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**V Dhanushkodi**  
ICAR-Krishi Vigyan Kendra,  
Sirugamani, Tiruchirappalli  
District, Tamil Nadu, India

**S Easwaran**  
ICAR-Krishi Vigyan Kendra,  
Sirugamani, Tiruchirappalli  
District, Tamil Nadu, India

**G Amuthaselvi**  
ICAR-Krishi Vigyan Kendra,  
Sirugamani, Tiruchirappalli  
District, Tamil Nadu, India

## Agroforestry: A novel techniques to enhance farmers' income under changing climate

V Dhanushkodi, S Easwaran and G Amuthaselvi

### Abstract

Management of trees in conjunction with crops in rainfed areas minimize the risk associated with stress period through diversified components and through efficient utilization of limited natural resources. The present study was undertaken to recognize the contribution of agroforestry on income of farmers in Musiri Taluk, Tiruchirappalli district. A total of 100 lead farmers from five villages were selected for the study. Data was collected by using a standard structured questionnaire administered through face-to-face interviews. *Media dubia* and *Ayilanthus excelsa* are the tree species planted by the farmers. The majority of the respondent indicated effective utilization of farm output for income generation from agroforestry (95%) followed by employment generation (88%). The major impact of agroforestry adoption on the improvement of livelihoods of farmers identified were increased farm income, reduced input cost and entrepreneurship development. Therefore, it was concluded from the study, agroforestry is a Multidimensional farming approach, which is very effective in solving several problems of achieving farmers' livelihood security under changing climate.

**Keywords:** Agro forestry, Rainfed, tree species, increased income, climate changes

### Introduction

Agroforestry is recognized as a promising land-use technology and an interface between agriculture and forestry, especially in developing countries of the tropics and sub-tropics. Agroforestry, as a science and practice, has the potential to contribute to the improvement of rural livelihood, due to the capacity of its various forms to offer multiple alternatives and opportunities to smallholders to enhance farm production and income, while protecting the agricultural environment. There are both ecological and economic interactions between the trees and other components. Through agroforestry, farmers' incomes are augmented, since cash crops are planted simultaneously with forest trees. This, in turn, translates to increased standard of living, economic growth and development (Julius *et al.*, (2012) <sup>[2]</sup>.

Drylands include arid and semiarid areas where annual evapo-transpiration exceeds precipitation. The human, livestock and wild life populations in the dry lands is increasing fast exerting a lot of pressure on the land (Jeremias Mowo *et al.*, (2010) <sup>[1]</sup>). Integrating economic trees into agricultural landscapes on a massive scale under dry land agro ecosystem would create an effective income generation and at the same time ensure sustainable food production, this would help adapt to climate change in other ways too. According to Garrity *et al.*, (2010) <sup>[3]</sup> is that conservation farming is a integration of trees with annual food crops and evergreen agriculture ensures that there is green cover on the land throughout the year therefore enhancing essential ecosystem services.

To a significant extent dry land communities rely on tree products as one of their major source of income (Jeremias Mowo *et al.*, 2010) <sup>[1]</sup>. The goal of this case study is to explore the possibility of turning the dry lands under low rainfall area into viable ecosystems capable of increasing farmers' income and meeting humanities' other needs. This case study is discussed in details below followed by an analysis of lessons learnt and how these experiences can be scaled out to benefit more landscapes and peoples in the dry lands under low rainfall area.

### Materials and Methods

A study was undertaken to assess the effect of agroforestry system on changes of farmers' income under dry land condition at Musiri block of Tiruchirappalli district. The villages covered under the study were Moovanoor, Peramanagalam, Manparai and Sukkampatti in Musiri Taluk, Tiruchirappalli district. Through field survey and farmers meeting at farm-level, the informations were collected during January, 2018. A samples of 100 farmers was selected. The criteria of selection based on the consideration that the farmers were growing trees continously and marked them to earn income.

**Correspondence**  
**V Dhanushkodi**  
ICAR-Krishi Vigyan Kendra,  
Sirugamani, Tiruchirappalli  
District, Tamil Nadu, India

An interview schedule was developed to collect the data on farmers' adoption and its influence on income. The survey included several open-ended questions to elicit farmers' perceptions regarding the system and the broader aspects of income changes in their field.

### Soil and climate of the study Area

The study was conducted in Musiri block in Tiruchirappalli district is located and about 731 meter above sea level. Located at latitude 10° 57' 10.76" N, longitude 78° 26' 39.37"

E. It receives 400 mm to 749 mm rainfall per annum, with annual temperature ranging from 14 °C to 34 °C. The study area is covered with Alfisols.

### Details of tree species grown

*Ailanthus excelsa* and *Melia dubia* are the important tree species grown in this area and covering about more than 250 ha in Musiri Taluk. Drought tolerant agricultural crops such as sorghum, pearl millet, moth bean and redgram are cultivated as inter crop in agroforestry system.

**Table 1:** Profile characteristic of farmers

S. No	Characteristics	Frequency	S. No	Characteristics	Frequency
1.	<b>Age</b>		6.	<b>Communication sources</b>	
	Young (<35)	17		Radio	49
	Middle (35-50)	58		Television	100
	Old (>50)	25		News paper	78
2.	<b>Educational status</b>			Magazine	37
	Illiterate	4		Through farmers	99
	Functionally literate	7		Friends	95
	Primary	12		Relatives	86
	Middle	22		Neighbours	75
	Secondary	21		Village leaders	86
	Higher secondary	25		Government officials	28
	Collegiate	9		NGOs	46
3.	<b>Occupational status</b>		7.	<b>Different farming system adopted</b>	
	Agriculture as primary	99		Agriculture	100
	Agriculture as secondary	1		Forestry alone	27
4.	<b>Farming experience</b>			Agro forestry	67
	Low (<5 years)	11		Cattle rearing	29
	Medium (5-10 years)	36		Agro silvipastoral system	25
	High (> 10 years)	63		Horticulture	13
5.	<b>Farm size</b>				
	Small (< 2 ac)	24			
	Marginal farmer (2-5 acre)	51			
	Large farmer (>5 acre)	25			

### Results and Discussion

It was observed that (Table 1) majority of the respondent were middle aged (35-50 years). Regarding educational status, the extremes were low viz., illiterate (4%), functionally literate (7%) and collegiate (9%) and majority with higher secondary (25%). Majority of the respondents were agriculture based with a good farming experience of more than 10 years. Regarding communication sources, television coming first followed by fellow farmers, their friends and relatives.

It is observed in the table 1 that majority of the farmers adopted agriculture, agroforestry, cattle rearing for their sustainable livelihood, which was followed by agro silvipastoral system. Whereas the farmers involvement in vegetable and fruit production was less. The reasons for the high adoption of agro forestry, forestry, cattle rearing and agro silvipastoral might be due to the fact that they are traditional farming practices, very easy to adopt and maintain at minimum cost. The feed requirement for cattle rearing is fetched from their own field is one of the most significant factors in adopting the silvipastoral system. The reason for the less involvement in horticulture might be due to the lack of availability of irrigation water. More number of respondent revealed that adoption of agroforestry system increased the

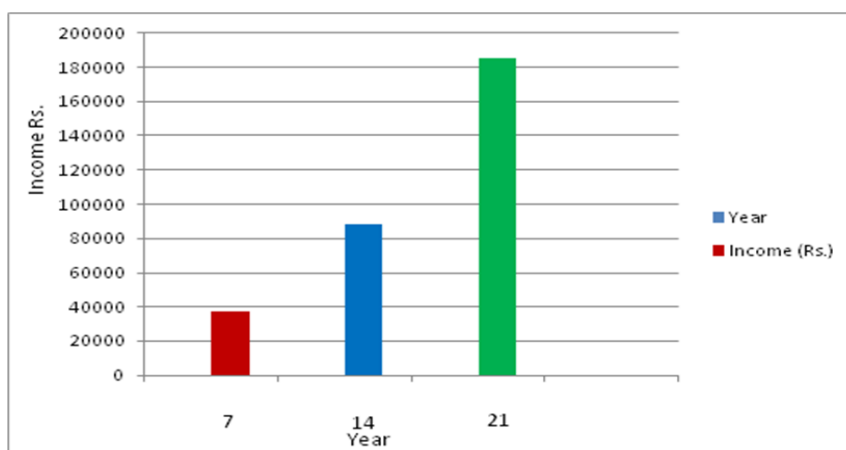
economic yield per unit area through providing money to the farmers round of the year, provided livelihood security.

**Table 2:** Reasons for the adoption of agroforestry system in Musiri block

S. No.	Developmental strategies	Number of respondents		
		Low	Medium	High
1.	Soil suitability	12	23	75
2.	Insufficient Rainfall	0	25	75
3.	Less ground water	2	35	76
4.	Labour shortage	42	31	26
5.	Reduced input cost	11	24	65
6.	Employment generation	-	12	88
7.	Infrastructure development	41	27	32
8.	Effect utilization of farm outputs	0	5	95
9.	Entrepreneurship development	23	26	51
10.	Income security			
	Low (<Rs.25000 per year)	-	25	-
	Medium (<Rs.250000-50000 per year)	-	-	32
	High(>Rs.50000 per year)	43	-	-

**Table 3:** Income generation through agro forestry system

Crop name	Gross Income	Cost of cultivation (Rs/ha)	Gross income (Rs/ha)	Net income (Rs/ha)	BC Ratio
<b>Income from tree/cutting</b>					
7 <sup>th</sup> year	12.5	18000	50000	37000	2.8
14 <sup>th</sup> year	22.2	27000	100000	88000	3.7
21 <sup>th</sup> year	40.0	42000	200000	185000	4.8
Average	24.9	29000	116667	103333	4.0
<b>Income from agricultural crop / year</b>					
Sorghum	1650	17500	29700	12200	1.7
Cumbu	1500	14000	24000	10000	1.7
Moth bean	260	9750	18400	8098	1.9
Redgram	380	12500	24700	12200	2.0

**Fig 1:** Additional income from trees under agro forestry system

The success of any production system is basically depend on need, availability of inputs and marketing channels by which one can marketed with remunerative price by using locally available resources. The key to the success of agroforestry system is the production of input like, seedlings, plant protection etc., plays a significant role. The study on economics of agro forestry indicated that it is 50-60% economical enterprise as compared to agricultural crops alone (Table 2). Direct marketing of wood from producer to wood industry was found to be strongest marketing channel and farmers avoided to sell their product through private and trader. Economics of Agroforestry was carried out in the farmers field to compare with pure agriculture and observed the increased net income of Rs. 37000/-, 88000/- and 185000/- during 7<sup>th</sup>, 14<sup>th</sup> and 21<sup>st</sup> year respectively (Fig.1). Similarly, increased cost benefit ratio: 2.8, 3.7 and 4.8 during 7<sup>th</sup>, 14<sup>th</sup> and 21<sup>st</sup> year respectively was recorded through agroforestry system (Table 3). Hence agroforestry is a viable option for combating negative impacts of climate change (Singh *et al.*, 2013) [5]. It is essential to clearly define a national policy on agroforestry by supporting private sector groups, NGOs or associations, and encouraging farmers to grow trees in their own field is very important in respective country. Similar view on agroforestry was expresses by Pratap Toppo and Abishek Raj (2018) [4].

### Conclusion

It is evident form the study that sustainable flow of income that respondents were more pleased with agroforestry system than any other farming systems. In the areas, it has served in the recent years as sources of economic development for individuals and communities, providing jobs, income, food grains, fodder etc. The sustainable streams of income from agroforestry may also be a prerequisite for development. As a

result of this sustainable income generation from agroforestry in the area, the rate of adoption of the farming system has increased tremendously. Further income from agroforestry had significant role in getting more income under dryland condition and can boost-up eco-friendly Indian economy which is today's essential need. On the basis of the above findings, it is clearly indicated that the agroforestry/ trees are plays a central role in livelihood security of farmers under low rainfall areas. Hence, the present study recommends a strong need to intensify promotion of agroforestry in low rainfall area and advocacy to policy makers.

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