Farmers' Preferences for Indigenous Trees Suitable for agroforestry Technologies in Ratnagiri District of Maharashtra state

D. D. Mulukh*, V. M. Mhaiske, S. S. Narkhede, V. K. Patil and A. D. Rane
College of Forestry, Dapoli, Maharashtra
Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli-415712, Ratnagiri (MS).

Abstract

A survey was conducted during the year 2015-16 in the Ratnagiri district of Maharashtra state, which consists of nine tehsils. From each tahsil, three villages were selected and from each village 6 farmers were selected randomly. The data was collected with the help of specially designed questionnaire by personal interview with the farmer. The survey revealed that almost every farmland contains a combination of different tree species. Knowledge on indigenous trees can be obtained from farmers because of their ability to identify most tree species found on their farms. Farmers generally prefer to grow fruit trees because they can get income, timber, fuel and fodder for their livestock. Maximum 14.07 per cent of respondents planted combination of mango and cashewnut plants on their farm. Indigenous trees identified by farmers that could be incorporated into agroforestry systems are Ain (*Terminalia tomentosa*), Kinjal (*Terminalia paniculata*), Teak (*Tectona grandis*), Cashewnut (*Anacardium occidentale*), Mango (*Mangifera indica*), Bamboo (*Bambusa arundinacea*) etc. Farmers have protected and managed some naturally grown or planted fodder trees in and around their farm fields for fodder, fruits, fuelwood and timber. Generally farmers plant those species which have multiple uses. Farmers obtained fuelwood from planted trees, naturally growing trees or from forest area. Farmers are aware of the value of multipurpose trees and plant more trees if given the opportunity.

Keywords: Agroforestry, indigenous trees, fodder, agrisilviculture, silvipasture.

***Corresponding author :** dmulukh98@gmail.com

Introduction

Agroforestry has been defined as it is a sustainable land-use system that maintains or increases total yields by combining food crops (annuals) with tree crops (perennials) and/or livestock on the same unit of land, either alternately or at the same time, using management practices that suit the social and cultural characteristics of the local people and the economic and ecological condition of the area (Chundawat and Gautam 1993).

There is tremendous scope for agroforestry because India has achieved self-sufficiency in food production. Now its attention is becoming more focused on the ecological problems and shortage of fuel, fodder and other outputs as well as unemployment. Agroforestry has vast scope in meeting this requirement through multipurpose tree species as: large area is available in the form of farm boundaries, bunds, waste lands where this system can be adopted. This system permits growing suitable tree species in the field where most annual crops are growing well. By growing trees and crops on agricultural or forest land, resources are utilized efficiently. System has potential to generate employment, provide raw material for the cottage industries, help in maintaining ecological balance, soil and water conservation, soil improvement, helps in meeting various needs of growing population. (Anon. 2017a).

Food security is a fundamental problem faced by the world today. Over 800 million people still suffer from malnutrition. Sustainable food production depends on a favourable and stable environment. At local, as well as regional and global level, multipurpose trees may have profound influence on the environment. In many rural areas forests and farm trees provide critical support to agricultural production by maintaining and improving

soil conditions and also maintaining hydrological systems. Multipurpose trees contribute directly to food security by providing fruits, nuts, and other edible foods. These contribute to people's diets in almost all rural areas by adding diversity and flavouring as well as providing essential minerals to the human diet. Within settled agriculture, the most widespread direct contribution of multipurpose trees to food production is through food producing trees on farm and fallow land and around the home.The extent of this contribution varies widely. Often multipurpose food trees are selectively left in farm and fallow areas while other fruit trees are planted outside the house. Management of home garden are prominent features of agroforestry systems, Home gardens are defined as a land use practices involving deliberate management of multipurpose trees and shrubs in intimate association with annual and perennial agricultural crops and livestock within the household compounds, the whole crop-tree-animal unit being intensively managed by family labour.

Materials and Methods

The study was conducted in Ratnagiri district of Maharashtra state, which consists of nine tehsils. These are Dapoli, Khed, Mandangad, Chiplun, Guhagar, Ratnagiri, Sangameshwar, Lanja, and Rajapur. All these tahsils were selected for present study. From each tahsil three villages were selected randomly thereby making 27 villages from Ratnagiri district. A list of farmers was obtained from the revenue record of the identified villages. From each village 6 farmers were selected randomly thus making 18 farmers from each tahsil. 18 farmers were selected such that 15 farmers actively engaged in agroforestry activities and 3 farmers not practicing agroforestry. Thus out of total 162 farmers, 135 were practising agroforestry whereas 27 were not practising agroforestry. The data was collected with the help of specially designed questionnaire by personal interview with the farmers. The schedule was prepared taking into consideration the specific objectives set forth for this investigation. Information were collected from the respondents regarding age, education, occupation, size of family, land details, livestock details, and other information regarding agroforestry, reasons for practising agroforestry, needs of farmers' satisfied by the agroforestry technologies, agroforestry technology practiced by farmers' etc. were collected. The data and information for the present study pertained to the production season of 2015-2016. Sample respondents were interviewed during the months of August to November. For the purpose of achieving the specific objectives of the study the collected data was analysed separately for each group to draw the conclusions. Further, the pooled analysis was carried out for whole sample to draw overall conclusions of the study area. The data where arranged in suitable tables and cross tables simple statistical tools such as arithmetic mean, averages, frequency distribution, percentages were used for analysis.

Results and discussion

In the study area out of the 162 respondents 72.23 per cent were males and 27.77 per cent were females. Age denotes the chronologically completed calendar years by the respondents. Physical and psychological development of an individual is related to his/her age. Age influences behaviour of an individual by exposing to varied situations for a number of times. Therefore, age of the respondents was considered in the study. The data collected from the respondents about age is depicted in Table 1. It is observed that largest age group of the respondents was the age group of above 61 years constituting 29.63 per cent of the 162 respondents. The age group of respondents less than 20 years formed the lowest age group representing 0.62 per cent.The results indicated that most of the respondents belonged to the middle age group. According to family size, the respondents were grouped into four categories as shown in Table 1. The household size varied from 1 to 15 members. Among the sample households 42 (25.92%) households having 1-3 family members, 90 (55.5%) having 4 to 6 family members, 26 (16.04%) sample households having 7 to 9 family members and 4 (2.46%) sample households having more than 10 family members.

Formal education successfully completed by the respondents was considered. Education is important factor influencing skill; managerial ability and technical

knowledge. According to educational status of the respondents, the following categories of education were made to indicate educational level of the respondents. It is revealed from Table 1 that generally, the level of education among the respondents was low. Majority of respondents (53.09 %) had primary education. A greater proportion of respondents (12.35 %) are illiterate, this low level of education could affect the adoption of agroforestry technologies in the district.

According to Adesina *et al.* (2000) farmers with a higher education level are more likely to adopt new technologies compared to less educated farmers. Mekoya *et al.* (2008) also emphasized that technologies are knowledge intensive and therefore require high levels of education. Oino and Mugure (2013) and Sheikh *et al*. (2003) have stated that education significantly influences adoption of improved soil conservation technologies. Occupation is also important factor directly affecting the income of the family. The distribution of the cultivators according to occupation is given in Table 1. The main occupation of respondents in the study area was found to be farming constituting 83.95 per cent of the 162 respondents. Other local employment was identified as the second main occupation among respondents representing 11.73 per cent. Furthermore, some respondents were public/ civil servants and artisans who practiced farming as a secondary occupation.

Source of land for respondents in the study area

Farmers in the study area could obtain land through family, purchase, and lease arrangements (Table 2). Ninety two per cent respondents in the study area had own land. Majority (74.07%) of respondents had obtained land through the family. Combination of family and lease (24.07%) was identified as the second main mode of land acquisition in the district. A small number of farmers (8.02%) obtained land through only lease.Some of the respondents also obtained their land through purchase (0.61%). The study found that about 1.23 per cent of respondents obtained land through both family and purchase.

Farm size of respondents in the study area

Most of the respondents in the study area are small

Table1. Summary of some socio-economic profile of the respondents

Variables	Respondents (N=162)	
	Number	Percentage
Age Group (Years)		
Less than 20	1	0.62
21 - 30	11	6.79
31 - 40	30	18.52
41 - 50	38	23.46
51 - 60	34	20.99
Above 61	48	29.63
Total	162	100.00
Family Members		
1 - 3	42	25.92
4 - 6	90	55.5
7 - 9	26	16.04
> 10	4	2.46
Total	162	100
Education Level		
Primary	86	53.09
Highschool	43	26.54
College	10	6.17
UG	3	1.85
Illiterate	20	12.35
Total	162	100
Occupation		
Farming	136	83.95
Gov./ Private service	4	2.47
Business	1	0.62
Artisans	2	1.23
Others	19	11.73
Total	162	100

Table 2. Source of land for the respondents

Sr. No.	Source	Respondents (N=162)	
		Number	Percentage
1.	Family	120	74.07
2.	Purchase	1	0.61
3.	Freehold	-	-
4.	Lease	13	8.02
5.	Family + Lease	26	16.04
6.	Family + Purchase	2	1.23
	Total	162	100

farmers. Most of the respondents (78.39%) had total land size below 2 ha while few respondents (1.7%) had above 6 ha. The average land under agroforestry was 0.24 ha in the study area. Results revealed that about 48 per cent of participants answered in affirmation when asked whether size of farm influenced their decision to plant or not to plant trees.

The high rate of increase in population in district has led to fragmentation of land and shared by too many people, so that after planting cash and food crops, there is limited space for planting of trees. The small size of the farmland in the district could be a factor which discouraged farmers from adopting technologies. This is because farmers may not risk accepting new technologies because of the small size of their farms.

Cramb *et al.* (1999) found that farmers with large farm sizes could invest resources in new technologies and get better returns, which encourage adoption of conservation technologies. Amsalu and Graaff (2007) found that in Ethiopia, farmers with large farm sizes are more likely to invest in soil conservation measures as the farmers can take more risks including relatively high investment and survive crop failure.

Agroforestry technology practiced by farmers

Farmers raise and protect the tree species (fodder, fruit and fuel wood) in their land and adjacent to their households. From the time immemorial, farmers' have been practicing different agroforestry practices. They are well known for their shading effects. They have planted the fruit trees in their farmlands for income and subsistence. The existing agroforestry practices in the study area contain different types of crops such as rice, millets and vegetables and different fruit, fodder, fuelwood and timber yielding tree spp.

The result showed that maximum 20 per cent of respondents practice combination of Agrisilvicultural and Silvipastural system and some respondents practice only single agroforestry system which are Agrisilvicultural (17.03%), Silvipastural (0.74%) and Agrisilvipastoral systems (3.70%) in the study area. The result showed that maximum number of respondents practice Agrisilvicultural, Silvipastoraland Agrisilvipastural system in the study area (Figure 2).

There are six technologies developed by Dr. BSKKV, Dapoli. (Anon. 2017b). In the present study, it was found that 43.70 per cent of respondents practised one agroforestry technology from among these. This technology is cutting the branches of Ain *Terminalia tomentosa* tree for the use of fuelwood, which does not affect growth of the trees.

Reasons for practicing agroforestry

Farmers practicing agoforestry in the study area for food, fodder, fuelwood, timber, grass, benefits from trees, soil and water conservation, boundary marking and free supply of tree seedlings. It was found that maximum 14.07 % farmers' practicing agroforestry in the study

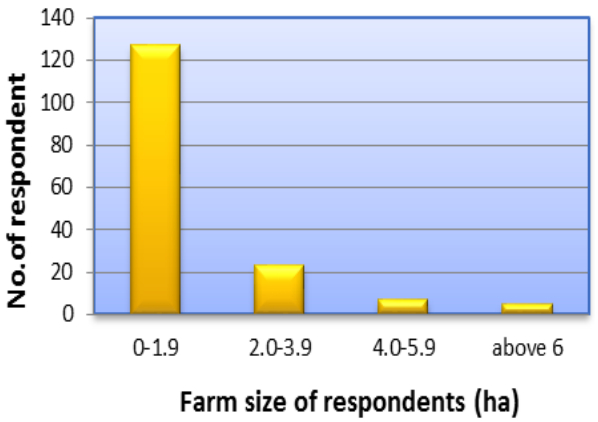

Figure 1. Farm size of respondents

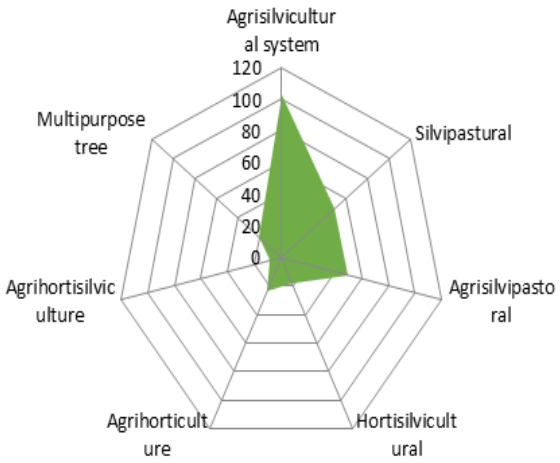

Figure 2. Agroforestry technology practiced by farmers

area for the provision of food, fodder, Fuelwood, timber, benefits from tree for the household.

A reasonable percentage (8.88 %) of farmers practised because combination of products such as food, fodder, fuelwood, timber, benefits from tree, grass, medicine which they obtained from these trees. It was found that maximum number of farmers practising agroforestry in the study area for the provision of food, fodder, fuelwood, timber, benefits from tree for the household (Figure 3). These results indicate that there is scope for expanding agroforestry in the study area.

Tree species planted by farmers' in the study area

Farmers in the district had previously planted trees and even indicated the desire to plant more trees when provided with tree seedlings depending on the products and services that could be obtained from such trees. Tree species planted by the farmers in the study area are given in Figure 4.

Maximum 14.07 per cent of respondents planted combination of mango and cashewnut plants on their farm. 5.92 per cent of respondents planted only mango plant and 4.44 per cent of respondents planted only cashewnut on their farm. Maximum number of respondents planted mango, cashewnut and coconut plants on their farm.

Gliricidia and Nirgudi are observed to be planted by farmers for fencing purpose. Scarcity of fuelwood was not observed in the area. Farmers have protected and managed some naturally grown or planted fodder trees in and around their homesteads and farm fields for fodder, fruits, fuel wood and timber. Generally, farmers plant those species which have multiple uses. Farmers obtained fuelwood from planted trees, naturally growing trees or from forest area.

However, it is in contrast to the report from Godoy (1992) that high fuelwood demand stimulates tree production, suggesting that this is only the case of tree planting when there is a fuelwood crisis.

Wafuke (2012) states that agroforestry could provide more trees available for local consumption and sale. It also has the ability to resolve conflicts among various land users as a multiple land use system since the majority of the farmers are willing to plant and retain trees. Sale and Aladi (2014) found that almost every farmland contains a combination of different tree species. Farmers generally prefer to grow fruit trees because they can provide income, timber, fuel and fodder for their livestocks. Similar situation is observed in the present study area.

Farmers' knowledge of indigenous trees

Knowledge on indigenous trees can be obtained from farmers because of their ability to identify most tree species found on their farms. Farmers have knowledge

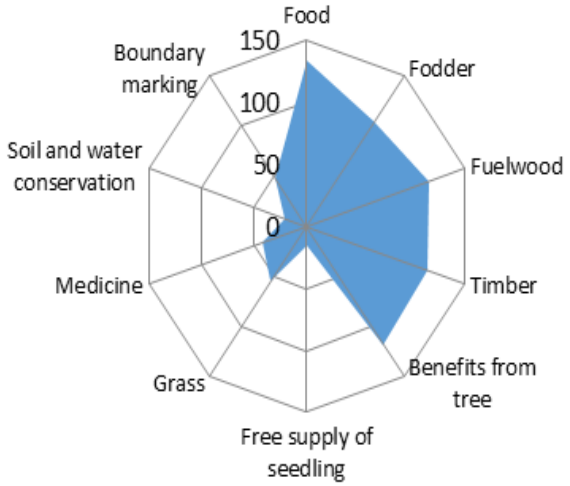

Figure 3. Farmers' reasons for practicing agroforestry

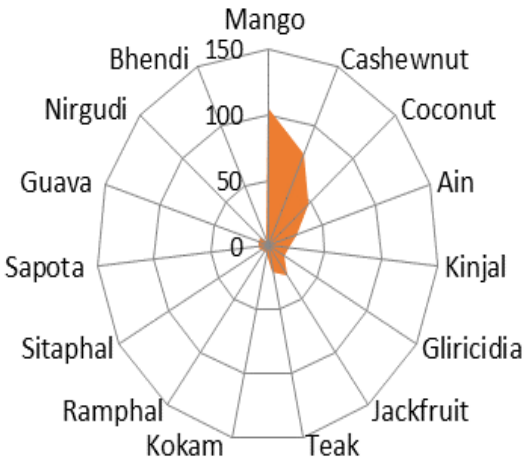

Figure 4. Tree species planted by farmers.

and experience of integrating trees in their farming systems for centuries. Therefore, developing new strategies for encouraging farmers to grow trees in existing systems can be designed if characteristics of the farms and farmers are studied in relation to tree planting in existing systems.

Djossa *et al.* (2008) found that farmers leave trees on farmlands when preparing land for cropping. A similar situation can be seen in the present study area as farmers allow certain tree species to grow on their farms for various benefits such as fuelwood production, timber production and soil fertility improvement. It was found that most farmers were particularly concerned about the shade that some trees provide on their farms.

Sources of tree saplings for planting

The majority of farmers interviewed (60.74%) use their own saplings, 21.48 per cent farmers buy only from private nurseries, 6.66 per cent get from state government and 1.48 per cent borrow from friends (Table 4). A small proportion (2.96%) of respondents get their saplings from both private nursery and state government and 2.22 per cent of respondents use own and private nursery seedlings.

Table 3. Perceived characteristics of indigenous trees by farmers' in the study area

Sl. No.	Tree species	Desirable characteristics
1	Ain (*Terminalia tomentosa*)	For building and fuel wood
2	Kinjal (*Terminalia paniculata*)	For building and fuel wood
3	Teak (*Tectona grandis*)	Grows for high quality timber
4	Cashewnut (*Anacardium occidentale*)	Fruits have high economic value
5	Mango (*Mangifera indica*)	Fruits have high economic value
6	Bamboo (*Bambusa arundinaceae*)	For building and market demand
7	Hirda (*Terminalia chibula*)	Has high medicinal value
8	Kokam (*Garcinia indica*)	Fruits have high economic value
9	Jackfruit (*Artocarpus heterophyllus*)	Fruits have high economic value
10	Gliricidia (*Gliricidia sepium*)	Improves soil fertility
11	Shivan (*Gmelina arborea*)	For building, fodder and fuel wood

Conclusion

The study revealed that respondents were aware of the benefits of agroforestry and therefore practiced it. Maximum number of respondents practices Agrisilvicultural, Silvipastoral and Agrisilvipastural system in the study area. It was found that maximum number of farmers practising agroforestry in the study area for the provision of food, fodder, fuelwood, timber, benefits from tree for the household. The findings from the research revealed that knowledge of indigenous trees could be obtained from farmers because of their ability to identify most tree species found on their farms. The field survey found that farmers have knowledge of indigenous trees which support agroforestry as they allow certain tree species to naturally grow on their farms and tend them for various benefits such as fuelwood production, timber production, water conservation and soil fertility improvement. Mango and cashewnut was the most preferred combination by the respondents. Maximum

Table 4. Sources of tree seedlings for planting

Sr. No.	Sources	Respondents (N=135)	
		Number	Percentage
1.	Own	82	60.74
2.	Private nursery	29	21.48
3.	Friends	2	1.48
4.	State Gov.	9	6.66
5.	Own + Private nursery	3	2.22
6.	Own + Friends	2	1.48
7.	Own + State Gov.	3	2.22
8.	Private nursery + State Gov.	4	2.96
9.	Own + Private nursery + State Gov.	1	0.74
	Total	135	100

number of respondents planted mango, cashewnut and coconut plants on their farm. Indigenous trees identified by farmers that could be incorporated into agroforestry systems are ain (*Terminalia tomentosa*), kinjal (T*erminalia paniculata*), teak (*Tectona grandis*), cashewnut (*Anacardium occidentale*), mango (*Mangifera indica*), and bamboo (*Bambusa arundinacea*). The source of planting material for most of the respondents was their own small backyard nursery.

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