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Research Note

Factors Affecting Adoption Rate of Agro Forestry Technologies in Tamil Nadu§

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Abstract

The paper has to determined the factors affecting the adoption of agroforestry technologies by farmers in Tamil Nadu. Despite the low rates of adoption, agro forestry remains an important component of sustainable land-use, development of agricultural production and reduction of food insecurity. For data collection, structured questionnaire were designed and administered to 240 farmers who were selected randomly from two villages in Dharmapuri district. The data were analysed using descriptive statistics regression analysis and pearson product moment correlation (PPMC). The study has indicated that the farmers were largely aware of agroforestry and had adopted silviculture/agrisilviculture technology. The mean adoption rate of agroforestry technologies was 79.0 per cent. The main determinants of the adoption were farmers' age, household size, educational level, farm size, farming experience, income, access to credit and extension contacts. All these variables, except the age of farmers, affected the adoption rate of agroforestry technologies positively. The study has recommended that farmers be provided with loans at concessional interest rates for adopting innovations. Additionally, information on management of agroforestry systems needs to be communicated in a simpler local language for easy understanding and interpretation by the farmers in this region.

Key words: Agro forestry, multiple regression, household-benefits, agro-technologies, Tamil Nadu.

JEL Classification: Q 01

Introduction

Agroforestry is a concept that harmonizes agriculture with forestry and pastoralism. Owonubi and Otegbeye (2012) described agro forestry as a multiple land-use system in which agricultural crops and woody perennials are grown on the same land. The integration of trees into the farming system could go a long way to help ameliorate environmental problems and can help protect soil erosion and moderate extreme temperatures (Adedire, 2004). In Tamil Nadu, the contribution of forestry towards GDP was 1.6 per cent (2013) and the percentage of area under forest was not only lower than the recommended coverage, but also lower than the national average. In 2013, the estimated forest and tree cover in Tamil Nadu was 2.83 million ha constituting 21.79 per cent of the geographical area of the state — 3.63 per cent of tree cover and 18.16 per cent of forest area (ISFR – FSI, 2014). The adoption of agroforestry technologies among farmers in the state has been a subject of concern among stakeholders in agriculture. The reason for the increasing concern of stakeholders on the adoption of agroforestry technologies is due largely to the interactive benefits of agroforestry and other farming activities (Egeonu and Okoro, 2005). Most of the review of literature revealed that not much has been studied on the socio-economic aspects and adoption of agro forestry

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technologies. This has caused a void in research. The objective of this study was to identify and quantify the factors affecting the adoption of agro forestry technologies and the household benefits in agro forestry in Tamil Nadu

In Tamil Nadu, Dharmapuri district is a region which is involved in agro forestry practices. The traditional agricultural practices in this region have become less viable due to economic, environmental and social issues. Therefore, to maintain the producers and attain an economically viable future operation, they must diversify their operations. The study hypothesized that there is no significant relationship between adoption of agroforestry technologies and farmers' (i) socio-economic characteristics, and (ii) awareness level.

Data and Methodology

For the study, primary data were collected using a structured questionnaire from 240 agro forestry farmers selected randomly from a list of tree growers in Pennagram and Morappur talukas for the 2013-2014 agriculture seasons. In each taluk, 120 tree-growing farmers were randomly selected. The predicted value of dependent variable can be used for determination of factors affecting the adoption of agro forestry.

For analysis, descriptive statistical tools such as frequency counts, percentages and means were used and to test the hypotheses, inferential statistical tools were used conducting Pearson product moment correlation (PPMC) and multiple linear regressions. The rate of adoption was calculated as the percentage of technologies adopted of the total number of technologies transferred (Kuntash *et al.*, 2002; Ajayi *et al.*, 2006). The implicit model of the regression was:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + e_1$$

where,

Y = Adoption rate of agro forestry technologies (%)

X_1 = Age of farmers (years)

X_2 = Educational level (years)

X_3 = Household size (No. of members)

X_4 = Farming experience (years)

X_5 = Farm size (ha)

X_6 = Farmers' income (₹ /year)

X_7 = Farmers' access to credit (Dummy variable, Yes =1, No = 0)

X_8 = Farmers contact with extension service providers (No./month), and

e_1 = Error-term.

Results and Discussion

Household Benefits of Agro-forestry

Agricultural productivity makes a major contribution to the livelihood of farmers. In this section, the benefits towards the farmers' livelihood have been categorized as produce from agro forestry.

Table 1 shows the major produce from agro forestry in Tamil Nadu and the proportion of farmers use or sell it. In the study area, most of the produces are used at home or sold for local consumption. In Dharmapuri district, for most of the farmers marketing of produce is a significant cash source. However, even after selling a proportion of their produce in the market, the farmers retain a portion for home consumption. The results revealed that selling of milk (40.83 %), animals (93.63%), firewood (89.42 %), poles (18.18%), timber (100%) and poultry (75.21%) made a significant addition to household income. Cow was the major source of milk for sale, while local breed cattle produced milk for home consumption. Buffalo, goats and sheep were the animals reared for sale by the farmers.

About 91 per cent of the respondents admitted that they regularly prune trees to get fodder for their livestock. It was evident that the pruning of trees for animal feed is largely carried out by the cattle rearers, and some local farmers, mainly during the dry season, and especially after crop harvests. The proceeds from the livestock of agroforestry farmers (Table 1) also generate additional income for the farmers. A substantial amount of resources were therefore generated from the products of different components of agro forestry, and were used by the farmers to meet their family needs. This, in turn, had contributed enormously to enhancing the economy of the rural communities (Stocking *et al*., 1990; Gordon *et al*., 1997; Kang *et al*., 1999).

Table 1. Household benefits of agro forestry

Produce from agro forestry	No. of respondents			
	Total use of produce at home	Use more at home than sell	Sell more than use at home	Total
Milk	90 (37.50)	52 (21.66)	98 (40.83)	240
Animals	8 (5.10)	2 (1.27)	147 (93.63)	157
Firewood	3 (2.88)	8 (7.69)	93 (89.42)	104
Poles	160 (72.73)	20 (9.09)	40 (18.18)	220
Timber	0 (0.00)	0 (0.00)	240 (100.00)	240
Fodder	136 (91.89)	11 (7.43)	2 (1.35)	148
Home implements	154 (80.21)	5 (2.60)	33 (17.19)	192
Fruits	30 (25.00)	10 (8.33)	80 (66.67)	120
Raw materials	192 (96.00)	6 (3.00)	2 (1.0)	200
Poultry	20 (8.55)	38 (16.24)	176 (75.21)	234

Note: Figures within the parentheses indicate percentage to the total

Socio-cultural Benefits of Agro Forestry

The socio-cultural beliefs play a significant role in influencing agro forestry adoption among the rural households in Dharmapuri district. The belief systems existing across the rural people may inhibit or promote the practices of agro forestry. Table 2 shows that 48.33 per cent of the respondents planted 'Tamarind' as it provided shade for people and animals house, whereas 51.7 per cent respondents planted teak for ornamental shade and its use to demarcate the homestead. About 28.8 per cent respondents planted tamarind + sorghum for fodder purpose and the remaining 31.7 per cent respondents planted teak + maize for food and fodder purposes, respectively.

Environmental Benefits

Tables 3 indicates that 48.3 per cent of the respondents had multipurpose benefits including reduced soil erosion, mulch preparation from leaves which is used to increase yield. The litter fall and waste assimilation were the other intended benefits. About 51.6 per cent of respondents planted teak to increases carbon biomass, reduce waterlogging and enrich soil in the study area.

Table 2. Social and cultural benefits of agro forestry in Tamil Nadu

Type of agro forestry	No. of respondents planted (N=240)	Benefits	No. of respondents benefitted (N = 240)
Tamarind	47	Shade for people and animal house, boundary marking	116 (48.33)
Teak	48	Contains livestock, ornamental, shade for people and animals and to demarcate the homestead	124 (51.66)
Tamarind + Sorghum	69	Shade for people, animals, house, boundary marking, food purpose	69 (28.75)
Teak + Maize	76	Contain livestock, ornamental, shade for people and animals and to demarcate the homestead, food and fodder	76 (31.66)
Total	240		240 (100.00)

Note: Figures within the parentheses indicate percentage to the total

Table 3. Environmental benefits of agro forestry

Responses	No of respondents planted (N=240)	Use	No. of respondents benefitted (N = 240)
Tamarind	116	Control soil erosion and provide mulch, litter fall, waste assimilation	116 (48.33)
Teak	124	Control soil erosion, increase carbon bio-mass, reduce waterlogging and enrich soil	124 (51.66)

Note: Figures within the parentheses indicate percentage to the total

Results of Regression Analysis

The rate of adoption was calculated as the percentage of technologies adopted in the total number of technologies transferred. The coefficient of multiple determination (R_2) had the value of 0.791, indicating that the independent variables (X_1, X_2,……., X_8) could together explain 79.1 per cent of the variations in the dependent variable (Y). Consequently, the regression results indicated as follows: Farmers' age (X_1) was negatively related to adoption of agro forestry technologies, that is younger farmers were more ready to adopt the technologies than the older farmers. This relationship was significant at 5 per cent level of probability as the t-calculated value (2.005) was greater than the t-tabulated value (1.98). Farmers' educational level (X_2) had a positive relationship with adoption rate of agro forestry technologies implying that educated farmers adopted more agro forestry technologies than less-educated farmers. The relationship was significant at 1 per cent level of probability as the t-calculated value (3.206) was greater than the t-tabulated value (2.617). Farmers' household size (X_3) was positively related to adoption rate of agro forestry technologies indicating that farmers having larger households adopted the technologies more than their counterparts having smaller households. The effect was however insignificant at the 10 per cent level of probability as the t-calculated value (0.121) was less

Table 4. Multiple regression estimates of factors affecting farmers' adoption rate of agro forestry technologies in Tamil Nadu

Independent variables	Linear form		Exponential form		Double log form	
	Coefficient	t- ratio	Coefficient	t- ratio	Coefficient	t- ratio
Intercept	2.08	0.181	5.6+28	0.103	2.373	1.544
X_1 Farmers age (years)	-0.179	-2.005**	-7.89E-07	-0.02	-0.294	-0.751
X_2 Educational level (years of schooling)	0.145	3.265***	-1.6E+22	-0.536	-0.048	0.321
X_3 Household size (No.)	-0.662	0.121	-2.2E+23	-0.028	0.133	0.895
X_4 Farming experience (years)	0.07	0.427	-4.6E+08	-0.010	0.008	0.070**
X_5 Farm size (ha)	0.213	2.325**	2.2E+28	4.374***	0.174	1.933
X_6 Agro forestry income (N)	-0.254	3.206***	0.001	0.0001	0.141	1.703*
X_7 Farmers access to credit (Dummy variable, Yes =1, No = 0)	0.561	1.968*	-7.0E+28	-0.639	0.271	1.464
X_8 Farmers contact with extension service providers (No./month)	-0.159	4.250***	1.3E+28	2.781***	0.295	2.788***
R square	0.823		0.297		0.284	
χ^2	0.777		0.228		0.208	
F-ratio	5.477***		4.286***		3.723***	

Notes: ***, ** and * denote significance at 1 per cent, 5 per cent and 10 per cent levels, respectively
NS = Non–significant

than the t-tabulated value (1.658). Farmers' experience (X_4) had a positive effect on adoption rate of agro forestry technologies showing that the experienced farmers adopted the packages more than the less-experienced farmers. The effect was insignificant at 10 per cent level of probability. The farm size (X_5) was positively related to adoption rate of agro forestry technologies. This effect was significant at 5 per cent level of probability. Farmers' income (X_6) was positively related to adoption of agro forestry technologies and the effect was significant at 1 per cent level of probability. Farmers' access to credit (X_7) had a positive effect on adoption of agro forestry technologies and it was statistically significant at 10 per cent level of probability. Farmers' contact with extension service providers (X_8) was positively related to the adoption rate of agro forestry technologies and the relationship was statistically significant at 1 per cent level of probability.

Conclusions and Recommendations

Although the study was limited to Tamil Nadu State constituted the sample of the study, certain reasonable conclusions have been made from the results of the study. The study conducted in Dharmapuri districts of Tamil Nadu has revealed that the farmers are mostly marginal with farm size of less than 1.0 ha. This definitely confines them to practise agro forestry farming on a small scale. The study has outlined the significance of age, educational level, income, access to credit, and extension contact in adoption of agro forestry technologies. This implies that adoption of agro forestry technologies require mainly young, educated, large and rich farmers with access to credit and higher contact with extension personnel. The study has made following recommendations.

- The access to credit being very important for adoption of innovations, the farmers should be provided loans preferably at market interest rates.
- Inputs like planting and starting stocks should be subsidized so that the poor rural farmers can easily adopt the technologies.
- The Agricultural Development Programme should be intensified to sensitize and motivate farmers towards enlisting in farmers' co-operative societies.
- Farmers' socio-economic factors should be considered while designing extension intervention strategies.

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