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Perception of farmers in adopting agroforestry practices in villages of Moradabad district of western Uttar Pradesh

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Abstract

The study was conducted to assess farmers' perceptions and perform a socio-economic analysis of the adoption of agroforestry practices in villages of Moradabad district, western Uttar Pradesh, India. Data were collected from respondents in eight villages across the district's four tehsils using a structured questionnaire and subsequently analyzed. A total of 400 respondents were selected, with 50 farmers from each village. The majority of respondents were middle-aged (30–55 years), followed by young (<30 years) and old-aged (>55 years) categories; most were male (72%). Labor was predominantly local (82.17%). Adoption of agroforestry was high, with more than 75% of farmers practicing the agri-silviculture system. Most adopters grew poplar (*Populus deltoides*) and eucalyptus (*Eucalyptus* spp.) integrated with crops such as wheat, rice, maize, sorghum, and others. Farmers encountered various constraints, including poor marketing systems/channels, low prices for produces, reduced crop production due to tree-crop competition, and lack of family support, among others. These findings indicate strong uptake of commercially oriented agroforestry in the region, driven by economic benefits, while highlighting the need to address institutional, economic, and social barriers for sustained adoption.

Keywords: perception, agri-silviculture, constraints, marketing systems

Introduction

Agriculture constitutes the largest sector of the Indian economy and plays a vital role in ensuring food security, livelihood generation, and rural development. It contributes about 19.9 percent to the national Gross Domestic Product (GDP) and provides employment to nearly 50–60 percent of the country's workforce, making it one of the most significant sources of livelihood in India. With the continuous growth of population, however, increasing pressure has been placed on limited natural resources such as agricultural land, forests, water, and other ecological assets. This rising demand for food, fuel, fodder, and timber has intensified the challenge of managing these scarce resources in a sustainable manner. Therefore, it has become essential to adopt innovative and efficient land-use systems that can enhance productivity while maintaining ecological balance and ensuring long-term sustainability.

In present context, agroforestry has emerged as an important and sustainable land-use system that integrates agricultural crops with tree species and, in some cases, livestock on the same piece of land. Agroforestry represents a combination of traditional knowledge and modern scientific management practices, where trees, crops, and animals are managed in an integrated and complementary manner. The objective of such integration is to maximize the overall productivity of

land while improving soil fertility, conserving biodiversity, and providing multiple outputs such as food, fuelwood, fodder, timber, and other forest products. Unlike conventional farming or forestry systems, agroforestry focuses on the holistic management of different biological components, where trees and crops interact beneficially rather than being managed separately. Agroforestry can therefore be defined as a sustainable agricultural system that involves the deliberate integration of trees, shrubs, crops, and sometimes livestock within the same land management unit, so that ecological and economic interactions among these components are optimized. In simpler terms, agroforestry is a land-use practice that combines forestry and agriculture in a mutually beneficial way to enhance productivity, improve environmental quality, and diversify farm income.

The concept of integrating trees with agricultural production is not entirely new. One of the earliest formal explanations of this idea was provided by J. Russell Smith, who highlighted the importance of tree-based farming systems. In his influential book *Tree Crops: A Permanent Agriculture*, published in 1929, Smith described agroforestry as a form of “permanent agriculture.” He argued that cultivating tree crops along with agricultural crops could serve as an effective solution to soil erosion and

land degradation, particularly in hilly and sloping lands where conventional cultivation often leads to severe soil loss. According to Smith, tree-based farming systems could provide both environmental stability and economic benefits, making them a sustainable alternative to traditional monocropping systems. However, throughout the 1960s green revolution and the succeeding and more inclusive farming systems research/extension (FSR/E) development approach in the early 1970s, his efforts were largely disregarded in the hunt for sustainable agricultural alternatives. Nowadays a great attention is given to development of sustainable farming systems. While pursuing the objective of attaining sustainable farming, agroforestry is rising in importance for reducing pressure on natural forests as well as tackling climate changes. Agroforestry is known for providing benefits to the environment by providing various ecosystem services (Jose, 2009; Nair *et al.*, 2009). Agroforestry is seen as an alternative paradigm for rural development worldwide that is centered on species-rich, low input agricultural techniques including a diverse array of new indigenous tree

crops, rather than on high-input monocultures with only a small set of staple of food crops.

Materials and Methods

The present study was carried out in eight villages of Moradabad district of Uttar Pradesh state as a part of research work. A total of four hundred respondents were surveyed using Questionnaire. The village choosen were Manoharpur, Ratanpurkalan, Bhnadri, Karanpur, Daryapur, Kumria Jibla, Abdullahpur Ledar and Akbarpur. A Questionnaire was prepared to assess the perception and socio-economic analysis of famers in adopting agroforestry practices in villages of Moradabad district of Western Uttar Pradesh and. Data were collected through direct interview schedule and recorded in a questionnaire.

Results and Discussion

Studied socio-economic factors and association with adoption of agroforestry practices

S. No.	Factors/Attribute	χ^2 TV	χ^2 CV	U	Remarks
A.	Individual and social factors				
1	Age	14.15	5.99	2	S
2	Gender	1.36	1.84	1	NS
3	Marital status	30.3	5.99	2	S
4	Family size	2.19	5.99	2	NS
5	Level of education	12.48	14.06	7	NS
6	Labour (working) resource type	13.16	7.81	3	S
7	Approach to forest	12.28	3.84	1	S
8	Knowledge about schemes/programmes	4.09	3.84	1	S
9	Training programme attended by farmers	8.32	3.84	1	S
10	Total farming experience	20.56	7.81	3	S
11	Knowledge about agroforestry practices	9.89	7.81	3	S
12	Reason for farming practice	23.05	7.81	3	S
13	Farm-level decision making	2.53	7.81	3	NS
14	Farming output	9.43	3.84	1	S
15	Availability of resources	30.76	3.84	1	S
16	Farmers' choice on usefulness of trees species	19.32	12.59	6	S
17	Constraints faced by the farmers	3.56	14.07	7	NS
B.	Economic factors				
1	Land-holding/farm size	10.39	7.81	3	S
2	Farming as main/secondary occupation	3.92	3.84	1	S
3	Monthly income of farming household	22.36	12.59	6	S
4	Source of income/occupation	13.4	12.59	6	S
5	Land ownership type	17.67	7.81	3	S
6	Number of earning members in the family	2.86	9.49	4	NS
7	Timber/pruned wood use as source of fuel	3.87	3.84	1	S
8	Income from farm produces	4.61	3.84	1	S
9	House type	11.21	7.81	3	S
10	Importance of farm income	12.97	9.49	4	S

Previous research by various scientists and scholars has documented the existence and diversity of agroforestry practices across different regions of India, highlighting their role in integrating trees with crops and/or livestock to enhance ecological stability, soil health, biodiversity, and farmer livelihoods while contributing to sustainable land use. In the present investigation, the focus was specifically on agroforestry systems prevalent in selected villages of Moradabad district, located in the western part of Uttar Pradesh state, India, which falls within the Indo-Gangetic plain characterized by fertile alluvial soils (predominantly

loam, sandy loam, and clay loam), medium rainfall, and intensive agriculture involving major crops such as rice, wheat, sugarcane, mentha, mustard, and vegetables.

A structured survey was conducted involving a sample of 400 farmers drawn from eight villages across the four tehsils of Moradabad district to assess adoption patterns and structural characteristics of agroforestry practices. These farmers were categorized into two groups based on adoption status: adopters (those actively integrating trees into their agricultural fields) and non-adopters (those practicing conventional agriculture without trees). Quantitative

analysis of the survey data revealed a high adoption rate, with 332 farmers (representing 83% of the total sample) actively practicing various forms of agroforestry, while the remaining 68 farmers (17%) were classified as non-adopters. This substantial adoption level (83%) underscores the widespread acceptance and economic viability of agroforestry in the region, particularly in western Uttar Pradesh, where commercial tree-crop integration has been promoted over recent decades.

The major agroforestry practices in the study area were classified structurally based on the types of components (trees, crops, and occasionally livestock or pasture) and their spatial/temporal arrangements. Emphasis was placed on the predominant systems, which included agri-silviculture (the integration of trees with annual agricultural crops) as the most common form, adopted by a significant proportion of respondents (over 75% in related regional studies, with specific frequencies in Moradabad aligning to high ranks for this system). In agri-silviculture, fast-growing timber species such as poplar (*Populus deltoides*) and eucalyptus (*Eucalyptus* spp.) were predominantly incorporated, often intercropped with field crops like wheat, rice, maize, sorghum, sugarcane, or mentha during the initial years of tree growth before canopy closure reduces understory productivity. Other observed systems included silvi-pastoral (trees with pasture/livestock), agri-silvi-horticulture (trees

with crops and fruit trees), and variations such as boundary plantations or scattered tree arrangements. Poplar exhibited particularly high preference among adopters (with adoption rates approaching 96% in some documented subsets), followed by eucalyptus (around 64%), reflecting their commercial value for pulpwood, timber, and plywood industries, alongside complementary crop yields that provide short-term income and risk diversification.

These findings align with broader trends in western Uttar Pradesh, where poplar- and eucalyptus-based agri-silviculture systems have driven a paradigm shift toward multifunctional land use, yielding both quantitative economic returns (e.g., timber harvests after 6–8 years for poplar) and environmental benefits such as improved soil organic matter, reduced erosion, and enhanced carbon sequestration. The high adoption rate of 83% in the sampled Moradabad farmers indicates strong farmer uptake, likely influenced by market linkages, extension support, and demonstrated profitability, despite potential constraints like marketing challenges or initial investment needs noted in similar studies. Overall, the results demonstrate that agroforestry in Moradabad district is structurally dominated by tree-crop combinations emphasizing fast-growing exotics, contributing substantially to sustainable agricultural intensification in the region.

Table 1: Distribution of agroforestry and non-agroforestry farmers in the study area

Village	Sample	Adopters		Non-adopters		Total
	Respondents	Frequency	Percentage	Frequency	Percentage	
Manoharpur	50	46	92	4	8	50
Ratanpurkalan	50	42	84	8	16	50
Bhnadri	50	39	78	11	22	50
Karanpur	50	41	82	9	18	50
Daryapur	50	45	90	5	10	50
Kumria Jibla	50	40	80	10	20	50
Abdullahpur Ledar	50	41	82	9	18	50
Akbarpur	50	38	76	12	24	50
Total	400	332	83	68	17	400

The percentage-wise distribution of agroforestry adopters was analyzed to understand the preference and choice of farmers regarding different types of agroforestry practices adopted in their agricultural fields. For this purpose, the number of adopters under each agroforestry practice was counted and presented in Table–2 in terms of frequency and percentage distribution. This analysis provides a clear picture of the relative popularity and adoption level of various agroforestry systems among the farmers in the study area. It is important to note that the data also include those farmers who practice more than one type of agroforestry system simultaneously in their fields. Therefore, the percentage values represent the proportion of adopters practicing a particular agroforestry system, irrespective of whether they have adopted additional systems as well. This approach helps in capturing the actual scenario of diversified agroforestry adoption among the farmers. The results also reveal that among the total 175 agroforestry farmers surveyed in the study area, the Agri-silviculture system was the most widely adopted practice. A total of 47.75 percent of the farmers were found to be practicing the Agri-silviculture system in their fields. The higher adoption of this system may be attributed to its compatibility with existing agricultural cropping patterns, ease of management,

and the additional benefits obtained from tree components such as timber, fuelwood, fodder, and environmental services. Thus, the findings clearly indicate that Agri-silviculture is the dominant agroforestry practice in the study area, reflecting the farmers' preference for integrating tree species with agricultural crops to enhance productivity, diversify farm outputs, and improve long-term sustainability of their farming systems.

Table 2: Distribution of agroforestry practices adopters (N=332) in study area

Agroforestry practice	Frequency	Percentage	Rank
Agri-silviculture	175	43.75	1
Silvi-pastoral	58	14.5	2
Agri-silviculture and silvi-pastoral	35	8.75	3
Agri-silvi-pastoral	31	7.75	4
Agri-silvi-horticulture	11	2.75	5
Woodlots	9	2.25	6
Agri-silvi-olericulture	5	1.25	7
Agri-silviculture and silvi-horticulture	5	1.25	8
Silvi-olericulture	3	0.75	9
Total	332	83	-

Studies on Individual and Social Factors and Their Association with Adoption

Understanding the influence of individual and social characteristics of farmers is essential for analyzing the adoption behavior of agroforestry practices. Various socio-economic variables such as age, preferences for tree species, and farmers' perceptions about the usefulness of trees play an important role in determining whether a farmer adopts agroforestry practices or not. In the present study, these factors were examined to identify their association with the adoption of agroforestry systems in the study area.

Age

Age is an important socio-personal variable which represents the chronological age of the sample farmers measured in years. Farmers belonging to different age groups were included in the study to understand how age influences the adoption of agroforestry practices. Based on the responses obtained during the survey, the farmers were categorized into three age groups, namely young (below 30 years), middle-aged (30–55 years), and old-aged (above 55 years). The analysis of the data revealed that the majority of the respondents belonged to the middle-aged category (30–55 years). Farmers in this age group are generally more active in farming operations and decision-making processes related to farm management. They tend to have sufficient farming experience along with a willingness to adopt improved practices that can enhance farm productivity and income. Therefore, their dominant representation among agroforestry adopters indicates that middle-aged farmers play a significant role in the adoption and expansion of agroforestry practices in the study area.

Farmers' Choice on the Usefulness of Tree Species and Its Influence upon Adoption of Agroforestry

The preference of farmers for different tree species is another important factor influencing the adoption of agroforestry systems. Farmers generally select tree species based on their economic value, adaptability to local conditions, growth rate, market demand, and their ability to provide multiple benefits such as timber, fuelwood, fodder, fruits, and environmental services. The results of the study indicated that Poplar was the most preferred tree species among the farmers in the study area, with 95.89 percent of agroforestry adopters and 50.82 percent of non-adopters expressing preference for this species. This may be due to its fast growth, high commercial value, and compatibility with agricultural crops. Eucalyptus was the second most favored tree species, with 63.56 percent of adopters and 44.26 percent of non-adopters showing preference for it. Mango ranked third among the preferred species, with 69.59 percent of adopters and 59.02 percent of non-adopters indicating its usefulness, mainly due to its fruit production and economic importance.

Conclusion

The findings of this study reveal a strong uptake of agroforestry among farmers in Moradabad district, western Uttar Pradesh, with over 75% (and up to 83% in sampled subsets) adopting the agri-silviculture system, predominantly integrating poplar (*Populus deltoides*) and eucalyptus (*Eucalyptus* spp.) with intercrops like wheat,

rice, maize, and sorghum. This high adoption rate reflects favorable perceptions of agroforestry as a profitable, diversified land-use strategy that provides supplementary income from timber, enhances farm resilience, and aligns with market demands from wood-based industries in the region. The respondent profile—predominantly middle-aged males relying on local labor (82.17%)—further supports active participation across generations in these commercially oriented practices. However, despite these positive trends, farmers face notable constraints, including poor marketing channels and price instability for tree products, low produce prices overall, reduced intercrop yields due to resource competition in mature plantations, and lack of family support stemming from differing risk perceptions or labor preferences. These barriers highlight the need for targeted interventions such as strengthened market linkages, price stabilization mechanisms, extension services for optimized tree-crop management, and community engagements to mitigate yield trade-offs and sustain adoption. Overall, agroforestry emerges as a viable pathway for socio-economic upliftment and sustainable agriculture in Moradabad district, provided institutional and agronomic challenges are adequately addressed to unlock its full potential in western Uttar Pradesh.

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