



## Understanding Farmer Perceptions of Trees on Farms to Increase Adoption of Agroforestry in Uttar Pradesh

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### HIGHLIGHTS

- Among surveyed farmers, 77 per cent had adopted agroforestry practices, with boundary plantation being most common (45%).
- Younger, educated farmers were more inclined toward agroforestry than older counterparts.
- Farmers recognized income diversification and environmental benefits but faced market uncertainties and access to quality planting materials as major constraints.
- Lack of technical support and training identified as primary barrier requiring to strengthen agroforestry extension services.

### ARTICLE INFO

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### ABSTRACT

A structured survey was administered in 2024-25 in Ayodhya district across various landholding categories to understand the perception of farmers about agroforestry practices that hold a significant potential in improving rural livelihoods and environmental resilience. A sample of 180 farmers was drawn using multistage random sampling. Correlation analysis was used to determine relationships between socio-economic parameters and farmers' perception of agroforestry practices. The results revealed that approximately 77 per cent of the sampled population have been practicing agroforestry, with boundary plantations being the most preferred (45%) among all. Analysis of socio-demographic variables showed a significant correlation with farmers' perceptions. Education, land ownership, training, and knowledge were positively associated with favourable perceptions, while age showed a negative correlation. Major barriers identified during the survey included a lack of technical knowledge, insufficient extension services, and market uncertainties. The results indicated that despite recognizing multiple benefits of agroforestry systems, farmers require better institutional support, access to quality planting materials, and market linkages to expand adoption. Targeted interventions focusing on training programs, extension services, and credit facilities could bridge the gap between positive perceptions and actual implementation of diverse agroforestry practices in the region.

### INTRODUCTION

Agriculture remains a cornerstone of rural livelihoods, especially in emerging economies like India, where majority of

population depends on farming for sustenance and income (Pawlak & Kolodziejczak, 2020). However, traditional agriculture systems are increasingly under stress due to land degradation, erratic climatic patterns, and growing socio-economic vulnerabilities. In this

circumstance, agroforestry, a deliberate integration of woody perennials with crops and/or livestock on same land management unit, has emerged as a resilient and multifunctional strategy (Gupta et al., 2023). Although traditionally practiced for centuries, agroforestry's modern relevance lies in its potential to meet contemporary challenges of food security, climate change, loss of biodiversity, and rural poverty (Jhariya et al., 2019). Unlike monoculture farming that often leads to soil degradation, agroforestry helps in improving soil fertility, reducing erosion, sequestering carbon, and providing multiple economic products such as timber, fruits, fodder, fuelwood etc (Kumar et al., 2020). Furthermore, it is gaining recognition for its role in climate change mitigation by both policymakers and scientists. Depending on species, system type, and climate, agroforestry is estimated to sequester 0.29 to 15.21 Mg C/ha/year (Tefera et al., 2019). In addition to carbon sequestration, it also contributes in achieving Sustainable Development Goals (SDGs). Hence, integrating agroforestry into mainstream agriculture is important for attaining both environmental and socio-economic sustainability.

Internationally, nations like Brazil, Kenya, Indonesia, and the Philippines have made notable advances in promoting agroforestry through community-based initiatives and national policies. India also has a rich tradition of indigenous agroforestry practices such as home gardens, silvipasture, boundary plantations, and horticultural systems. It became the first country globally to adopt National Agroforestry Policy (NAP) in 2014, aimed at institutionalizing agroforestry practices. At present, agroforestry covers about 28.42 million hectares (8.65%) of India's total geographical area (Banoo et al., 2024). Also, in Uttar Pradesh, agroforestry is gaining traction, especially in regions like Saharanpur, Lakhimpur Kheri, and in eastern parts, including Ayodhya (Katariya et al., 2024). Ayodhya has a rich agricultural heritage and diverse farming systems. This district is characterized by small and marginal landholdings, with farmers primarily engaged in crop production. However, traditional agroforestry practices such as boundary plantations have always been part of the farming system in this region (Yadav et al., 2024).

Despite the state's high agricultural dependence and large rural population, agroforestry remains underutilized due to challenges like fragmented landholdings, limited extension services, market volatility, and regulatory barriers. In such a context, agroforestry can play a transformative role in improving farm resilience, income stability, and environmental health. However, the success of agroforestry interventions depends largely on farmers' attitudes, awareness, and willingness to adopt. A farmer-centric approach is essential, as local perceptions influence the design, implementation, and outcomes of agroforestry programs (Prajapati et al., 2025). If farmers perceive agroforestry as beneficial, accessible, and manageable, they are more likely to adopt and sustain these systems.

## METHODOLOGY

Recognizing the relevance of understanding regional perspectives on agroforestry, this survey was conducted during year 2024-25 in Ayodhya district, located in the eastern zone of Uttar Pradesh, India. Geographically, it is situated between 26°47'N

latitude and 82°12'E longitude in approximately 2,764 square kilometre area and is part of the fertile Gangetic plain, characterized by alluvial soil that is highly suitable for agriculture and tree-based farming systems. The district has a subtropical humid climate with an average annual rainfall of about 1100 mm, which occurs mainly during the monsoon season. The annual temperature ranges from 4°C to 24°C in winter, while it goes up to 45°C in summer.

The present study employed a multistage sampling procedure. In the initial phase, Ayodhya district was purposively selected as study area due to its agricultural importance and potential for agroforestry development. In the second stage, six blocks were selected randomly to represent different geographical areas and farming systems within the district. Two villages were randomly selected from each block, resulting in a total of twelve villages. Finally, fifteen farmers were randomly selected from each village, leading to a sample size of 180 farmers.

The data were collected through personal interviews using a structured questionnaire. Perception toward agroforestry was measured using a Mean score on a five-point Likert scale (1- Strongly Disagree, 2 - Disagree, 3 -Neutral, 4 - Agree, 5- Strongly Agree) for various statements concerning the economic, environmental, and social aspects of agroforestry. The collected data during the study were coded, tabulated, and analysed using SPSS (Statistical Package for the Social Sciences) software. Correlation analysis was performed to examine the interrelationship between various independent variables and farmers' perceptions toward agroforestry. The strong sampling strategy and meticulous data analysis made sure that this study's results were reliable, representative, and offered useful insight for promoting sustainable agroforestry farming methods in the Ayodhya district.

## RESULTS

The thorough analysis of obtained data revealed a positive inclination of farmers towards the agroforestry practices. Within 180 sampled farmers, 139 (77.2%) were found to have undertaken some form of agroforestry practice on their farmlands, while 41 were non-adopters. Among the adopters, the most common agroforestry practice was boundary plantation (45%), followed by a combination of boundary plantation and agri-silviculture/ horticulture (23.3%). The tree species commonly grown in the agroforestry systems included timber species such as Poplar (*Populus deltoides*), Eucalyptus (*Eucalyptus* spp.), Shisham (*Dalbergia sissoo*), and Teak (*Tectona grandis*), fruit trees including Mango (*Mangifera indica*), Guava (*Psidium guajava*), and Jamun (*Syzygium cumini*); and multipurpose trees like Neem (*Azadirachta indica*) were predominant in the region. The main agricultural crops grown in the agroforestry systems were wheat, rice, pulses, vegetables, and oilseeds. The choice of tree species and their integration with crops varied based on factors such as landholding size, market access, and farmers' preferences. The farmers' attitude toward various aspects of agroforestry were measured using a 5-point Likert scale, and the mean scores are depicted in Table 1. Overall, farmers had positive perception about agroforestry, with an average perception score of 3.87 out of 5. Among the various perception statements, provisional services of agroforestry practices received the highest mean score, followed by its role in enhancing

**Table 1.** Farmers' perceptions toward agroforestry

| S.No.                    | Perception Statement                                              | Mean Score | Rank |
|--------------------------|-------------------------------------------------------------------|------------|------|
| 1.                       | It contributes to sustainable agriculture                         | 3.81       | 16   |
| 2.                       | It develops the culture of growing trees with food crops          | 4.16       | 10   |
| 3.                       | Provide diverse farm income                                       | 4.41       | 5    |
| 4.                       | It doesn't ensure higher income to farmers                        | 1.97       | 20   |
| 5.                       | It will not empower the marginal farmers                          | 2.00       | 19   |
| 6.                       | Land scarcity will resist the farmer to adopt it over food crop   | 4.61       | 3    |
| 7.                       | Protection of crops against wind and other climatic factors       | 3.92       | 13   |
| 8.                       | Protection of crops against animals and birds                     | 3.79       | 17   |
| 9.                       | It improves soil fertility                                        | 4.44       | 4    |
| 10.                      | It increases biodiversity                                         | 3.84       | 15   |
| 11.                      | Risk minimization of crop failure                                 | 4.11       | 12   |
| 12.                      | Competition will result in stunted growth of less competent crops | 4.17       | 9    |
| 13.                      | It helps in climate change mitigation                             | 4.13       | 11   |
| 14.                      | It increases water retention capacity                             | 3.89       | 14   |
| 15.                      | High initial cost of inputs for agroforestry practices            | 4.33       | 6    |
| 16.                      | Provide fuelwood and small timber                                 | 4.70       | 1    |
| 17.                      | It is riskier than monoculture                                    | 2.19       | 18   |
| 18.                      | It is a tool to improve forest area                               | 4.62       | 2    |
| 19.                      | Long term practice will lead to prosperity of village             | 4.24       | 7    |
| 20.                      | Will you adopt agroforestry in future                             | 4.21       | 8    |
| Overall Perception Score |                                                                   | 3.87       | -    |

forest cover. On the other hand, statements related to negative aspects of agroforestry like it plays no significant role in enhancing farmers income and improving rural livelihood received lower mean scores, indicating that farmers did not strongly agree with these negative perceptions.

Data for correlation among independent variables of demographic & institutional feature and farmers' perception toward agroforestry is presented in Table 2. The results revealed that education, farmer type, land ownership, training received, knowledge about agroforestry, and adoption of agroforestry had demonstrated significant positive relationships with farmers' perceptions toward agroforestry. This

**Table 2.** Correlation between farmers' perceptions toward agroforestry and various independent variables

| Variable             | Correlation Coefficient (r) |
|----------------------|-----------------------------|
| Age                  | -0.157*                     |
| Education            | 0.250**                     |
| Family Type          | -0.136                      |
| Farmer Type          | 0.181*                      |
| Land ownership       | 0.189*                      |
| Land Holding (ha)    | 0.140                       |
| Any related training | 0.212**                     |
| Farming Experience   | -0.053                      |
| Income               | 0.061                       |
| Knowledge            | 0.555**                     |
| Adoption             | 0.198**                     |

\*Significant at 0.05 level; \*\*Significant at 0.01 level

indicates that farmers with higher education levels, larger landholdings, ownership of land, access to training, and better knowledge about agroforestry had more favourable perceptions toward agroforestry. On the other hand, age had a significant negative correlation with perceptions, suggesting that younger farmers had more optimistic attitude toward agroforestry compared to older farmers. Variables such as family type, landholding size, farming experience, and income did not exhibit significant correlations with farmers' perceptions toward agroforestry.

The interaction during questionnaire survey revealed several benefits and constraints associated with agroforestry practices, as perceived by the farmers. These benefits were additional income source like timber, fuelwood, fodder etc. that improves livelihood, helps in soil and water conservation, enhances biodiversity, provides resilience against crop failures and enhances forest cover. However, according to them, longer gestation period of trees, market uncertainties for agroforestry products, lack of technical knowledge and extension support emerged as the most significant barrier to agroforestry adoption. Nevertheless, they firmly held the view that these practices will not only improve their economic well-being but also mitigate climate change and strengthen farm resilience in longer run.

## DISCUSSION

The study revealed a positive perception of agroforestry among farmers in Ayodhya district, as evidenced by the overall perception score (Table 1). Among the 180 respondents, 77.2 per cent had adopted agroforestry practices indicating that farmers recognized the benefits of integrating trees with agricultural crops (Nkurikiye et al., 2024). However, they primarily prefer boundary plantations depicting a risk-averse approach, where farmers favour integrating trees along field borders without disrupting core agricultural operations (Chavan et al., 2022). They also expressed a high perception score (4.24) regarding the belief that long-term agroforestry practices can lead to village prosperity. This belief stems from the multiple benefits provided by fruit trees, which contribute to household well-being, and non-fruit trees, which supply timber, firewood, and stakes (Cyamweshi et al., 2021).

Perception statements related to direct economic benefits ranked the highest. Among these, the highest mean score was associated with fulfilling fuelwood and small timber requirements (4.70), followed by improvements in forest area. These responses indicate that farmers highly value the tangible and resource-based advantages of agroforestry. At the same time, acknowledgment of land scarcity as a barrier to adoption reflected real constraints faced by marginal farmers (Kpoviwanou, 2024). However, strong perceptions of agroforestry's ability to diversify farm income and enhance soil fertility highlighted the multifunctionality of these systems. In contrast, negative statements such as agroforestry being riskier than monoculture or failing to guarantee higher income had received lowest rankings. This suggested a growing confidence in economic viability of agroforestry, especially when supported by appropriate institutions and markets.

Correlation analysis (Table 2) demonstrated that knowledge of agroforestry had the strongest positive correlation with

perception. This aligns with findings by Dhakal et al., (2015) and Mfitumukiza et al., (2017), emphasizing that awareness and understanding are crucial in shaping favourable attitudes among farmers. Education also showed significant correlation with perception, as educated farmers tend to explore new practices and are more capable of accessing relevant information. This corroborates with Ahmad et al., (2025), who highlighted the role of education in technology adoption and farm-level decision-making. Land ownership and farmer type were also positively associated with perception, indicating that large landholders tend to adopt agroforestry more frequently, likely due to greater capacity for long-term investment (Dwivedi & Aashutosh, 2013; Saha et al., 2018).

Interestingly, age exhibited a significant negative correlation with perception, implying that younger farmers are more inclined toward agroforestry. Their openness to innovation, better access to training, and longer-term perspective support findings by Jahan et al., (2022), who noted that younger farmers are more adaptive and willing to take risks. On the other hand, variables such as family type, landholding size, farming experience, and income did not show significant correlations, suggesting that these may not directly influence perception in this context. Access to training, however, showed a strong positive impact, emphasizing the importance of extension services in promoting agroforestry (Basamba et al., 2016; Islam et al., 2016).

Despite the positive outlook, several constraints emerged during field interactions. Farmers expressed concern about high initial costs, lack of quality planting material, and limited extension support. Similar challenges were highlighted by Naik et al., (2022) and Jahan et al. (2022), who stressed that positive perception must be backed by effective institutional support to lead to action. Long gestation periods of trees were another major concern, particularly for small and marginal farmers seeking quicker returns (Pathania et al., 2020). Market-related uncertainties further hamper adoption, underscoring the need for market development and value chain strengthening (Tranchina et al., 2024). However, the high mean perception score for future adoption reflected the strong intent among farmers, which must be supported through systematic interventions like market linkages and agroforestry-specific advisory services.

## CONCLUSION

The study revealed that farmers in Ayodhya district exhibit a favourable perception about agroforestry, with a high adoption rate, indicating its potential as a sustained livelihood activity. Boundary plantations were the most adopted practice in the region due to lower risk and high compatibility with existing cropping systems. Farmers recognized the economic benefits, such as fuelwood and income diversification, along with environmental advantages like improved forest cover and soil fertility. Their perception was significantly influenced by knowledge, education, training, and land ownership, while younger farmers showed a higher inclination toward adoption. However, constraints such as limited technical guidance, market uncertainties, and high input costs continue to hinder wider implementation. Hence, to ensure continued and meaningful adoption, it is essential to strengthen agroforestry

extension services, improve access to quality planting material, and establish strong market linkages. Also, policies should integrate agroforestry into mainstream extension frameworks with localized models and appropriate incentives.

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