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RESEARCH ARTICLE

Scale development and validation: Towards a reliable and valid measure of motivation to cultivate marigold

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Abstract

Floriculture has become one of the fastest-growing agricultural sectors, contributing significantly to income diversification, employment generation and export potential. Among floricultural crops, marigold (*Tagetes* spp.) holds prime importance in India due to its cultural, economic and industrial applications. Despite its wide cultivation, limited empirical work has explored the motivational factors influencing farmers' participation, especially in the Jammu region. This study aimed to develop and standardise a reliable and valid scale to measure motivation for marigold cultivation among farmers in Jammu. Scale construction followed a two-stage process: development and validation. Initially, 46 items were generated through literature review and expert consultation, later refined to 40 items. Using Lawshe's method, content validity ratio (CVR) and content validity index (CVI) were calculated, with 22 items meeting the CVR threshold (≥ 0.49). The overall scale-level content validity index (S-CVI) value of 0.89 confirmed strong content validity, while Kappa values (0.80–1.00) indicated excellent inter-rater agreement. The scale was administered to 40 marigold farmers, yielding a Cronbach's Alpha of 0.89, demonstrating high internal consistency reliability. The developed tool provides a robust framework for assessing farmer motivation and can guide policymakers and extension professionals in promoting sustainable marigold entrepreneurship in the Jammu region and beyond.

Keywords: content validity index; content validity ratio; farmer motivation; floriculture; internal consistency reliability; Kappa; marigold; scale validation

Introduction

Floriculture has emerged as one of the fastest-growing sectors of agriculture worldwide, contributing significantly to income diversification, employment generation and international trade. Between the years 2016 and 2020, global flower exports rose from USD 19.6 billion to USD 22.4 billion (1). Marigold (*Tagetes* spp.), a widely cultivated flower crop, holds immense cultural, religious and commercial significance in countries like India, China and Mexico (2, 3). In Asia, countries such as China, India and Thailand are expanding their floriculture base due to favourable agro-climatic conditions and growing domestic demand (4). The increasing demand for marigold in religious ceremonies, decorative purposes, pharmaceutical applications and natural dye production has led to its widespread cultivation. Farmers are increasingly adopting marigold cultivation due to its short cropping cycle, relatively low input costs and high market demand, making it a viable alternative to traditional food crops (5). In India, floriculture has transitioned from a subsistence activity to a commercial enterprise, supported by rising domestic consumption, export opportunities and government initiatives under the Mission for Integrated Development of Horticulture (MIDH). The country ranks among the top producers of loose flowers, with marigold (*Tagetes* spp.) occupying a dominant share of total area and production (6). Its adaptability to varied climatic zones, low gestation period and multipurpose uses ranging from religious offerings and decorations to industrial dye and pharmaceutical applications make it an attractive choice for small and marginal farmers (7). The economic significance of marigold cultivation is evident from comparative studies, which show higher employment and income generation compared to staple crops. For instance, in Jammu, marigold cultivation provided nearly 125 man-days per season, surpassing rice and wheat, while offering higher profitability (7). Beyond economics, marigold carries socio-cultural importance as it is indispensable during festivals, weddings and religious rituals across India. Despite these advantages, the expansion and sustainability of marigold cultivation depend largely on the motivational factors influencing farmers' decisions. These motivations are not limited to financial gain but also include social recognition, risk management, access to extension services and government support schemes (4, 8). Recognising and measuring these factors systematically is critical for strengthening floriculture in India and beyond.

Motivation is a central driver of farmer behaviour, influencing decisions about crop adoption, technology use and long-term engagement in agricultural enterprises. In the context of marigold cultivation, motivation arises from a blend of economic incentives like income, profitability, cost-benefit ratio, socio-cultural aspects such as prestige, ritual use, employment

generation and institutional factors such as extension support, government policies and credit access (8). Studies across India highlight that economic viability is often the strongest motivator. In Chhattisgarh, farmers adopted marigold primarily due to favourable returns and employment potential (6). Similarly, in Tripura, farmers reported experience, exposure and favourable natural conditions as influential motivators alongside economic benefits (8). However, barriers such as inadequate marketing facilities and limited post-harvest infrastructure remain constraints that dampen motivational strength. In the Jammu region, where farmers traditionally rely on cereals, the adoption of marigold cultivation represents a shift toward high-value horticulture. While recent studies have documented the economic and employment benefits of marigold cultivation in Jammu, little attention has been given to the psychological and motivational dimensions underlying this shift (7). Understanding these factors is essential for designing interventions that can enhance adoption rates, improve market linkages and sustain farmer interest in floriculture.

Despite the availability of general motivation scales in agricultural research, no standardised and context-specific instrument exists to measure motivational factors influencing marigold cultivation, particularly in the Jammu region. Existing scales often fail to capture the crop-specific economic, socio-cultural and institutional dimensions unique to floriculture. Therefore, there is a need to develop a reliable and valid scale tailored to marigold farmers to ensure precise measurement and effective policy and extension interventions.

Materials and Methods

Stage I: Developing the scale

The first stage, "Developing the scale," considers the step used to create a sound scale. This stage further consists of two steps, i.e. substantive validity and content validity. The stage starts with the generation of items that will in due course end up as a scale. The objective is to evaluate and refine the scale before it is administered to the farmers. During this stage, the steps to follow and important factors that need to be considered aiding in scale development are discussed under the following:

Substantive validity

Substantive validity ensures the conceptual adequacy of the scale items through literature review and expert evaluation. A comprehensive literature review was conducted to identify key motivational factors influencing farmers' decisions to cultivate marigold. The review covered research on agricultural motivation, behavioural theories and floriculture adoption models (9, 10).

Item generation

For scale construction, a pool of items was generated relevant to the motivating factors from various secondary sources, experts and subject matter specialists' opinion. Initially, 46 items were generated.

Item wording/editing and selection

The initially generated items undergo the review and revision process and the items were restructured applying 14 criteria (11). Further, as per the suggestions and comments of the experts and subject matter specialists, the items were again revised and restructured. After the suggested revision, 40 items were retained for the next step.

Item scaling

With respect to scaling of the items, it is important that the scale used generates sufficient variance among respondents for subsequent statistical analysis (12). Among the number of different scaling techniques, the most used Likert-type five-point scale was used for sufficient variance (13).

Content validity

Validity ensures the items measure what they claims to measure. Content validity assesses whether the scale items adequately represent the motivational constructs and are relevant to marigold cultivation.

Content validity ratio (CVR)

To ensure the content relatedness of the scale items, content validity ratio (CVR) was calculated following Lawshe's formula. The CVR quantifies expert agreement on whether an item is essential for measuring the construct. A panel of 15 subject matter experts (SMEs) in agricultural extension, floriculture and behavioural sciences evaluated each item. Experts evaluated each item using a three-point scale (14):

1 = Not necessary, 2 = Useful but not essential, 3 = Essential.

For CVR calculation, only the number of experts rating an item as "Essential" (Ne) was considered.

Lawshe's (1975) formula:

$$CVR = (Ne - N/2) / N/2$$

Where,

N = Total number of experts

Ne = Number of experts who rated the item as "Essential" (score = 3)

The minimum CVR threshold for item retention was determined based on the Lawshe (1975) critical values table (Table 1). For 15 experts, the minimum CVR threshold is ≥ 0.49 (14–17).

Interpretation and item selection

Items with CVR ≥ 0.49 were considered valid and included in the scale. Items with CVR ≥ 0.49 were discarded.

Content validity index

The CVI of the instrument was computed by item-content validity index (I-CVI) and S-CVI (15). For CVI, judges were asked to rate each item of the scale from not relevant, somewhat relevant, quite relevant and highly relevant by scoring them from 1, 2, 3 and 4 respectively.

Formula used:

$$\text{I-CVI} = \frac{\text{total judges giving an item rating 3 or 4}}{\text{total judges in panel}}$$

The S-CVI was computed by summing up all the I-CVI of the scale items and dividing it by the total number of items of the scale. S-CVI ranges between 0 and 1. The acceptable threshold is a S-CVI of 0.80 or higher (15–17).

Formula used:

$$\text{S-CVI} = \Sigma \frac{\text{I-CVI}}{n}$$

n = total no. of items

Table 1. Final motivating factor scale for marigold cultivation

Item	CVR	I-CVI	S-CVI	Pc	Kappa	Reliability of the scale
1	0.86	0.93		0.000457	0.93	
2	1	1		0.0000305	1	
3	0.86	0.93		0.000457	0.93	
4	0.60	0.80		0.0138	0.80	
5	0.60	0.80		0.0138	0.80	
6	0.60	0.80		0.0138	0.80	
7	0.86	0.93		0.000457	0.93	
8	1	1		0.0000305	1	
9	0.73	0.80		0.0138	0.80	
10	1	0.87		0.0032	0.87	
11	0.86	0.87	S-CVI = 19.54/22	0.0032	0.87	Cronbach's Alpha = 0.89
12	0.60	0.87	S-CVI = 0.89	0.0032	0.87	
13	0.86	0.93		0.000457	0.93	
14	0.86	1		0.0000305	1	
15	0.86	1		0.0000305	1	
16	0.86	0.87		0.0032	0.87	
17	0.86	0.87		0.0032	0.87	
18	0.60	0.80		0.0138	0.80	
19	0.73	0.87		0.0032	0.87	
20	0.60	0.80		0.0138	0.80	
21	0.73	0.80		0.0138	0.80	
22	1	1		0.0000305	1	

CVR: content validity ratio; I-CVI: item content validity index; S-CVI: scale level content validity index; Pc: probability of chance.

The S-CVI of the scale was found, which was well above the accepted threshold, to be 0.89. Thus, the content validity of the scale was found to be high.

Kappa statistics

Kappa statistics were utilised in addition to CVI to eliminate any random chance agreement among the judges, thus ensuring a better understanding of content validity. Kappa statistic supplements CVI by ensuring that the experts' agreement is beyond chance (15–20). Probability of chance agreement is assessed prior to computation of Kappa statistics.

Formula used:

$$P_c = \frac{N!}{A!\,(N-A)} \times 0.5^N$$

Whereas,

Pc = probability of chance agreement

N = number of experts in the panel

A = number of experts in the panel who agree that the item is relevant

Formula used for Kappa statistics:

$$k = \frac{(I\text{-}CVI) - p_c}{1 - Pc}$$

The Kappa value of the scale items ranges from 0.80–1. Since the kappa was above the threshold, 0.74 it was considered as excellent.

Stage II: Testing of new scale

The second stage, "Testing of new scale," considers two steps involved in testing and statistically validating the new developed scale i.e., selection of sample, administration of the scale and internal consistency reliability. The stage starts with selection of sample to whom the scale will be administered. The idea is to evaluate and refine the scale before it is administered to the farmers. Under this stage, the steps and important factors that needs to be followed and to consider in for further statistically validating the newly developed scale are discussed under the following:

Sample selection

The scale was administered on 40 randomly selected non-sampled marigold farmers for further statistical analysis of the scale. The list of marigold farmers was procured from the Department of Floriculture Gardens and Parks, Jammu (21). The sample size of 40 farmers was considered adequate for preliminary reliability testing, as recommended in scale development studies for pilot validation (22). However, it is acknowledged that a larger sample would enhance generalisability and therefore, the present study should be considered as an initial validation effort within a broader research framework.

Administration of the scale

The newly developed scale was administered on 40 non-sampled marigold famers.

Internal consistency reliability

Cronbach alpha coefficient was employed to determine the reliability of the scale (20). Internal consistency reliability (ICR) is important while developing a scale to the extent to which all items in a construct measures the same underlying concept (22, 23). The ICR ensures that the scale is coherent, stable and free from random measurement errors. A reliable scale has items that are highly interrelated and consistently measures the intended construct, it also helps in confirming that each item of the scale contributes meaningfully to the scale (24). A reliable scale minimises random errors, ensuring that the observed variance reflects the true construct rather than measurement inconsistencies, high reliability of scale increases confidence in repeated measurements, making results more reproducible in different samples (25, 26).

Construct validity was not assessed in the present study due to the exploratory nature and limited sample size. Future studies are recommended to employ exploratory and confirmatory factor analysis on larger samples to further validate the dimensional structure of the scale.

Results and Discussion

The content validity assessment provided strong empirical evidence supporting the representativeness and conceptual adequacy of the

motivating factor scale. Based on evaluations from a panel of fifteen subject matter experts, 22 items achieved acceptable to excellent levels of content validity. The CVR values, ranged between 0.60 and 1.00, exceeded the minimum acceptable threshold of ≥ 0.49 for 15 experts, indicating that the items were considered essential to the construct of the scale. Similarly, the I-CVI ranged from 0.80 to 1.00, confirming that experts found the items to be both relevant and clearly worded. The S-CVI of 0.89 further reflected high overall agreement, signifying that the scale comprehensively represents the domain of motivation. Additionally, the low probability of chance agreement (Pc) values and high modified Kappa coefficients (K= 0.80–1.00) suggested that expert consensus was systematic rather than coincidental. Collectively, these findings affirm that the scale exhibits robust content validity, with items that are theoretically grounded, empirically supported and contextually appropriate for measuring motivational constructs. The results provide a strong foundation for proceeding with reliability testing and subsequent field validation.

The internal consistency reliability of the 22 items of the scale was examined using Cronbach's Alpha. The obtained coefficient (α = 0.892; standardised α = 0.913) indicated excellent reliability. Corrected item-total correlations ranged from 0.050 to 0.860, with most items exceeding 0.40, demonstrating adequate homogeneity among items. The "alpha item deleted" analysis showed that removal of any item did not meaningfully improve reliability, except for Items 3 and 11, which displayed weak correlations. Although Items 3 and 11 exhibited relatively low corrected item-total correlations, they were retained due to their conceptual relevance in capturing specific dimensions of farmer motivation.

The findings align with previous studies highlighting the multi-dimensional nature of farmer motivation, where economic, socio-cultural and institutional factors jointly influence decision-making (9, 10). The high reliability and content validity observed in this study are consistent with similar scale development efforts in agricultural extension, reinforcing the robustness of the methodological approach. However, the relatively low corrected item-total correlations for certain items indicate the need for further refinement, suggesting that farmer motivation is context-specific and dynamic.

These results confirm that the scale demonstrates strong internal consistency and reliable item performance for assessing motivating factors.

Conclusion

The study successfully developed and validated a reliable and context-specific motivating factors scale for marigold cultivation. The scale demonstrated strong content validity and internal consistency reliability, confirming its suitability for assessing farmer motivation. The instrument can be effectively utilised by policymakers, extension agencies and researchers to design targeted interventions, enhance farmer participation and promote sustainable livelihood diversification. Furthermore, the scale offers potential applications in evaluating extension programs, understanding behavioural drivers and guiding policy formulation. Future research should focus on cross-regional validation, longitudinal assessment of motivation and incorporation of advanced statistical techniques such as factor analysis to further strengthen the scale.

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Authors' contributions

Conceptualisation and research design were carried out by MMA and JSM. Data collection, statistical analysis and manuscript writing were performed by MMA. SK and JSM assisted in literature review, scale development, data entry and interpretation of results. JSM and PP contributed to manuscript editing, critical revision and final approval of the version to be published. All authors have read and approved the final manuscript.

Compliance with ethical standards

Conflict of interest: Authors do not have any conflict of interest to declare.

Ethical issues: None

References

1. Guaita-Pradas I, Rodríguez-Mañay LO, Marques-Perez I. Competitiveness of Ecuador's flower industry in the global market in the period 2016-2020. Sustainability. 2023;15(7):5821. https://doi.org/10.3390/su15075821
2. Chadha KL. Handbook of Horticulture. New Delhi: Indian Council of Agricultural Research; 2012.
3. Dole JM, Wilkins HF. Floriculture: Principles and Species. Pearson Education; 2005.
4. Navalur NP, Tirlapur LN, Patil BO. Floriculture scenario in India. Int J Commerce Bus Manage. 2015;8(2):184–7. https://doi.org/10.15740/HAS/IJCBM/8.2/184-187
5. Bhattacharjee SK, De LC. Advanced Commercial Floriculture. Vol. 2. Jaipur: Pointer Publishers; 2002.
6. Vennel Raj J, Singh JK, Kumar NM, Jangre N. Economic analysis of marigold flower in research farm of IGKV Raipur, Chhattisgarh, India. Int J Environ Climate Change. 2022;12(10):165–70. https://doi.org/10.9734/ijecc/2022/v12i1030781
7. Kaur M, Bhat A, Sadik-Zada ER, Sharma R. Productivity analysis and employment effects of marigold cultivation in Jammu, India. Horticulturae. 2022;8(3):263. https://doi.org/10.3390/horticulturae8030263
8. Deb R, Uddin A. Entrepreneurship through marigold cultivation: Evidence from Laxmibill area of Tripura. J Entrepreneurship Manage. 2015;4(3):40–54. https://doi.org/10.21863/jem/2015.4.3.014
9. Rogers EM. Diffusion of Innovations. 5th ed. New York: Free Press; 2003. p. 551.
10. Ryan RM, Deci EL. Intrinsic and extrinsic motivation from a self-determination theory perspective: Definitions, theory, practices and

future directions. Contemp Educ Psychol. 2020;61:101860. https://doi.org/10.1016/j.cedpsych.2020.101860

11. Edwards AL. Techniques of Attitude Scale Construction. New York: Appellation Century Crafts; 1957.
12. Lirios CG, González MDRM. Confirmatory factor analysis of the scale that measures biosecurity in light of the SDGs and COVID-19. Int Clin Case Stud Rep. 2021;1(1):1–17.
13. Likert R. A technique for the measurement of attitude. Arch Psychol. 1932;140:28–48.
14. Lawshe CH. A quantitative approach to content validity. Pers Psychol. 1975;28(4):563–75. https://doi.org/10.1111/j.1744-6570.1975.tb01393.x
15. Ansari MM, Khan S. An in-depth examination of validity assessment: Exploring diverse methodologies and dimensions of validity in social research studies. Asian J Agric Extension Econ Sociol. 2023;41(10):772–82. https://doi.org/10.9734/ajaees/2023/v41i102224
16. Ansari MM, Manhas JS, Parihar P. Development of knowledge test to measure the knowledge level of marigold farmers on marigold cultivation practices. Gujarat J Extension Educ. 2024;38(1):163–8. https://doi.org/10.56572/gjoee.2024.38.1.0027
17. Khan S, Parihar P, Manhas JS, Ansari MM. Development of knowledge test to measure the knowledge level of farmers on interventions of the NICRA project for climate change adaptation. Int J Agric Extension Social Dev. 2024;7(11):162–6. https://doi.org/10.33545/26180723.2024.v7.i11Sc.1365
18. Shrotryia VK, Dhanda U. Content validity of assessment instrument for employee engagement. SAGE Open. 2019;9(1):1–7. https://doi.org/10.1177/2158244018821751
19. Wynd CA, Schmidt B, Schaefer MA. Two quantitative approaches for estimating content validity. West J Nurs Res. 2003;25(5):508–18. https://doi.org/10.1177/0193945903252998
20. Khan S, Parihar P, Ansari MM. Scale development for assessing farmers' perception regarding climate smart interventions under technology demonstration component of NICRA project. Agric Assoc Textile Chem Crit Rev. 2025;13(1):403–8. https://doi.org/10.21276/AATCCReview.2025.13.01.403
21. Department of Floriculture (DoF). Office communication record through Department of Floriculture, Jammu; 2023.
22. DeVellis RF. Scale Development: Theory and Applications. 4th ed. Thousand Oaks (CA): SAGE Publications; 2016.
23. Hair JF, Black WC, Babin BJ, Anderson RE. Multivariate Data Analysis. 8th ed. Boston: Cengage Learning; 2019.
24. Cronbach LJ. Coefficient alpha and the internal structure of tests. Psychometrika. 1951;16(3):297–334. https://doi.org/10.1007/BF02310555
25. Nunnally JC, Bernstein IH. Psychometric Theory. 3rd ed. New York: McGraw-Hill; 1994.
26. Ansari MM, Manhas JS. Development and validation of an attitude scale for assessing marigold farmers' attitude on marigold cultivation. Agric Assoc Textile Chem Crit Rev. 2025;13(3):295–8. https://doi.org/10.21276/AATCCReview.2025.13.03.295

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