cultivation can enhance market competitiveness even during off-seasons or market fluctuations.					
5	Protected cultivation offers farmers the opportunity to engage in contract farming or establish direct partnerships with retailers or wholesalers, ensuring a steady market and stable prices for their produce.					
6	Initial investment costs for constructing protected structures can be significantly high, requiring careful financial planning and access to capital.					
7	Maintaining and operating protected structures requires substantial expenses for heating, cooling, ventilation, and maintenance					
D	**Perception towards Efficient Resource Management**					
1	Protected cultivation optimizes water use efficiency through technologies like drip irrigation, reducing water consumption and preserving water resources.					
2	Protected cultivation promotes efficient land use by maximizing production in limited space, reducing the need for land expansion.					
3	It promotes efficient pest and disease management practices, reducing the need for excessive pesticide applications and minimizing chemical residues.					
4	It offers the potential for automation and mechanization, reducing labor requirements and improving operational efficiency.					
5	Protected structures can be designed for optimized airflow and ventilation, improving energy efficiency, and minimizing temperature fluctuations.					
6	It reduces the need for manual weed control, as enclosed environments limit weed intrusion and competition.					
E	**Perception towards Market Demand and Consumer Preference**					
1	Protected cultivation technology allows farmers to meet the increasing market demand for year-round availability of fresh, high-quality produce					
2	Protected cultivation enables farmers to cater to specific consumer preferences by offering a wide range of specialty or exotic vegetables and flowers that may not be easily grown in traditional open fields					
3	By providing a consistent and reliable supply of vegetables and flowers, protected cultivation helps farmers establish strong and long-term relationships with wholesalers, retailers, and other buyers					
4	Protected cultivation provides farmers with opportunities for market diversification, allowing them to tap into multiple distribution channels such as restaurants, hotels, specialty stores, and online platforms, expanding their customer base and revenue streams					
5	Protected cultivation enables farmers to produce export quality products catering to the standards of overseas markets.					
6	Protected cultivation enables growers to meet the increasing demand for locally grown,					

	fresh produce and flowers						
7	It facilitates the cultivation of out-of-season crops, enabling growers to capture premium prices when supply is limited.						
E	**Perception towards Skill and Social development**						
1	Protected cultivation technology empowers farmers by providing them with a sustainable and economically viable livelihood.						
2	Protected cultivation offers great scope for entrepreneurship development among the farmers leading to development of the society						
3	Practicing successful Protected cultivation improves the social status and recognition of the farmer						
4	Growers need specialized knowledge and skills to effectively manage the complex environmental conditions within protected structures.						
5	Protected cultivation may require skilled labour for tasks such as manual pollination and maintaining optimal growing conditions.						
6	Adequate training and education on protected cultivation practices may be limited, making it challenging for growers to acquire necessary skills.						

Table 2: Perception of vegetable and flower growers towards protected cultivation

(n=36)

Sl. No.	Perception categories	Vegetable and flower growers		Mean	Standard deviation
		Number	**Percent**		
1.	Poor (< 122.76 score)	07	19.44	132.00	18.48
2.	Good (122.67 to 141.24 score)	14	38.89		
3.	Better (>141.24 score)	15	41.67		
	Total	36	100.00		

Conclusion

The perception scale developed is found to be reliable and valid, hence it can be used to analyze the perception of vegetable and flower growers towards protected cultivation. The perception scale when administered to the vegetable and flower growers under protected cultivation revealed that vast majority of the vegetable and flower growers (80.56%) had good to better perception towards protected cultivation.

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