

International Journal of Agriculture Extension and Social Development

Volume 9; Issue 5; May 2026; Page No. 472-475

Received: 02-03-2026
Accepted: 08-04-2026

Indexed Journal
Peer Reviewed Journal

Perception of farmers towards recommended soil health management practices in rice–wheat cropping system

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DOI: <https://www.doi.org/10.33545/26180723.2026.v9.i5f.3613>

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Abstract

Soil health management is a critical component of sustainable agriculture, particularly in intensive cropping systems such as rice–wheat. Farmers' perception plays a decisive role in the adoption of recommended soil health management practices, as it influences their acceptance and continued use of such practices. The present study was conducted to assess the perception of farmers regarding various soil health management practices in the rice–wheat cropping system in Punjab. Data were collected from 300 respondents using a structured interview schedule from 5 districts of Punjab. The perception was measured using mean scores for individual statements and categorized into low, medium, and high levels. Results revealed that farmers had a generally positive perception towards practices such as leguminous cover crops, farmyard manure application, surface mulching, green manuring, and avoidance of paddy straw burning, which are known to improve soil fertility and sustainability. However, relatively lower perception was observed for practices like direct seeded rice, soil test–based fertilizer application, and incorporation of leguminous cover crops. Overall, 42.33 per cent of farmers exhibited a high level of perception, indicating growing awareness and acceptance of soil health management practices. The findings underline the need for targeted extension interventions to strengthen farmers' understanding and adoption of scientifically recommended practices.

Keywords: Soil health management, farmer perception, rice–wheat system, organic practices, mulching, green manuring

Introduction

The rice–wheat cropping system (RWCS) is one of the most dominant and productive agricultural production systems in South Asia, particularly across the Indo-Gangetic Plains (IGP) of India. The system plays a critical role in ensuring national food security by contributing substantially to the production of staple cereals such as rice and wheat. Punjab, Haryana, and western Uttar Pradesh are among the major regions where intensive rice–wheat cultivation has been practiced for decades following the Green Revolution (Ladha *et al.*, 2003) ^[11]. Although the system has significantly enhanced agricultural productivity and farmers' income, continuous cultivation of rice and wheat under intensive management has led to several ecological and soil-related concerns.

Over the years, excessive dependence on chemical fertilizers, imbalanced nutrient application, intensive tillage operations, and overexploitation of groundwater resources have adversely affected soil health and environmental sustainability (Lal, 2015) ^[12]. Continuous monocropping and indiscriminate use of agrochemicals have contributed to declining soil fertility, depletion of soil organic carbon, nutrient imbalance, soil compaction, and deterioration of

soil biological activity (Brady & Weil, 2016) ^[2]. In addition, residue burning practices commonly followed in northwestern India have resulted in significant nutrient losses, greenhouse gas emissions, and environmental pollution (Gupta *et al.*, 2004) ^[18]. These issues pose serious threats to the long-term sustainability and resilience of the rice–wheat production system.

In response to these challenges, sustainable soil health management practices have gained increasing importance in recent years. Practices such as integrated nutrient management, organic manuring, green manuring, crop residue incorporation, use of leguminous cover crops, conservation tillage, biofertilizer application, and soil test–based fertilizer recommendations have been widely promoted to restore soil fertility and improve nutrient use efficiency (Yadav *et al.*, 2000; Mandal *et al.*, 2008; FAO, 2017) ^[25, 15, 5]. These practices improve the physical, chemical, and biological properties of soil, enhance microbial activity, increase soil organic matter content, and contribute to long-term agricultural sustainability. Moreover, sustainable soil management practices help reduce dependency on synthetic fertilizers and improve resilience against climate variability and environmental

degradation (Pretty, 2008) ^[18].

Despite the proven benefits of these recommended practices, their adoption among farmers remains limited and uneven across regions. The success of sustainable agricultural interventions largely depends on farmers' perception, awareness, and willingness to adopt improved practices. Perception refers to the way farmers interpret, understand, and evaluate the usefulness, compatibility, and effectiveness of a technology or practice (Rogers, 2003) ^[19]. Farmers' decisions regarding adoption are often influenced by socio-economic conditions, educational status, farming experience, access to extension services, institutional support, risk orientation, and cultural beliefs (Lawanrisha, 2018) ^[13]. Therefore, understanding farmers' perception towards soil health management practices is essential for developing effective extension approaches, policy interventions, and location-specific strategies to encourage wider adoption.

Several studies have highlighted that positive perception towards sustainable farming practices significantly increases the likelihood of adoption and continued use (Meena *et al.*, 2017) ^[17]. Conversely, lack of awareness, inadequate technical knowledge, labor constraints, and uncertainty regarding economic benefits often discourage farmers from implementing soil health improvement measures. Thus, assessing farmers' perception not only provides insights into existing knowledge gaps and behavioral patterns but also helps policymakers and extension agencies formulate targeted interventions for promoting sustainable agriculture. In this context, the present study was undertaken to assess the perception of farmers towards recommended soil health management practices in the rice–wheat cropping system and to categorize their overall level of perception. The study aims to generate empirical evidence that can support the design of need-based extension strategies and contribute to the long-term sustainability of intensive agricultural systems.

Materials and Methods

Locale of the Study and Sample Size

The study was conducted among farmers practicing the rice–wheat cropping system. The Punjab state is divided into five agro-climatic zones. From each agro-climatic zone, one district was selected randomly i.e., Gurdaspur, Ropar, Jalandhar, Firozpur and Sangrur. From each district two blocks were selected randomly and from each selected block two villages were selected randomly. A total of 300 respondents were selected for the study using appropriate sampling techniques.

Measurement of Perception

Farmers' perception towards soil health management practices was measured using a set of 22 statements related to organic manures, crop residue management, green manuring, leguminous cover crops, soil testing, and other related practices. Responses were recorded on a Likert-type scale, and mean scores were calculated for each statement. Based on the total perception score, respondents were classified into three categories:

- Low level of perception (45–50)
- Medium level of perception (51–76)
- High level of perception (77–90)

Results and Discussion

Farmers' Perception Towards Soil Health Management Practices

The perception pattern of farmers towards soil health management practices revealed a transition from input-intensive conventional agriculture towards a gradually emerging sustainability-oriented mindset. However, this transition was uneven across practices, reflecting differences in farmers' experiential learning, economic feasibility, visibility of benefits, and access to technical knowledge.

Table 1: Farmers' perception towards different categories of soil health management practices

Practice category	Mean perception score
Nutrient enhancement through legumes and green manuring	4.08
Organic manure and soil moisture conservation	4.12
Crop residue management and mulching	3.66
Soil-test based fertilizer management	2.23
Direct seeded rice and conservation approaches	2.12
Operational constraints in sustainable practices	2.89

The findings demonstrated that farmers expressed the strongest perception towards practices directly associated with visible improvements in crop productivity and soil fertility. Practices related to organic manuring, green manuring, and leguminous cover crops received comparatively higher perception scores, indicating that farmers increasingly recognize the role of biological nutrient management in sustaining rice–wheat productivity. Farmers particularly associated legumes with improved nutrient availability and reduced fertilizer dependence, reflecting growing awareness regarding ecological nutrient cycling and integrated nutrient management. Similar trends have been documented in sustainable intensification studies across South Asia, where legume integration significantly improved farmers' perception of soil restoration and yield stability (Jat *et al.*, 2020; Sapkota *et al.*, 2021) ^[10, 20].

A similar positive perception emerged for organic manure application and residue mulching practices. Farmers perceived that farmyard manure and organic amendments improved soil water retention, suppressed weed growth, and enhanced crop vigor. Such perceptions are strongly linked with farmers' direct field experiences, where visible outcomes such as better moisture conservation and crop appearance influence technology acceptance. Previous studies by Choudhary *et al.* (2018) ^[4] and Bhaduri *et al.* (2022) ^[1] also reported that tangible and short-term agronomic benefits significantly strengthen farmers' confidence in sustainable soil management interventions.

Interestingly, the perception towards crop residue management reflected a dual narrative. On one hand, respondents acknowledged that paddy straw burning deteriorates soil health and contributes to long-term fertility decline. This suggests increasing environmental awareness among farmers, likely influenced by extension campaigns, government regulations, and growing public discourse surrounding residue burning in northwestern India. On the other hand, farmers simultaneously perceived straw incorporation as operationally difficult because of machinery limitations, labor scarcity, delayed sowing, and

residue handling costs. This contradiction highlights the classic gap between environmental awareness and practical adoption feasibility, which has also been observed in conservation agriculture studies conducted in the Indo-Gangetic Plains (Jain *et al.*, 2023) [9].

The relatively lower perception towards soil test-based fertilizer management and direct seeded rice indicates persistent skepticism towards technically complex or knowledge-intensive practices. Many respondents continued to rely on traditional fertilizer application methods or peer-based recommendations rather than scientific nutrient diagnostics. Such behavior reflects inadequate extension reach, limited trust in institutional advisory systems, and poor accessibility of soil testing services. Similar findings were reported by Singh *et al.* (2021) [23], who observed that farmers often prefer experiential judgment over laboratory-based recommendations due to delayed feedback and uncertainty regarding economic returns.

Table 2: Perception gradient of farmers towards sustainable soil health practices

Perception level	Frequency	Percentage
Low	74	24.66
Medium	99	33.00
High	127	42.33

The overall perception distribution further reinforces the evolving sustainability orientation among rice–wheat farmers. Nearly half of the respondents belonged to the high-perception category, while one-third demonstrated medium perception levels. This pattern indicates that awareness regarding sustainable soil health management has expanded considerably among farming communities, although substantial heterogeneity still exists.

The dominance of medium-to-high perception groups may be attributed to increasing exposure to extension programs, farmer networks, climate-related risks, and visible evidence of soil degradation under intensive farming systems. Farmers are increasingly realizing that long-term productivity cannot be sustained solely through chemical fertilizer dependence. Nevertheless, the persistence of a sizeable low-perception group suggests that awareness alone is insufficient to ensure behavioral transformation. Socio-economic limitations, resource constraints, risk aversion, and lack of technical support continue to shape farmers' decision-making processes.

From an agroecological perspective, these findings suggest that farmers' perception evolves not merely through information dissemination but through experiential validation, social learning, and institutional trust. Practices producing immediate and observable benefits tend to gain faster acceptance, whereas practices requiring technical precision, delayed returns, or structural changes face greater resistance. Therefore, future extension interventions should move beyond generalized recommendations and adopt differentiated, farmer-centered approaches emphasizing participatory demonstrations, localized success stories, and adaptive learning frameworks.

The findings collectively reveal that sustainable soil health transitions within the rice–wheat system are not purely technological processes but socio-ecological transformations shaped by farmers' knowledge systems,

perceptions, and practical realities. Strengthening institutional support, improving access to residue management technologies, and promoting experiential learning platforms will be critical for accelerating adoption of sustainable soil health practices in intensive agricultural regions.

Conclusion

The study demonstrates that farmers in the rice–wheat cropping system possess an emerging yet uneven perception towards sustainable soil health management practices. Farmers showed stronger perception towards practices associated with visible agronomic benefits, particularly organic manuring, green manuring, mulching, and legume-based nutrient management. In contrast, technically intensive practices such as soil test-based fertilizer management and direct seeded rice received comparatively lower acceptance due to operational difficulties, knowledge gaps, and uncertainty regarding outcomes.

The findings indicate that sustainable agricultural transitions in intensive farming systems depend not only on technological availability but also on farmers' experiential learning, institutional trust, and socio-economic feasibility. Therefore, policy interventions should prioritize participatory extension models, location-specific demonstrations, residue management support systems, and farmer-led knowledge networks to enhance adoption of sustainable soil health practices. Such strategies can significantly contribute to long-term soil resilience, climate adaptation, and sustainability of the rice–wheat production system.

References

1. Bhaduri D, Purakayastha TJ, Chakraborty D. Soil health management for sustainable agriculture under changing climate. *Journal of Environmental Management*. 2022;301:113755.
2. Brady NC, Weil RR. The nature and properties of soils. 15th ed. New York: Pearson Education; 2016.
3. Brady NC, Weil RR. The nature and properties of soils. 15th ed. Pearson Education; 2016.
4. Choudhary M, Jat HS, Datta A, Yadav AK, Sapkota TB, Sharma PC. Sustainable intensification influences soil quality, biota, and productivity in cereal-based agroecosystems. *Applied Soil Ecology*. 2018;126:189–198.
5. FAO. Soil organic carbon: The hidden potential. Rome: Food and Agriculture Organization of the United Nations; 2017.
6. FAO. Voluntary guidelines for sustainable soil management. Rome: Food and Agriculture Organization of the United Nations; 2017.
7. Gangwar KS, Singh KK, Sharma SK, Tomar OK. Alternative tillage and crop residue management in wheat after rice in sandy loam soils of Indo-Gangetic Plains. *Soil and Tillage Research*. 2006;88(1-2):242–252.
8. Gupta RK, Ladha JK, Singh S, Singh RG, Jat ML, Saharawat Y, *et al.* Production technology for direct seeded rice. *Rice-Wheat Consortium Technical Bulletin Series*. 2004;8.
9. Jain N, Singh R, Pathak H, Bhatia A. Crop residue

- management and conservation agriculture for climate-resilient farming in India. *Agricultural Systems*. 2023;204:103534.
10. Jat ML, Chakraborty D, Ladha JK, Rana DS, Gathala MK, McDonald A, *et al.* Conservation agriculture for sustainable intensification in South Asia. *Nature Sustainability*. 2020;3(5):336-343.
 11. Ladha JK, Dawe D, Pathak H, Padre AT, Yadav RL, Singh B, *et al.* How extensive are yield declines in long-term rice-wheat experiments in Asia? *Field Crops Research*. 2003;81(2-3):159-180.
 12. Lal R. Restoring soil quality to mitigate soil degradation. *Sustainability*. 2015;7(5):5875-5895.
 13. Lawanrisha M. Farmers' perception and adoption behaviour towards sustainable agricultural practices. *International Journal of Agricultural Extension*. 2018;6(2):85-92.
 14. Lawanrisha R. Farmers' perception and adoption of soil health management practices. *Journal of Extension Education*. 2018;30(3):6102-6108.
 15. Mandal B, Majumder B, Adhya TK, *et al.* Potential of double-cropped rice ecology to conserve organic carbon under subtropical climate. *Global Change Biology*. 2008;14(9):2139-2151.
 16. Mandal KG, Misra AK, Hati KM, Bandyopadhyay KK, Ghosh PK, Mohanty M. Rice residue-management options and effects on soil properties and crop productivity. *Food, Agriculture & Environment*. 2008;6(2):224-231.
 17. Meena BS, Singh R, Meena HR, Kumar A. Farmers' perception towards climate resilient agricultural technologies. *Indian Journal of Extension Education*. 2017;53(1):85-89.
 18. Pretty J. Agricultural sustainability: Concepts, principles and evidence. *Philosophical Transactions of the Royal Society B*. 2008;363(1491):447-465.
 19. Rogers EM. *Diffusion of innovations*. 5th ed. New York: Free Press; 2003.
 20. Sapkota TB, Jat ML, Rana DS, Khatri-Chhetri A, Jat HS, Bijarniya D, *et al.* Crop diversification and sustainable intensification in cereal systems of South Asia. *Agricultural Systems*. 2021;187:102986.
 21. Sharma P, Abrol V, Sharma RK. Impact of tillage and mulch management on crop performance in maize-wheat rotation. *European Journal of Agronomy*. 2011;34(1):46-51.
 22. Singh B, Shan YH, Johnson-Beebout SE, Singh Y, Buresh RJ. Crop residue management for lowland rice-based cropping systems in Asia. *Advances in Agronomy*. 2008;98:117-199.
 23. Singh R, Sharma P, Kaur J. Farmers' perception and adoption behaviour towards soil health management practices in northwestern India. *Indian Journal of Agricultural Sciences*. 2021;91(8):1175-1180.
 24. Subbarao A, Srivastava S. Soil health and agricultural sustainability. *Indian Journal of Fertilisers*. 2016;12(7):24-37.
 25. Yadav RL, Dwivedi BS, Pandey PS. Rice-wheat cropping system: Assessment of sustainability under green manuring and chemical fertilizer inputs. *Field Crops Research*. 2000;65(1):15-30.