Original Research Article   https://doi.org/10.20546/ijcmas.2017.609.237

Diagnostic Survey of Existing Farming System and Agro Forestry Practices in the Koderma District of Jharkhand, India

Rupesh Ranjan[1*], S. Shekhar[1] and C.V. Singh[2]

[1]Krishi Vigyan Kendra (ICAR-NRRI-CRURRS) Koderma, Jharkhand 825324, India
[2]Central Rainfed Upland Rice Research (ICAR-NRRI, Cuttack, Odisha), Station, Hazaribag, Jharkhand, India
*Corresponding author

A B S T R A C T

A study was conducted in Koderma district of Jharkhand with the objective to make an inventory of the current farming systems and identify key strengths and weaknesses of agro forestry system, including economic efficiency. The farming system judgment was based on focus group discussions and in-depth interviews with 36 villages and 216 family head as responded for this study. The study showed that about 15.2% farmers were derived their income from Agro-forestry field. The farmer's knowledge about benefit of agro-forestry data reveals that 80.0% of the respondent considered is beneficial for better supply of fuel wood followed by timber 69.4%, fodder 43.9%, compost 32.4%, increase living standard 31.0%, fruit 23.6%, employment 23.1%, environment conservation 18.9%, climate control 15.7%, very few number of respondent were aware of benefits like soil conservation 10.1% and protection from flood and water conservation 6.9% and 4.6% respectively. Only 6.9% of the farmers were deadly against the tree and 90.2% were interested to have trees either mixed with agricultural crops or on bunds of field or on boundary or on wasteland or around home compound or separate orchard. Among the respondent majority of the farmers 67.1% liked agri-horticulture system, 57.8% agri-silvi system, 13.8% horti-pastoral system and very little numbers 10.6% of farmers liked silvi-pastoral system. Although about 18.0% showed interest to develop a separate orchard. It was also concluded from the study that farmers were not adopting agro forestry mainly due to their lack of awareness about benefits of the tree. They considered that the trees compete with agricultural crops for water and nutrients uptake and degrade their farmlands etc. The findings of the study were helps in identify agro forestry systems with potential for wider adoption and also lay the groundwork for the design or redesign of effective agro forestry research in the region.

Introduction

Agro forestry in India contributes to the target set by the Indian Council of Agricultural Research (ICAR) for increasing forest cover from the present level of 23% of land area to 33%. "Agro-forestry is a collective name for land use system and technologies, where woody perennials (trees, shrubs, palms, bamboos etc.) are deliberately used on the same land management unit as agricultural crop and/or animals, either in same form of spatial arrangement or temporal sequence. In agro-forestry system there are both ecological and economical interactions between the different components" (ICRAF, 1993). The

Report of the Task Force of Greening India for Livelihood Security and Sustainable Development (Planning Commission, 2001) has suggested that 10 million ha of irrigated land and 18 million ha of rain-fed land should be managed under agro forestry systems.

The forest cover of India is only 67.83 M ha (20.68% of the geographical area) and other tree cover is estimated as 9.99 M ha (3.04% of the geographic area), thus the total forest and other tree cover is computed as 77.82 M ha, which is 23.68 per cent of its geographical area (FSI, 2003). In addition to this, about 25.72 M ha area is under various types of tree plantations such as, social forestry and agro forestry. In India, a social forestry programme started in 1976. Under this programme, trees were planted in and around agricultural fields, railway lines, roadsides, river and canal banks, village common land and government waste land. The goal of social forestry is plantations by the people who can meet the growing demand for timber, fuel wood, fodder and other uses. It also provides social benefits by functioning as a protective system that ensures resource conservation through same of these are not directly measurable (Nath *et al.,* 2009). Agro forestry systems in India include the use of trees grown on farms, community forestry and a variety of local forest management and ethno forestry practices (Pandey, 1998). The ICAR has classified systems used in different agro-climatic zones as silvipasture, agrisilviculture or agrihorticulture based on irrigated or rain-fed conditions. The practice of growing scattered trees on farmland is quite old. These trees are used for shade, fodder, fuel wood, food and medicinal purposes.

Jharkhand is a new state with immense possibilities of development in industrial and agricultural sector. Almost 50% of the country's minerals are located in the state. The notified forest covering area of the state is 23605.47 sq km which is 29.6% of the total geographical area of the state. 79714 sq km. community plantations yielding non-timber products in tribal areas of Jharkhand have potential for conservation of useful species as well as for making a contribution to the well-being of local people (Quli, 2001). Such initiatives have enhanced likelihood of success as these tribal communities are dependent on wild resources for their livelihood. In tree component of agro-ecosystems is particularly valued for specific roles including that of host species to insects yielding marketable products such as silk (Singh *et al.,* 1994), lac (Jaiswal *et al.,* 2002), and honey (Dwivedi, 2001). In Koderma nearly 42.93% area is covered with forest in which 229 sq km is dense forest, 387 sq km is open forest, 3 sq km is scrub forest (state of forest report, 2001, Forest Survey of India). The tree cover on farmlands can be expanded up to 10% without harming agricultural crops, which will be a great contribution to justify the needs of rural and urban people (Qureshi, 1998). The key factor in promoting the agro-forestry is the farmer. Some efforts have been made to assess the farmers' participation in agro-forestry but no formal and moral effort was made in the past to find out the reasons for non-adoption of agro-forestry in the district. The information based on agro-forestry is weak in the state. It should be truthfully confessed; constantly waking on the subject without further loss of time, before it is too late the new vistas, which deserves more and more attention.

Hence this study was taken to provide the baseline information in this regard. The main objective of this research study was to know the agro-forestry existing system and their uses highlight the reasons for non-adoption of agro-forestry and to suggest corrective measures to overcome the constraints and problems faced by the farmers in agro-forestry adoption.

Materials and Methods

According to Kerlinger (1986), survey research methodology is most appropriate in determining the behaviour, expectations, perceptions and interests of the respondents. This study was conducted in Koderma district of Jharkhand. The district consists of six blocks namely Koderma, Jainagar, Markachho, Chandwara, Satgawan and Domchanch. For the present study purposely selected six villages from each block. In each of the selected villages, 36 farmers with same form of agro-forestry were selected. In this study adopted multistage random sampling technique. Thus a total of one district, 6 blocks and 36 villages and 216 farmers formed the sample unit of study. Head of the selected families were considered as respondents for the study. The information regarding the agro-forestry existing system and their uses, reasons for not planting trees on farmlands by farmers, benefits and disadvantages in comparison with agricultural crops and constraints faced by the farmers in practicing agro forestry were obtained with the help of a focus group discussions, in-depth interviews and interview schedule in person. The results collected were analyzed by using suitable statistics to draw conclusions and suggest measures for convincing for adopting agro forestry.

Results and Discussion

Socio-economic characteristics of the respondents

The Socio-economic characteristics included age, education, land holding and source of income. Different studies revealed that the socio-economic characteristics had much influence on the adoption behaviour regarding new practices (Jamal, 2005). FAO (1989) reported that the innovators and early adopters were those who were higher in their socio-economic status. The results (Table 1) revealed that majority of the respondents (38.8%) belonged to middle age group, among the respondents 43.5% were illiterate and 56.4% were literate. Out of literate respondents, 36.5% were from primary to middle while only 19.9% were up to matriculation and above. This study also revealed that 29.6% respondents reported that they earned their income mainly from crop sector while 17.1% from trees grown for commercial purposes and 15.2% from crops along with trees (agro-forestry). This study showed that illiteracy was also the main reason for non-adoption of agro-forestry by farmers. Amir (2003) also reported that education was the main and vital weapon for bringing a positive change in the behaviour of individual farmer, which develops knowledge and other desirable qualities of mind and general competence. It was confirmed through many research studies that the education played a significant role in the adoption process of recommended agricultural practices. Hence the illiteracy among the farmers is much influencing their behaviour to adopt agro forestry practices. It is one of the main hindrances because it creates ignorance and unawareness among the individuals. The sources of income and the occupations also determine the social standing of the individuals and these material circumstances also affect the adoption behaviour of the people.

The marginal farmers had an average number of respondents i.e., 49.8%, the small farmers' category had a 28.7%, while the medium to large farmers category is 22.2%. Thus the overall in Koderma district number of farmers' category is marginal. The results depicted in table 1 showed that only a small number of farmers (15.2%) were actively engaged in agro forestry and 84.5% were not practicing it. The farmers who were planting trees on their farmlands were also confronted with major problems like timber and fuel wood marketing. So these farmers mainly

utilized these tree species as fodder sources for their livestock. Thus these farmland trees affected their income generation and saved their money.

Effectiveness of some dominant agro forestry practices in the study villages

Rain fed agriculture system dominates the economy of Jharkhand and also Koderma district. Rice is the single major crop covering about 1.977 million ha. In Koderma district the farmers grow varieties of crop for home consumption and income generation. The major crop of the district is rice. Farmers are growing number of crops to meet the family need, market requirement and to avoid risk.

Some crops grown in the district are namely maize, pigeon pea, niger, wheat, ragi, horse gram, tomato, okra, beans, potato, mustard and radish etc. 48% of the farmers were found sufficient in food, 24% having surplus food and selling in the market whereas, 28% of the farmers were found to have shortage of food for more than 3 months in a year.

Table.1 Distribution of the respondents according to their socio-economic characteristics

Characteristic	Frequency	Percentage
1.Age (Years)		
Up to 30	62	28.7
31-40	84	38.8
Above 40	70	32.4
2.Educational Level		
Illiterate	94	43.5
Primary to Middle	79	36.5
Up to Matric and Above	43	19.9
3. Land Holding		
Marginal (<1ha)	106	49.07
Small (1-2 ha)	62	28.70
Medium/Large (>2 ha)	48	22.22
3.Source of Income		
Livestock	31	14.3
Crops	64	29.6
Poultry	28	12.9
Trees for commercial purposes	37	17.1
Crops + Trees	33	15.2
Crops + Livestock	23	10.6

Table.2 Agroforestry Farming System Practices in the study areas

Sl. No.	Description	Frequency	Percentage
1.	Farmers interest to have trees either mixed with agricultural crop or on bunds or on boundary or on waste lands or around house compound or separate orchard etc.	195	90.2
2.	Farmers not interested in any type of tree along with agricultural crops or even alone.	15	6.9
3.	Farmers interested to have trees only on field bunds (including fruit tree).	125	57.8
4.	Farmers interested to have tree only on boundary of their land.	109	50.4
5.	Farmers interested to have tree along with agricultural crops in the fields.	35	16.2
6.	Farmers interested to have trees on waste lands including ponds, river, etc.	80	37.0
7.	Farmers interested to develop separate fruit orchard (excluding those which are already having)	39	18.0
8.	Farmers liking for tree near home compound/surrounding	97	44.9
9.	Farmers liking Agri-horti system	145	67.1
10.	Farmers liking Agri-silvi system	125	57.8
11.	Farmers liking Silvi-pastoral system	23	10.6
12.	Farmers liking Horti-pastoral system	30	13.8

Table.3 benefits from Agro forestry Farming System Practices

Sl. No.	Benefits	Frequency	Percentage
1.	Fuel wood	173	80.0
2.	Timber	150	69.4
3.	Fruit	51	23.6
4.	Fodder	95	43.9
5.	Climate control	34	15.7
6.	Soil conservation	22	10.1
7.	Environment conservation	41	18.9
8.	Water conservation	10	4.6
9.	Protection from flood	15	6.9
10.	Compost	70	32.4
11.	Living standard	67	31.0
12.	Employment	5	23.0
13.	Source of money in emergency	80	37.0

Table.4 Problems and constraints faced by respondents in the adoption of agro forestry

Problems	Frequency	Percentage
Lack of education	112	51.8
Lack of technical skills	71	32.8
Lack of technical assistance	87	40.2
Lack of marketing facilities	63	29.1
Lack of capital	126	58.3
Unawareness	113	52.3
Lack of interest	38	17.5
Lack of transportation facilities	59	27.3

The dominant farming system in the 36 selected villages (Table 2), nearly 18% of the farmers have separate fruit orchards whereas 57% of the farmers are having fruit trees on bunds, boundary around home compound, sloppy land, degraded lands etc. Large number farmers (75%) were found to have liking for mango trees (*Magifera indica*) followed by guava (*Psidium guajava*) 56% and papaya (*Carica papaya*) 45%. As much as 70% of the farmers were found to have liking sagwan (*Tectona grandis*) (55%), sisum (*Dalbergia sissoo*) 46%, bamboos (*B.vulgaris*) 30%, mahua (*Madhuca longifolia*) 28%, gamhar (*Gmelina arborea*) 22% and jackfruit (*Artocarpus heterophyllus*) 18%. Only 6.9% of the farmers were deadly against the tree, 90% were found to be interested to have tees either mixed with agricultural crops or on bunds or on boundary or on waste lands or around home compound or separate orchard. Interests of the farmers in Koderma district with respect to different agro forestry systems (Table 2), it can be inferred that majority of the farmers have liking for agri-horti system (67%), followed by agri-silvi system (57%) and horti-pastoral system (13%). The choices of the farmers were very little towards silvi-pastoral system (10%) although about 18% farmers showed liking to develop a separate orchard. Abbas (1993) also reported that the advantages got from trees were less than disadvantages, so that they all preferred to grow agricultural crops without trees. Many research studies

revealed that the trees grown along with crops could give better economic returns as compared to agricultural crops. Jamil (2003) also concluded in his study that a majority of the respondents (66%) were hesitating to grow trees on their farmlands because they hindered the agricultural crops. Chaudhry *et al.,* (2003) conducted a study to find out physio-chemical characteristics of wheat variety Inqalab-91 intercropped with poplar (*Populus deltoides*) at various densities, during 7th and 8th years of its age showed a positive relationship between crops and trees. They concluded that the net income received from this intercropping system was more than crops. They also discussed the growth and yield of poplar trees under intercropping agro forestry system and found that agro forestry was superior as compared to monoculture farming system. Such field demonstrations must be displayed to aware the farmers about intercropping culture of trees and agricultural crops. Some other research studies also support these results. There is a general identification of the multiple benefits of agro forestry including revenue from sale of wood products and environmental outcomes particularly. The farmers generally believe that the trees planted along with agricultural crops damage the crop production and affect the economic returns. The benefit obtained from the farming practices of upland farmers were relatively high. The most profitable benefits are 80.0% of the respondents considered is beneficial for better supply of

fuel wood followed by timber (69.4%), fodder (43.9%), source of money in emergency (37.0%), compost (32.4%), increase living standard (31.0%), fruit (23.6%), employment (23.1%), environment conservation (18.9%),climate control (15.7%),very few number of respondents were also aware of benefits like soil conservation (10.1%) and protection form flood and water conservation 6.9 and 4.6% respectively (Table 3).

Constraints faced by the farmers in the adoption of agro forestry

The respondents were asked to report about the problems, being faced by them in the adoption of agro forestry (Table 4). Result indicated that unawareness, lack of education, technical skills, capital, technical assistance, interest, marketing and transportation facilities as the main hindrances in the adoption of agro forestry. These all constraints can be easily overcome by launching awareness campaigns, training workshops, providing technical assistance and establishing marketing points.

Several studies have also examined such constraints i.e., marketing and transportation facilities confronting the farmers in practicing agro forestry (Pattanayak *et al.,* 2003; Montambault and Alavapati, 2005). The majority of these studies have concentrated on classical factors such as land tenure systems, farm size, education, income generation activities and extension etc. These studies also concluded that the basic issue in marketing the forest products was the transportation. It was also concluded that the farmers were not adopting agro forestry mainly due to their lack of awareness about the tree benefits. They considered that the trees compete with agricultural crops for water and nutrients uptake and degrade their farmlands etc

From the present study it was concluded that the farmers were not adopting agro forestry

mainly due to lack of awareness about the tree benefits and their concern with the comparison of trees and agricultural crops. A majority of the farmers were not educated; therefore they considered that the trees compete with agricultural crops and degrade the land by taking up all water and nutrients. No formal awareness programmes were running here to increase the knowledge of farmers to change their farming attitude towards agro forestry. The government should initiate such projects especially in the rural areas for the capacity building of the farmers and equip them with the new farming techniques through training and orientation workshops. They should provide scientific guidance to the farmers about suitable tree species grown on agricultural land with agricultural crops, their silvicultural operations and tree management practices along with free supply of seeds and seedlings and loan schemes for the promotion of agro forestry.The outcome of this survey indicated that there is ample scope of introduction of agro-forestry in Koderma district. Such surveys are required to be conducted in any area to find out need of the farmers, their interests and scope of implementation of any agro forestry system

References

Abbas, S. S., 1993. Socio-economic impact of forest plantation on the adjoining farmers in district Faisalabad. M.Sc. (Hons) Thesis, Dept. of Rural Sociology, Univ. of Agri., Faisalabad, Pakistan.

Amir, J., 2003. An investigation into the adoption of broiler production/management practices by poultry farmers in tehsil Samundri. M.Sc. (Hons) Thesis, Dept. of Agri. Ext., Univ. of Agri., Faisalabad.

Basu, J. P., 2014. Agroforestry, climate change mitigation and livelihood security in India. *New Zealand J. of For. Sci.,* pp. 1-10.

Chaudhry, A. K., Khan, G. S., Siddiqui, M.T., Akhtar, M. and Aslam, Z. 2003. Physico-chemical characteristics of wheat variety inqalab-91 under poplar (*Populus deltoids*) based agro-forestry system. *Pak. J. Agri. Sci.* 40 (1-2): 77-81.

Dwivedi, M. K., 2001. Apiculture in Bihar and Jharkhand: A study of costs and margins. *Agri. Marketing*. 44(1):12-14.

F.A.O., 1989. Agricultural extension a reference manual, Food and Agriculture Organization of United Nations, Rome, Italy.

Forest Survey India (FSI) 2003. State of Forest Report 2003. Forest Survey of India, Ministry of Environment and Forests, Dehradun.

Forest Survey India (FSI): State of Forest Report 1999. Dehradun, India: Forest Survey of India, 2000.

G.O.I. (Government of India) 2001. *Report of the Task Force on Greening India for Livelihood Security and Sustainable Development*. Planning Commission, New Delhi, pp. 17–44.

Jaiswal, A. K., Sharma, K. K., Kumar, K. K., Bhattacharya, A. 2002. Household's survey for assessing utilisation of conventional lac host trees for lac cultivation. *New Agriculturist*. 13:13-17.

Jamal, N., 2005. An investigation into the adoption of recommended livestock production practices by rural women in district Faisalabad. M.Sc. (Hons) Thesis, University of Agriculture, Faisalabad Pakistan.

Jamil, M., 2003. Farmers Attitude towards Tree Plantation in District Attock. M.Sc. (Hons) Thesis, Pakistan Forest Institute, Peshawar.

Kerlinger, F. N., 1986. Foundation of Behavioural Research, Fort Worth, TX: Holt, Renihart and Winston, Inc.

Montambault, J. R., and Alavalapati, J. R. R. 2005. Socioeconomic research in agroforestry: A decade in review, Agroforest. Syst. 65(2):151–161.

Nath, S., Das, R., Chandra, R., Sinha, A. 2009. Bamboo based agro-forestry for marginal lands with special reference to productivity market trend and economy. *Jharkhand News*, March-PP.80-96.

Nouman, W., Khan, G. S., Siddiqui, M.T. and Riaz, A. 2008. Farmers' attitude towards agro-forestry in district Faisalabad. *Pak. J. Agri. Sci.* 45(1), 60-64.

Pandey, D., N.1998. Ethno-forestry: Local knowledge for sustainable forestry and livelihood security. New Delhi, India: Himanshu/AFN.

Pattanayak, S. K., D. E., Mercer, S., Erin, Y. and Jui- Chen. 2003. Taking stock of agroforestry adoption studies, *Agroforest. Syst*. 57(3):173–186.

Planning Commission, Government of India. 2001. Report of the Task Force of Greening India for Livelihood Security and Sustainable Development.

Quli, S. M. S., 2001. Agro-forestry for NTFPs conservation and economic upliftment of farmers. *Indian Forester*. 127:1251-1262.

Rahman. S. A., 2008. Land use patterns and the scale of adoption of agro-forestry in the rural landscapes of Padma floodplain in Bangladesh. *Forests, Trees and Livelihoods*, 18, pp. 193–207

Singh, M. P., Dayal, N., Singh, B. S. 1994. Importance of genetic conservation of tasar host plants in agro-forestry programme in Chhotanagpur region of Bihar. *J. of Palynology*, 30:157-163.