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Economic analysis of prevailing agroforestry system among different categories of farmers in Azamgarh district (U.P.), India

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Abstract
The Study that used as a first step toward a more quantitative study since it could offer useful guidance regarding which variables are worth quantifying. This part of the instrument measured economic farm profitability by taking into account the respondents' cost of cultivation. 20 farmers from one district, four blocks, and four villages per block were arbitrarily chosen, and they were categorised according to their socioeconomic standing and use of an agroforestry system. The respondents were separated into Palhani and Bilariyaganj block farmers based on the cost of cultivation and measures of economic farm profitability. For the cultivation of paddy crops, Palhani block in the Azamgarh district spent the most on labour, or Rs. 2848.25, followed by seed expenses, Rs. 4581.95, machinery expenditures, Rs. 3582.82, and irrigation costs, Rs. 5852.85. The cost of labour was highest in Bilariyaganj block at 6314.15 Rupees, followed by irrigation at 7148.30 Rupees, machinery at 10542.82 Rupees, rental charges of owned land at 4000.00 Rupees, and fertiliser and manure at 4286.14 Rupees. Seed cost 2341.25 rupees, interest on fixed costs was 980.00 rupees, interest on working capital costs was 1260.10 rupees, and plant protection costs were 923.32 rupees, in that order. The respondents' gross income was Rs. 59392.55, their farm business income was Rs. 30010.50, their net income was Rs. 20390.90, their farm investment income was Rs. 25306.60, their family labour income was Rs. 54476.85, and their input-output ratio was 1.19, respectively.

Keywords: Agroforestry, farming system, cost cultivation, measure economic farm profitability

1. Introduction
Agroforestry has the potential to help with various ecosystem functions as well as reducing land degradation, increasing food security and reducing poverty (Kuyah *et al*., 2019) [11]. Additional advantages of agroforestry include enhanced recreational circumstances, reduced carbon emissions and sanctification of the water and air. It can, for instance, improve soil fertility, shield cattle and crops from the wind, restore harmed land, promote water conservation, manage pests, and lessen soil erosion. However, well-designed and managed agroforestry systems can support biodiversity protection, climate change adaptation, and mitigation. But agroforestry is less harmful to the environment when crops and trees don't compete with one another (FAO 2018).
Agroforestry is an exceptional land use system because of its emphasis on sustainability in terms of economics (production and profitability), ecology (environmental and resource conservation), and social issues (food security, health and safety) (Kaushal, 2020) [9]. Indian husbandry has a number of challenges and constraints as a result of growing demographic pressure, increased food, feed, and fodder demand, dwindling natural resource availability, and climate change (Dhyani *et al*., 2013) [6]. These opportunities led to the creation of agroforestry as a technique for sustainable land use in thriving areas (Hoang *et al*., 2017) [7]. Although it is a very old practise in the humid tropics, where peasant husbandry mixes seasonal crops, animal husbandry, tree care, and lumber harvesting, agroforestry is a relatively young scientific topic (Nair *et al*., 2004) [10]. Agroforestry raised household income and created more employment options, which reduced ranch expenses. In order to convince growers to use agroforestry, environmental education will be crucial. In order to engage in and promote agroforestry, growers must be aware of its benefits (Sanou *et al*., 2019) [16]. Researchers have noted the benefits of agroforestry techniques and a number of seasonal crops, including jackfruit, mango, pineapple, and pineapple (Akter *et al*., 2020) [2]. According to studies, the tribesmen can profit from a number of economic activities, including agricultural production (like cultivating fruits, vegetables and cereals), animal production (like keeping poultry and

cattle), non-farming (like rearing pigs and breeding pigs), and non-agricultural (such as manufacturing). small and medium companies, tailors, nurseries and other like establishments (Mondal 2006) [14]. Smallholder farmers combine or modify various CSATs with other approaches and practises to address specific problems and circumstances because of differences in attitudes, cultures, goals, preferences, resource endowments, and socioeconomic backgrounds (Maguza 2017) [13]. Due to socioeconomic and environmental limitations, smallholder farmers, particularly in developing countries, significantly contribute to local, regional, and global food supply chains and economies. According to smallholder farmers, family farms or smallholders use around 75% of the world's agricultural land and produce the majority of the world's food (Lowder *et al.*, 2016) [12].

2. Methodology

2.1 Sampling technique

The district's coordinates are 26°06'N, 83°18'E and 64 m height. In 2017, there were 1.23 percent of forests on Earth's land surface. The district is bordered by the Mau district on the east, Gorakhpur on the north, Deoria, Jaunpur, and Sultanpur on the west, and Ambedkar Nagar on the south and west. The Ghaghara, the district's main river, flows through it. Depending on their socioeconomic status and use of an agroforestry system, 20 farmers from one district, four blocks, and four villages per block were randomly selected. Since it could offer valuable insights into which variables are worth investigating quantitatively, this method is typically used as a first step toward more quantitative study. This part of the instrument measured economic farm profitability by taking into account the respondents' cost of cultivation. This component of the schedules was intended to determine the respondents' familiarity with agroforestry systems as they are grown scientifically.

2.2 Research design

The descriptive research design was employed in this study to identify "what exists" in terms of variables or conditions in a situation and to learn more about the phenomenon's current state. Since it might offer useful insights into which variables are worth evaluating quantitatively, this method is typically used as a first step toward more quantitative study.

2.3 Data analysis

The survey was analysed using both statistical analysis and descriptive methods. MS Excel was utilised for analysis after the software had processed the observed data. For this analysis, the following statistical techniques were used: frequency (f), percentage (%), mean together with standard error (x) and standard deviation (Snedecor and Cochran).

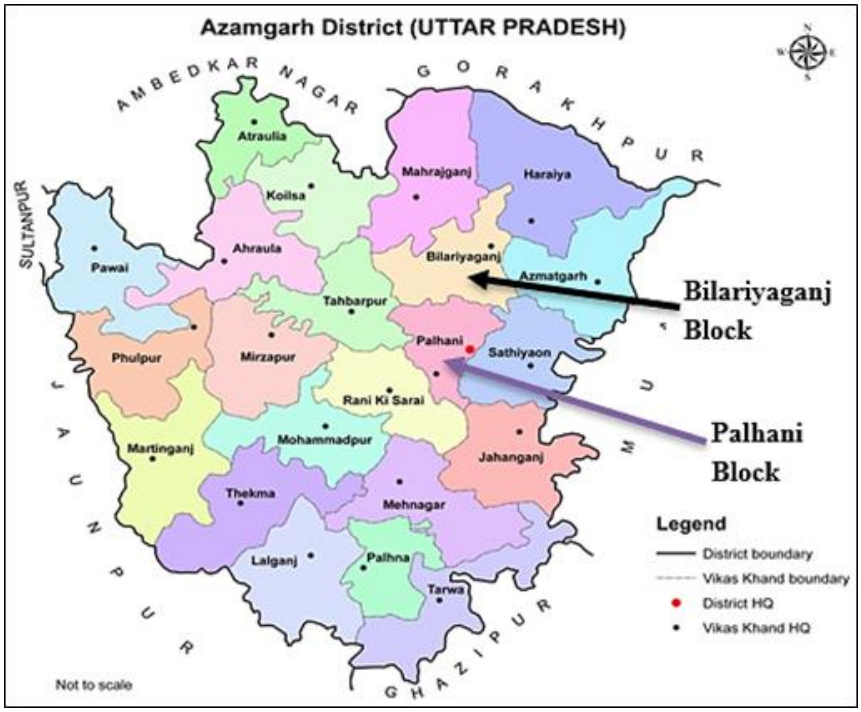

Fig 1: Location of study area Azamgarh District

3. Results and Discussion

3.1 Cost cultivation

The study also revealed that respondents in the Palhani block of Azamgarh district for paddy crops cultivation spent the most on labour, or Rs. 2848.25 followed by costs for seeds, Rs. 4581.95, machinery Rs. 3582.82, irrigation charges, Rs. 5852.85, manures and fertilizers, Rs. 7868.70, plant protection, Rs. 1435.10, Interest on working capital charges was 1489.24 rupees, and interest on fixed capital was 550.00 rupees.

The study also revealed that respondents of Azamgarh district in the Palhani block for Wheat cultivation incurred costs on hired labour, i.e., 8674.95 Rs. by irrigation charges, 9357.47 Rs., machinery charges, 8642.32 Rs., the rental value of owned land 4000.00 Rs., manures and fertilizers 5538.85, and seed costing 2864.18 Rs., interest on working capital charges was 1780.30 rupees, interest on plant protection costs was 990.00 rupees, and interest on fixed capital was 725.00 rupees, respectively. It is noteworthy that while family labour showed an inverse association with farm size holding responders, all input parameters showed a positive relationship with them (Prakash, 2013) [17].

Table 1: Cost cultivation per hectare in Agroforestry system on Palhani Block in Azamgarh District (U.P.), India

Particular	Palhani	
	Paddy	**Wheat**
Hired Labour	2848.25	8674.95
Seed	4581.95	2864.18
Machinery	3582.82	8642.32
Irrigation	5852.85	9357.47
Manures and fertilizers	7868.70	5538.85
Plant protection	1435.10	990.00
Interest on working capital	1489.24	1780.30
Cost A	27658.91	37848.07
Interest on fixed capital	550.00	725.00
Rental value of owned land	4000.00	4000.00
Cost B	32208.91	4725.00
Value of family labour	5628.14	2560.17
Cost C_1	37837.05	45133.24
10% of cost C_1	3783.71	4513.32
Cost C_2	41620.76	49646.56

3.2 Cost cultivation

The study also revealed that respondents in the Bilariyaganj block of Azamgarh district for paddy crops cultivation spent money on labour, or Rs. 2325.45, before spending Rs. 4057.54 on seeds for paddy cultivation, machinery costs came to Rs. 5265.21, irrigation costs came to Rs. 5284.36, manures and fertilizers costs came to Rs. 6225.10, plant protection costs came to Rs. 1054.30, interest on working capital costs came to Rs. 1234.42, interest on fixed capital costs came to Rs. 850.00 and rental value of owned land came to Rs. 4,000.00.

Further research revealed that respondents in the Azamgarh district in the Bilariyaganj block spent the most on labour, or 6314.15 Rs., followed by irrigation costs of 7148.30 Rs., machinery costs of 10542.82 Rs., rental costs of owned land of 4000.00 Rs., and fertilizer and manure costs of 4286.14 Rs., Interest on working capital costs was 1260.10, seed cost 2341.25 rupees, interest on fixed costs was 980.00 rupees, and plant protection costs were 923.32 rupees, in that order. It is noteworthy that while family labour showed an inverse association with farm size holding responders, all input parameters showed a positive relationship with them (Prakash, 2013) [17].

Table 2: Cost cultivation per hectare in Agroforestry system on Bilariyaganj Block in Azamgarh District (U.P.), India

Particular	Bilariyaganj	
	Paddy	**Wheat**
Hired Labour	2325.45	6314.15
Seed	4057.54	2341.25
Machinery	5265.21	10542.82
Irrigation	5284.36	7148.30
Manures and fertilizers	6225.10	4286.14
Plant protection	1054.30	923.32
Interest on working capital	1234.42	1260.10
Cost A	25446.38	32816.08
Interest on fixed capital	850.00	980.00
Rental value of owned land	4000.00	4000.00
Cost B	30296.38	4980.00
Value of family labour	4826.84	2172.25
Cost C_1	35123.22	39968.33
10% of cost C_1	3512.32	3996.83
Cost C_2	38635.54	43965.16

3.3 Economics of measures of farm profitability

The economic measures of farm profitability for respondents for the paddy crops cultivation in the Palhani block were gross income Rs. 66550.20, farm business income Rs. 28702.71, net income Rs. 16903.64, farm investment income Rs. 21628.64, family labour income Rs. 61825.20 and input-output ratio 1.33, respectively.

The economic measures of farm profitability for respondents for the wheat crops cultivation in the Palhani block were gross income Rs. 59749.60, farm business income Rs. 26933.52, net income Rs. 15784.44, farm investment income Rs. 20764.44, family labour income Rs. 54769.60 and input-output ratio 1.30, respectively.

Table 3: Economics of measures of farm profitability per hectare of in Palhani block Azamgarh District (U.P.), India

Particular	Palhani	
	Paddy	**Wheat**
Gross income	66550.20	59749.60
Farm business income	32102.71	26933.52
Net income	16903.64	15784.44
Farm investment income	21628.64	20764.44
Family labour income	61825.20	54769.60
Input output ratio	1.33	1.30

3.4 Economics of measures of farm profitability

The economic measures of farm profitability for respondents for the Paddy crops in the Biliriyaganj block were gross income Rs. 59392.55, farm business income Rs. 30010.50, net income Rs. 20390.90, farm investment income Rs. 25306.60, family labour income Rs. 54476.85, and input-output ratio 1.19, respectively correspondingly.

The economic measures of farm profitability for respondents for the wheat crops in the Biliriyaganj block were gross income Rs. 51291.79, farm business income Rs.23460.14, net income Rs.13999.10, farm investment income Rs.19084.40, family labour income Rs.46206.49 and input-output ratio 1.23, respectively correspondingly (Singh, 2013) [17].

Table 4: Economics of measures of farm profitability per hectare of in Biliriyaganj block Azamgarh District (U.P.), India

Particular	Bilariyaganj	
	Paddy	Wheat
Gross income	59392.55	51291.79
Farm business income	30010.50	23460.14
Net income	20390.90	13999.10
Farm investment income	25306.60	19084.40
Family labour income	54476.85	46206.49
Input output ratio	1.19	1.23

4. Conclusion

Agroforestry has a unique land use system due to its emphasis on sustainability in terms of economics (production and profitability), ecology (environmental and resource conservation) and social issues (food security, health and safety). This part of the instrument measured economic farm profitability by taking into account the respondents' cost of cultivation. This component of the schedules was intended to determine the respondents' familiarity with agroforestry systems as they are grown scientifically. It is interesting that all input characteristics showed a positive link with farm size holding respondents, however family labour showed an unfavourable association with them. Gross income of Rs. 66550.20, farm business income of Rs. 28702.71, net income of Rs. 16903.64, farm investment income of Rs. 21628.64, family labour income of Rs. 61825.20 and input-output ratio of 1.33 were the economic indicators of farm profitability for respondents for the paddy crops cultivation in the Palhani block, respectively. The decision to plant trees on agricultural land can be influenced by the living conditions of farming communities and the farm environment. In the early stages of technology diffusion in agricultural communities, this study's findings revealed the factors that are essential for farmers to adopt agroforestry technology.

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