Original Research Article

Analysis of Farmers’ Satisfaction with price and quality of Crop Protection Chemicals in Paddy Cultivation in Karimnagar district of Telangana state

ABSTRACT

|  |
| --- |
| **Aims:** To assess the satisfaction level of paddy farmers with crop protection chemicals, focusing on two key factors: price and product quality.  **Study design:** Cross-sectional analytical study.  **Place and Duration of Study:** Conducted in four mandals (Huzurabad, Jammikunta, Bejjanki, and Kamalapur) of Karimnagar district, Telangana, India, during the 2024 paddy crop cycle.  **Methodology:** The Sample size of the paddy farmers is 80, and all were chosen by a random sampling procedure. To collect primary data, a pre-tested interview schedule was employed. Farmers' opinions regarding the price and quality of crop protection chemicals were the main focus of the survey. Primary data was collected through a pre-determined interview schedule. The survey was primarily conducted to get the farmers' opinions on the price and quality of crop protection chemicals. The use of R software and multiple linear regression analysis helped in determining the perception of these factors on overall satisfaction.  **Results:** The regression model suggested that the perception of quality (β1 = 0.293; *P*< .001) and price (β2 = 0.242; *P* <.001) were the most influential variables to the satisfaction of the farmers. The model accounted for 56.85% of the changes in satisfaction (R² = 0.5685), and the overall model was statistically significant (F = 45.46, *P* < .001).  **Conclusion:** Farmers’ satisfaction with crop protection products is largely affected by the way they perceive the product’s quality and affordability. Collecting data after several crop cycles offers a reliable basis for making product development and farmer engagement strategy decisions. |

*Keywords: [Crop protection chemicals, farmer satisfaction, price perception, quality perception, multiple linear regression analysis]*

1. INTRODUCTION

According to the UNFPA's State of World Population Report 2024, India's population is expected to reach 1.428 billion people by 2024 at a growth rate of 1.2 percent. India is expected to have more than 1.5 billion people by 2030, making it the world's most populous nation [1]. Rice serves as a main staple food for over half of the world's population. Every year, about 480 million metric tons of milled rice are produced globally. China and India account for nearly 50 per cent of both the world's rice production and consumption [2]. The future demand for rice is expected to increase due to the ongoing population growth. This will require an increase in rice production [3]. The India Rice Market size is estimated at USD 54.09 billion in 2025, and is expected to reach USD 60.90 billion by 2030, at a CAGR of 2.4% during the forecast period [4]. Paddy farming is essential for maintaining global food security, but it faces ongoing challenges from various pest species. Some of these pests include the rice yellow stem borer (*Scirpophaga incertulas* Walker, 1863), leaf folder (*Cnaphalocrocis medinalis* Guenée, 1854), gall midge (*Orseolia oryzae* Wood-Mason, 1883), brown plant hopper (*Nilaparvata lugens* Stål, 1854), and white-backed plant hopper (*Sogatella furcifera* Horváth, 1899) [5]. Stem borers, such as *Scirpophaga incertulas* (the yellow stem borer) and *Chilo suppressalis*, are among the most harmful pests affecting rice in India, causing severe issues like “dead heart” and “white ear” at different stages of the crop [6]. The tillering and flowering stages of rice plants are the most vulnerable to stem borer infestation [7]. (Viajante and Heinrichs, 1987). One percent of dead heart can reduce yield by 0.3% (about 12 kg/ha), while one percent of white earhead can reduce yield by 4.2% (about 183 kg/ha), according to studies. Similarly, rice leaf folder infestations can reduce yields by 30% to 80%, posing a serious risk to total productivity [8]. Global pesticide use, (measured in tonnes of active ingredients) rose by 46% from 1996 to 2016, according to the FAOSTAT database from WHO [9]. Worldwide, herbicides make up the largest portion at about 50%, followed by fungicides and bactericides at 22.5%, and insecticides at 20.4%. In contrast, India relies mostly on insecticides, which account for 51.4%. Fungicides and bactericides follow at 32.6%, with herbicides making up 15.8% [10]. The need for efficient pest management techniques emerged from the growing frequency and intensity of pest infestations in rice farming. As a result, India's pesticide industry has experienced significant expansion and is now an essential component of today's farming methods; yearly usage is estimated to be between 60,000 and 62,000 metric tonnes. In 2023, approximately 108.2 million hectares of the total cultivated land were treated with chemical pesticides, while around 15.6 million hectares were treated with bio-pesticides [11]. Pesticides are classified based on their pest targets, such as fungicides, insecticides, herbicides, and rodenticides. For example, fungicides kill fungi, insecticides kill insects, and herbicides destroy weeds [12]. The widespread use of crop protection products makes understanding how farmers perceive their quality and cost important. Their satisfaction and usage patterns are significantly influenced by these perceptions. Perception and willingness to pay are two important psychological elements that influence these choices. The term "perception" describes how farmers evaluate a product's overall worth, safety, and efficacy in light of their own experiences and outside factors. Conversely, their willingness to pay indicates that they are prepared to invest in the product because of its alleged advantages. Even if a product is seen favourably, its high cost may prevent it from being widely adopted. On the other hand, a product with a fair price tag but a bad reputation could also be turned down. These elements aid in determining the usefulness and long-term viability of a product [13]. This study was therefore undertaken to evaluate farmer satisfaction concerning the quality and price of crop protection chemicals used in paddy cultivation to control stem borer, providing insights into their decision-making and real-world experience after multiple crop cycles.

2. Materials and methods

2.1 Data collection

This research was carried out in the Karimnagar district, which is known for its extensive paddy cultivation. A multistage sampling technique was used to select sample farmers [14] .In the first stage, four mandals—Jammikunta, Bejjanki, Kamalapur, and Huzurabad—were chosen based on the substantial paddy acreage under high crop protection input usage. Two villages were selected from each mandal for the second stage based on the total area under paddy cultivation. Ten paddy farmers were randomly selected from the village, representing a total sample size of 80. A structured and pre-determined interview schedule was used to gather primary data for trustworthy insights. Category and scaled responses were possible due to the schedule's combination of closed-ended and Likert scale-based questions. Farmers' opinions about the cost and calibre of frequently used crop protection chemicals were gathered through in-person interviews.

**2.2 METHODOLOGY**

Multiple linear regression analysis [15] was used with the support of R statistical software to examine the relationship between paddy farmers' perceptions of crop protection chemicals, specifically insecticides, and their level of satisfaction with price and product quality. The model examined perceptions of price and quality on the satisfaction level.

Where,

= Dependent Variable (Satisfaction Level)

𝛽0 = Intercept

, = Regression Coefficients

, = Independent Variables (Quality Perception and Price Perception)

3. results and discussion

**3.1 Perception of farmers regarding product quality**

Farmers were asked to share their perception on the performance of the crop protection chemicals in controlling pests. This information will help in knowing the satisfaction of the farmer based on the quality of the product. Such insights guide in identifying strengths to maintain and weaknesses that need focused improvement. The responses were recorded on a 5 point rating scale, where 5 indicates “Very poor” and 1 represents “Excellent” with product quality.

**Table 1. Farmer perception on the quality of crop protection chemicals**

|  |  |
| --- | --- |
| **Scale** | **Response in percentage (%)** |
| Very poor | - |
| Poor | - |
| Average | 7 |
| Good | 60 |
| Excellent | 33 |

*\*Farmer perception with quality of crop protection chemicals*

As shown in Table 1, the majority of farmers (93%) rated the product as either Good or Excellent, indicating high level of satisfaction with the quality of crop protection chemicals.

**3.2 Perception of farmers regarding product price**

Farmers were asked to share their views regarding the price of the crop protection chemicals. This evaluation helps in understanding whether farmers consider the product reasonably priced for its performance. The responses were collected using a 5-point scale, where 5 indicates strongly disagree and 1 represents strongly agree. Assess farmers' willingness to pay and whether the price could be a barrier to adoption or satisfaction.

**Table 2. Farmer perception on the price of crop protection chemicals**

|  |  |
| --- | --- |
| **Scale** | **Response in percentage (%)** |
| Strongly disagree | - |
| Disagree | 25 |
| Neutral | 12 |
| Agree | 51 |
| Strongly agree | 12 |

*\*Farmer perception with the price of crop protection chemicals*

As shown in Table 2, a combined 63 percent of the farmers agreed or strongly agreed that the price was fair for the performance, while 25 percent **expressed disagreement**. This mixed perception suggests that although most farmers recognize the value of Barroz, a segment still considers it relatively expensive, indicating a need for targeted price communication and possible cost-reduction strategies for wider acceptance.

**3.3 Multiple linear regression analysis for sample farmers**

The factors influencing farmers' satisfaction with crop protection chemicals were evaluated using a multiple linear regression analysis. In this analysis, Price Perception (PP) and Quality Perception (QP) were regarded as independent variables, and Satisfaction Level (SL) as the dependent variable. The purpose was to determine how the perceptions of farmers’ regarding quality and pricing impacted their overall satisfaction with the crop protection inputs they used in paddy cultivation.

By using R program: model = lm (SL~QP+PP, data)

**Table 3. Multiple linear regression analysis for sample farmers**

|  |  |
| --- | --- |
| **Component** | **Values** |
| Dependent Variable | Satisfaction Level (SL) |
| Independent Variables | Quality Perception (QP), Price Perception (PP) |
| Regression Equation | SL = 2.472 + 0.293(QP) + 0.243(PP) |
| QP Coefficient | 0.29303 (Significant, *P*=.000013) |
| PP Coefficient | 0.242 (Significant, *P*=.000037) |
| Intercept | 2.472 |
| R-squared | 0.569 |
| Adjusted R-squared | 0.556 |
| F-statistic | 45.46 (Model is highly significant, *P*<.001) |
| Residual Std. Error | 0.211 |

*\*Farmer satisfaction with the price and quality of crop protection chemicals*

The results of a multiple linear regression study showed that a farmer's satisfaction with the crop protection chemicals was greatly affected by the perception of quality and price. As shown in Table 3, the regression equation was:

Satisfaction Level (SL) = 2.472 + 0.293 (QP) + 0.243 (PP)

The baseline level of satisfaction when either quality or price perception was regarded as neutral or zero was represented by the intercept value (2.472). This value served as a starting point for interpreting the effects of the independent variables. When price perception remained constant, a one-unit increase in perceived quality led to a 0.293-unit increase in satisfaction, according to the Quality Perception coefficient (0.293). According to the Price Perception coefficient (0.242), a one-unit increase in perceived affordability or value resulted in a 0.243-unit increase in satisfaction when quality perception remained unchanged. Both predictors were statistically significant with extremely small *P*-values (QP: *P*<.001 and PP: *P*<.001), indicating that farmers’ views on both quality and pricing have a substantial impact on their satisfaction levels.

According to the model, the two independent variables explained 56.9% of the variation in satisfaction levels, which had an R-squared value of 0.569. The adjusted R-squared value (0.556) supported this prediction by considering the number of predictors used. At a significance level of *P*< 0.001, the model’s F-statistic of 45.46 is highly significant (*P* < .001) and confirms the overall statistical significance and robustness of the regression. The Residual Standard Error (0.211) suggests a minimal average difference between the observed and predicted satisfaction scores, demonstrating a good model fit for the collected data.

These findings are the real-life significance of product performance and affordability in the agriculture sector, which are the significant factors influencing farmer decision-making. Farmers, who see regular pest control performance and are convinced that they are getting good value for their money, will be more inclined to use and recommend the same products. The results emphasize the importance of the manufacturers and input suppliers adhering to the dual focus of quality assurance and cost-effectiveness if they want to gain farmer trust and build loyalty over time.

4. Conclusion

Gaining knowledge of farmers' opinions after several cropping seasons provides essential information about the effectiveness of crop protection chemicals. This study emphasizes the value of utilizing field experience in various seasonal and environmental conditions to gauge farmer satisfaction. These reviews demonstrate the products' dependability, consistency, and efficacy in controlling major pests that frequently impact paddy cultivation, like leaf folders and stem borers. Quality and pricing are two aspects that greatly influence overall satisfaction levels, according to an analysis of farmers' perceptions of both. This type of input validates the usefulness of crop protection products in practice and points out areas that could be improved to increase their usability and boost farmer confidence. Manufacturers, agri-input distributors, and extension organisations need these insights to improve their communication and product strategies. Stakeholders can support sustainable increases in crop productivity and more efficient pest management by better matching farmer expectations.

**REFERENCES**

1. Times of India. (2023). India’s agritech sector: The current scenario, trends, and budget implications. Times of India Blogs. Available: <https://timesofindia.indiatimes.com/blogs/voices/indias-agritech-sector-the-current-scenario-trends-and-budget-implications>

2. Muthayya, S., Sugimoto, J. D., Montgomery, S., & Maberly, G. F. (2014). An overview of global rice production, supply, trade, and consumption. *Annals of the New York Academy of Sciences*, 1324(1), 7–14.

3. Mahajan, G., Kumar, V., & Chauhan, B. S. (2017). Rice production in India. In B. S. Chauhan, K. Jabran, & G. Mahajan (Eds.), *Rice production worldwide*, 53–91.

4. Rice Industry in India Size & Share Analysis - Growth Trends & Forecasts (2025 - 2030).  
Available: <https://www.mordorintelligence.com/industry-reports/india-rice-market>

5. Mohammad, M. Y., Jahan, A. S. S., Sujarajini, V., & Haniffa, H. M. (2025). Comprehensive review on types of pest attacks in paddy cultivation and botanical control measures. *Crop, Forage & Turfgrass Management,* 11(1), 70026.

6. Dey, S. (2020). Stem borers, an important yield-reducing insect pest complex of rice in India: A review. *Journal of Entomology and Zoology Studies*, 8(5), 786–789.

7. Viajante, V. and Heinrichs, E.A. (1987). Plant age effect of rice cultivar IR46 on susceptibility to the yellow stem borer *Scirpophaga incertulas* (Walker) (Lepidoptera: Pyralidae). *Crop Protection*, 6(1), 33-37.

8. Muralidharan, K., & Pasalu, I. C. (2006). Assessments of crop losses in rice ecosystems due to stem borer damage (Lepidoptera: Pyralidae). *Crop Protection*, 25(5), 409–417.

9. Global situation of pesticide management in agriculture and public health. (2018). Report of the WHO-FAO survey. Available: <https://openknowledge.fao.org/server/api/core/bitstreams/722bf1b2-bdd1-454d-b51b-5bfd59fb8ce5/content>

10. Reddy, A.A., Reddy, M. and Mathur, V., 2024. Pesticide use, regulation, and policies in Indian agriculture. *Sustainability*, *16*(17), 7839.

11. Directorate of Plant Protection, Quarantine and Storage. (2025). Statistical database.

12. National Institutes of Health. (2021). Agriculture development. PubMed Central. Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7908628/>

13. Bandara, B. M. D. P., Abeynayake, N. R., Bandara, L., & Anjalee, G. H. I. (2013). Farmers’ perception and willingness to pay for pesticides concerning quality and efficacy. *Journal of Agricultural Sciences – Sri Lanka,* 8(3), 153–163.

14. Sadala, R. (2014). Comparative economics of improved and traditional methods of paddy cultivation in Karimnagar district of Andhra Pradesh (Doctoral dissertation, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani).

15. Muliya, J. B. (2022). Buying behaviour and satisfaction of farmers towards adjuvants in Junagadh district (Doctoral dissertation, Junagadh Agricultural University, Junagadh).