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Agroforestry: The scientific perspective of a traditional land use practice in Jharkhand

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Abstract

The emergence of Agroforestry as an alternative land use practice has paved the way to accomplish the increased pressure on a single tract of land. Most landholdings in Jharkhand are below one acre or even smaller. With the purpose of studying the scopes and challenges of Agroforestry practice in the context of Jharkhand, a sample survey of four panchayats in Namkum Block of Ranchi district in Jharkhand was carried out. The survey disclosed that most people of the mentioned region follow Agroforestry as a traditional land use practice. Among the existing practices, Agrisilviculture (37.50%) and Agriculture (36.87%) are the important land use practices along with Agrihorticulture (18.75%) and Hortisilviculture (6.87%) in the studied area. Agriculture is practiced in the selected village areas either singly or in combination with tree crops such as *Melia azaderach* (Bakain), *Leucaena leucocephala* (Subabul), *Dalbergia sissoo* (Shisham), *Gmelina arborea* (Gamhar), *Tectona grandis* (Teak) and *Pongamia pinnata* (Karanj). The agricultural crops present were *Triticum aestivum* (Wheat), *Brassica nigra* (Mustard), *Pisum sativum* (Pea), *Zea mays* (Maize) and *Oryza sativa* (Paddy) etc. The findings also indicated that most of the respondents (96.25%) had below one ha land holding status. The miniature farm sizes and the manner, in which they are fragmented and scattered, constitute an obstacle to farm improvement since they do not enable farmers to take advantage of economies of scale of production. The study suggests for awareness and extension activities to the farmers about Agroforestry technologies, marketing and information regarding the ecological and economic benefits of trees associated with farming. The state government should evolve a strategy towards implementation of the State Agroforestry Policy in consonance with the National Agroforestry Policy 2014, to plan, prioritize and develop agroforestry action plan suitable for Jharkhand.

Keywords: Agroforestry, scientific and traditional land

Introduction

Agroforestry, the inclusion of trees within farming systems, has been a traditional land use developed by subsistence farmers throughout most of the world. In the last 40 years it has also become a subject for systematic study and improvement, and a livelihood option promoted by land use managers and international development efforts Zoomer *et al.*, 2009. It has come to the attention of global analysts and policy makers, for example UNFCCC (2008) and MEA (Hassan *et al.*, 2005), and has been recognized in regional and national development plans (NEPAD, 2003) and is an obvious component of many farming systems. The apparent high potential of agroforestry systems are its applicability to control soil erosion, soil improvement, creating congenial and conducive microclimate for tree and understory crops and reduction in the accumulation of greenhouse gases in the atmosphere. Agroforestry has generated rather high levels of enthusiasm in recent years concerning with rainfed land use and sustainable resource management system. It has the most apparent potential in resource limiting small holding farming systems where monoculture agriculture may not be the most feasible or desirable, based on the principles of self-maintenance. In India forest cover about 24.16 % of the geographical area, which does not meets the demand as per National Forest Policy, 1988 (FSI, 2015) [2]. There is the demand of 140 million tons per year of fuelwood. Attempts are, therefore being made to meet the demand through the short rotation High Density Energy Plantation (HDEP) of the fast growing species. In India availability of fuel wood is considered to be among the priority areas of the rural society and therefore, energy plantation has achieved significant importance.

Jharkhand having only 2.4% of total geographical area of India consists of both plateau and sub-plateau region with a forest area of 29.61% and the current agriculture scenario is challenging due to number of problems such as soil erosion, soil acidity, moisture deficiency and low availability of nutrients mainly phosphorus besides erratic rainfall, poor water retention capacity and permeability of soil, resulting in low agricultural productivity.

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Due to very small land holding and low productivity of the land most household make out a living by maintaining a diversified pattern of occupations, no single activity provide sufficient resources to entirely ensure their livelihood. India is the first country in the world to adopt the National Agroforestry Policy in 2014, under its Ministry of Agriculture and Farmers Welfare. Its objective is to expand tree plantation in combination with crops and/or livestock to improve overall productivity, reducing unemployment, generating additional source of income and livelihood support to small landholders. The policy also highlights that agroforestry could be implemented to meet the domestic and industrial requirements of the country for wood and its products. Moreover, in this direction, efforts have been made by the farmers and researchers for introducing promising tree-based farming systems across the different states in order to attain sustainability.

At present there is a need for closer study of the prevailing agroforestry practices and their influence on people's life. So it is necessary to identify the existing agroforestry practice of the farmers, performance of tree as well as agricultural crops and constraints in adoption of agroforestry practices. For this the study was categorized to accomplish the two objectives viz. to identify the existing agroforestry practice and to study the component distribution of different agroforestry systems.

Materials and methods

The experiment was conducted at different sites of Namkum block of Ranchi district (Jharkhand) which lies between 85°22'E longitude and 23°21'N latitude in agro climatic zone IV. The site is situated 25 km away from the Birsra Agricultural University on Kanke-Ranchi-Namkum Road. Interview schedule for respondents was prepared on the basis of literature referred, reconnaissance survey and discussion with subject matter specialist to collect information from them regarding their socio economic status, land use characteristics general awareness with respect to various agroforestry activities, participation in various agroforestry activities. Selection of respondents was done by multi stage random sampling technique. Household heads were treated as respondents engaged in agroforestry activities and were selected as target group for the data collection.

The data were collected by personal interviews of the respondents through a structured interview schedule. A part from this qualitative analysis was done on the basis of observation and interaction with the respondents. Interview was conducted preferably in isolation and the information was further cross checked by Focus Group discussion and personal observations wherever possible. Four panchayat was selected in Namkum Block and in each block, two villages was selected. Further, in each village, 20 households were selected, so in this way, 120 households were surveyed. Data was collected on farm size, land use practices and agro forestry related activities.

Results and discussions

The farm size of the study area is classified into below 1ha, 1-2 ha, 2-4 ha, 4-10 ha and more than 10 ha and is presented in Table 1. Perusal of table indicated that most of the respondents (96.25%) had below 1ha land in all the villages. All the respondents (100%) of village Chene, Ulatu, Hardag and Jamgai had only less than 1ha land. It was also seen that all the respondents were confined to the farm size of 1-2 ha except that of Siri village where only one respondent had farm size in 2-4 ha category. Pooled data indicated the majority of the respondents i.e. 154 respondents (96.25%) had less than 1ha land followed by 5 respondents (3.125%) had 1-2ha. It was also found that no respondent was having more than 4 ha farm size in all the sampled panchayats. Similarly Madiwalar *et al.*, (2007) [4] found that the size of land holding was positively and significantly correlated with the extent of adoption of agroforestry model and Thamban *et al.*, (2008) the size of land holding was found to have significant and positive relationship with extent of participation in the field implementation of micro irrigation technology in Kasaragod district of Kerala state. The size of land holding had showed no link to the people's dependence and participation in forest management particularly fire management (Prakash and Sharma, 2008) [5]. This finding supports Benneh (1976) [1] who argued that miniature farm sizes and the manner, in which they are fragmented and scattered, constitute an obstacle to farm improvement since they do not enable farmers to take advantage of economies of scale of production.

Table 1: Farm size of selected villages of Namkum Block

Farm size	Rampur Panchayat		Lalkhatanga Panchayat		Dungri Panchayat		Saudaag Panchayat		Total	Mean± S.E(m)	%
	Chene	Ulatu	Kharsidag	Konchbong	Hardaag	Siri	Jamgai	Saudag			
Below 1 ha	20	20	19	19	20	17	20	19	154	19.28±0.36	96.25
1-2 ha	0	0	1	1	0	2	0	1	5	0.62±0.26	3.125
2-4 ha	0	0	0	0	0	1	0	0	1	0.12±0.12	0.625
4-10 ha	0	0	0	0	0	0	0	0	0	00	00

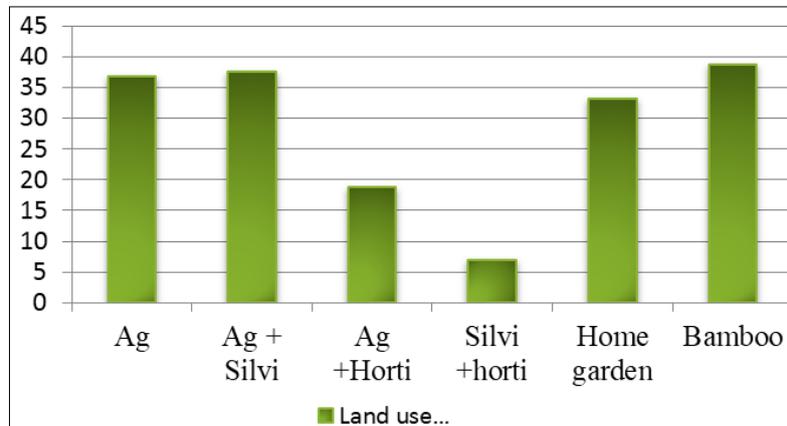
Land use practices of selected villages of Namkum Block

The land use practices of the study area are presented in Table 2. Perusal of data indicated that Agriculture is the main land use practices followed in the selected village areas either singly or in combination with tree crops, horticultural crops or bamboos. Many household planted tree crops in their garden and farmland such as *Gmelina arborea*, *Dalbergia sissoo*, *Melia azaderach*, *Leucaena leucocephala* etc followed Agrisilvicultural system and such land use practice is followed by 60 households (37.50%). Also 59 households i.e. (36.87%) were still engaged in traditional method of practicing only agriculture. In the sample villages 30 (18.75%) followed Agrihorticultural practices and cultivating vegetable, papaya, guava, mango etc. Further it was also

observed that a major portion of 58 households (36.25%) were engaged in Bamboo plantation in their farm on bunds. So, in the land use practice of study area the households mainly practiced agrisilvicultural system. Integration of horticulture is also followed by some of the household for cash income and it was seen in the land use practices of Agrihorticultural and Hortisilvicultural systems. In the surveyed areas it was also noticed that main occupation in the villages are agriculture and worked as labourers and dairy farming accounted for a major portion of total household income. Average land holdings were low and output from the agricultural land was also low. It is also observed that there was reduction in yield from agricultural fields in general (Iqbal *et al.*, 2014) [3].

Table 2: Land use practices of selected villages of Namkum Block

Land use practices	Rampur		Lalkhatanga		Dungri		Saudaag		Total	Mean±S.E M	%
	Chene	Ulatu	Kharsidag	Konchbong	Hardag	Siri	Jamgai	Saudag			
Agriculture	10	6	8	7	8	7	5	8	59	7.37±0.53	36.87
Agrisilviculture	5	9	7	8	7	8	8	8	60	7.50±0.42	37.50
Agrihorticulture	4	5	4	4	3	3	4	3	30	3.75±0.25	18.75
Hortisilviculture	1	0	1	1	2	2	3	1	11	1.37±0.32	6.875
Homegarden	5	8	6	7	5	6	7	9	53	6.62±0.49	33.11
Bamboo	4	5	7	09	7	10	7	9	58	7.75±0.97	36.25

**Fig 1:** Land use Practices of selected villages of Namkum Block

Components present in different Agroforestry systems identified in Namkum Block

The component distribution in different agroforestry systems in Namkum Block is presented in Table 3. Perusal of data indicates that the tree species and agricultural crop combination reflects the different agroforestry systems.

- Agrisilvicultural system
- Agrihorticultural system
- Silvipastoral system
- Homegarden system.

In agrisilvicultural system the tree components comprised of *Melia azadarech* (Bakain), *Leucaena leucocephala* (Subabul), *Dalbergia sissoo* (Shisham), *Gmelina arborea* (Gamhar), *Tectona grandis* (Teak) *Pongamia pinnata* (Karanj) and the agricultural crops present were *Triticum aestivum* (Wheat),

Brassica nigra (Mustard), *Pisum sativum* (Pea), *Zea mays* (Maize), *Oryza sativa* (Paddy) etc. In agrihorticultural system the tree species were *Artocarpus heterophyllus* (Jackfruit), *Mangifera indica* (Mango), *Syzygium cumini* (Jamun), *Psidium guajava* (Guava), whereas agricultural species were *Lycopersicon esculentum* (Tomato), *Solanum melongena* (Brinjal), *Zingiber officinale* (Ginger), *Capsicum annuum* (Chilly). In Silvipastoral system tree species were *Dalbergia sissoo* and *Mangifera indica* (Mango), whereas grass species were *Cynodon dactylon* and *Cyperus cariosus*. In Home garden system tree species were *Artocarpus heterophyllus*, *Dalbergia sissoo*, *Gmelina arborea*, *Mangifera indica*, whereas agriculture species were *Solanum tuberosum*, *Allium cepa* (Onion), *Solanum melongena*, *Zingiber officinale*, *Capsicum annuum* etc.

Table 3: Components of different Agroforestry systems identified in Namkum Block

S.N.	System	Components		
		Tree species	Agricultural crop	Horticultural crop
1.	Agrisilviculture	<i>Melia azadarech</i> , <i>Leucaena leucocephala</i> , <i>Dalbergia sissoo</i> , <i>Gmelina arborea</i> , <i>Syzygium cumini</i> , <i>Tectona grandis</i>	<i>Triticum aestivum</i> , <i>Brassica nigra</i> , <i>Pisum sativum</i> , <i>Zea mays</i> , <i>Oryza sativa</i> , <i>Solanum tuberosum</i> , <i>Lycopersicon esculentum</i>	
2.	Agrihorticulture	<i>Artocarpus heterophyllus</i> , <i>Mangifera indica</i> , <i>Syzygium cumini</i> , <i>Carica papaya</i> , <i>Psidium guajava</i> .	<i>Lycopersicon esculentum</i> , <i>Solanum melongena</i> , <i>Zingiber officinale</i> , <i>Capsicum annuum</i> , <i>Colocasia schott</i>	
3.	Silvipasture	<i>Dalbergia sissoo</i> , <i>Mangifera indica</i>		
4.	Home garden	<i>Artocarpus heterophyllus</i> , <i>Azadirachta indica</i> , <i>Dalbergia sissoo</i> , <i>Gmelina arborea</i> , <i>Litchi chinensis</i> , <i>Mangifera indica</i> , <i>Syzygium cumini</i> , <i>Tectona grandis</i>		<i>Solanum tuberosum</i> , <i>Allium cepa</i> , <i>Solanum melongena</i> , <i>Capsicum annuum</i> , <i>Zingiber officinale</i> , <i>Colocasia schott</i> , <i>Lycopersicon esculentum</i> , <i>Solanum melongena</i>
5.	Agriculture		<i>Triticum aestivum</i> , <i>Pisum sativum</i> , <i>Oryza sativa</i> , <i>Zea mays</i>	

Conclusion

Majority of the respondents i.e. 96.25% respondents had below 1ha farm size followed by 3.12% respondents had 1-

2ha and only 0.62% respondent had 2-4ha land. The existing agroforestry systems identified were Agrisilviculture, Agrihorticulture, Silvipastoral and Home gardens. In case of

land use practices, the maximum 37.50% respondents were engaged in agriculture+tree followed by 36.87% in agriculture. 36.25% were involved in bamboo cultivation, 18.75% were practicing agriculture+horticulture and minimum 6.87% respondents engaged in horticulture+tree. In agrisilvicultural system the tree species like *Melia azaderach* (Bakain), *Leucaena leucocephala* (Subabul), *Dalbergia sissoo* (Shisham), *Gmelina arborea* (Gamhar), *Tectona grandis* (Teak), *Pongamia pinnata* (Karanj) etc. were present. The tree species like *Artocarpus heterophyllus* (Jackfruit), *Mangifera indica* (Mango), *Syzygium cumini* (Jamun), *Psidium guajava* (Guava) etc. were present in agrihorticultural system. In Silvipastoral system the tree species were *Dalbergia sissoo* (Shisham), *Mangifera indica* (Mango), *Tectona grandis* (Teak) where as in Home garden system tree species were *Artocarpus heterophyllus* (Jackfruit), *Dalbergia sissoo* (Shisham), *Gmelina arborea* (Gamhar), *Mangifera indica* (Mango) etc. were present.

With the increase in needs and decrease in relative availability of land, the arable land faces a tremendous amount of pressure through contrasting nature of demands and if the prevailing land use practices sustains, the situation will further worsen gradually. The interaction with the villagers led towards the recommendations like techniques regarding agroforestry related practices should be included in the extension services and agriculture training institutions, marketing support for sale of products by minimum support price and further development of commercially viable agroforestry plantations largely contribute to employment opportunities and income for the landless and marginal farmers as well as the rural poor. There is a need of revisiting the various policies and programmes launched by the state government for tree farming in isolation to be brought under the umbrella of single nodal agency to synergize and coordinate effectively for promoting agroforestry. The state government should evolve a State agroforestry Policy in consonance with the National Agroforestry Policy 2014, to plan, prioritize and develop agroforestry action plan suitable for each agroclimatic zone. The provision for low interest and no mortgage loans like KCC should also be introduced for promoting agroforestry practices among the farmers. The state initiatives like Mukhyamantri Jan Van Yojana could be blended with modern Agroforestry techniques and to check the muffling of scheme, a quality monitoring must be ensured at various levels.

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