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Impact of Agroforestry practices on livelihood improvement of the farmers of Lohardaga District Jharkhand

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Abstract
A study was conducted for a period of one year from July to June, 2014-15 to evaluate agroforestry practices and its impact on farmer's livelihood improvement in Bhandra block of Lohardaga district Jharkhand. A questionnaire was prepared to know the independent and dependent variables. The independent variables were age, education, family member, farm size, agroforestry land size, cultivable land, fallow land, monthly income, knowledge about trees, and knowledge of agroforestry; while the dependent variable of the study was existing agroforestry practices. Average age of farmers was 39.27 years and it ranged from 25 to 65 years. Education level of farmers ranged from 0 -15 with an average was 9.51. Family size of the respondents in Bhandra ranged from 3-12 with an average of 6.95. The farm size of the farmers ranged from 0.6 – 8.0 ha. Agriculture land size of the respondents ranged from 0.6 – 4.5 ha with an average of 1.66 ha. Agroforestry land size of the respondents ranged from 0.2 – 1.2 with an average of 0.55 ha. The fallow land size of the farmers ranged from 0 – 0.8 ha with an average of 0.28 ha. Monthly income of the farmers was ranged from Rs. 2500 to 9500 with an average of Rs. 5570.73. In Ghamhar based agrisilviculrure system found B: C ratio 2.96 and average annual net returns were to the tune of Rs.28,875/- at current prices where as in mango based agrihorticulture system found B:C ratio 2.00 and average annual net returns were to the tune of Rs.23,050/- at current prices. In Shisham based silvipastoral system B:C ratio 2.44 and average annual net returns were to the tune of Rs.6,655/- at current prices. Whereas Teak based homegarden system B:C ratio 3.04 and average annual net returns were to the tune of Rs.27,520/- at current prices.

Keywords: Agroforestry, Agrisilviculrure, Agrihorticulture, Silvipastoral, Homegarden, B:C ratio

Introduction
Agroforestry is a dynamic, ecologically based natural resource management system that, through which the integration of trees/ woody perennials in farm and rangelands, diversifies and sustains production for increased social, economic and environmental benefits (Leakey, 1996). It can play a major role in bringing the desired level of diversification along with sustainability. The farm industry linkages have also helped the systems to be more sustainable than the traditional cropping systems (Kareemulla *et al.,* 2005; Saxena, 2000) [4, 10]. Agroforestry, which is the inclusion of woody perennials in farming system has been practiced as traditional land use and livelihood option in Jharkhand state of India since time immemorial. The Jharkhand state is well known for its vast coal reserves and forest cover, which also includes the traditional agroforestry systems. The state is having 4.21 per cent of total geographical area under tree green cover in agroforestry (FSI, 2011). Among various states of Eastern India (Eastern Uttar Pradesh, Bihar, Jharkhand, Odisha, Chhattisgarh, West Bengal and Assam), Jharkhand has the highest area under wastelands/ degraded lands (14.84%), followed by Assam (11.20%) and Odisha (10.69%) (World Bank, 2007) [11]. There is a need to restore those wastelands/degraded lands through agroforestry interventions in order to supply the increasing demands of food, fuel, fodder and timber requirements of rural folks in Jharkhand. Thus agroforestry serves as one of the option to tackle the problems of resource degradations and it's over exploitation in this state.
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) [7]. This study has tried to investigate how influential agroforestry practices are in terms of improving rural livelihoods.

Moreover, the agroforestry systems that have been traditionally practicing only return the subsistence need of the local people and from this subsistence return; the socio-economic status has not been uplifted. The present need is the commercial and semi-commercial return from their productions and the integrated farming system so that they can get maximum benefit from the limited resources. Keeping these facts, the study was carried out with objective of to identify the existing agroforestry practices and impacts of the agroforestry practices on their socio-economic condition.

Materials and Methods

Location of the study area: The experiment was conducted at Bhandra block which is situated in Southwest part of Lohardaga district. The altitude of site is about 676 m above mean sea level and its geographical coordinates are 23° 21' 0" North, 84° 48' 0" East. According to Census (2011) total population of the block is 57,332, male population was 28,727, female 28,605, population of 0-6 ages 9,623. Bhandra block is predominantly rural, with heavy dependence on agriculture and low industrial investments.

Sampling procedure and Survey schedule: A questionnaire was prepared for collecting information from the study area. Using this questionnaire relevant information was collected from 80 farmers which were randomly selected from the study area. Data were recorded from these selected farmers from June 2014 to July 2015. In conformity with the set objectives of the study, a set of preliminary survey schedules has been designed for collection of data for the study. Thus, the final survey schedule has been prepared in a simple manner maintaining logical sequences and necessary adjustments.

Results and Discussion

Characteristics of the respondents

Ten characteristics of which were the independent variables of the study were investigated viz age, education, family size, farm size, agriculture land size, agroforestry land size, Fallow land size, monthly income, knowledge about trees and knowledge about Agroforestry. Measuring system of the each characteristic, their observed range, mean and standard deviation are presented in the Table 1. Similarly Safa, 2005 and Ibrahim *et al.*, 2011 [3] studied the age, education, family size, farm size, Fallow land size, knowledge about trees and knowledge about Agroforestry.

Table 1: Characteristics of the respondents

Characteristics	Measuring system	Observed range	Mean	Standard deviation
Age	Years	25 - 65	39.27	8.54
Education	Level of schooling	0 - 15	9.51	3.86
Family size	Numbers	3 - 12	6.95	2.13
Farm size	Hectare	0.6 – 8	2.24	1.23
Agriculture land size	Hectare	0.6 – 4.5	1.66	0.72
Agroforestry land size	Hectare	0.2 -1.2	0.55	0.27
Fallow land size	Hectare	0.2 – 0.8	0.28	0.13
Monthly income	Thousand	2500 - 9500	5570.73	1348.11
Knowledge about trees	Score	5.0-75.0	25.78	16.35
Knowledge about agroforestry	Score	5.0-75.0	26.05	17.12

Cost benefits analysis of different agroforestry system

Ghamhar based Agrisilviculture System

The system wise economic analysis of agroforestry considering the rotation period, cropping pattern and the actual number of farmers who have the produce in the past ten years was done for the agrisilviculture systems separately for the major tree species. Ghamhar based systems with the average population maintained per ha, the B:C was worked out. The costs benefit analysis of agrisilviculture system of Ghamhar plantation with 20 year rotation in Table 2. The cropping pattern considered for the system was Wheat, Mustard, Pea, Maize, Paddy and Chilly. It may be noted that the B:C (discounted at 10 %) worked out to 2.96 The average annual net returns were to the tune of Rs.28875/- at current prices. Similarly found in (Dwivedi, *et al*., 2007) [2] in western Uttar Pradesh the B: C ratio has been found higher (3.00) for poplar based agrisilvicultural than poplar (2.84) and eucalyptus (2.68) based bund system by the farmers. Neupane and Thapa (2001) [5] indicated that the BCR for the improved agroforestry-based farming system (2.5) was considerably higher than that for the conventional system (1.8).

Table 2: Cost-benefit analysis of Ghamhar based agrisilviculture system

Particulars	Value / amount (Rs/ha)
Input cost for trees	12250
Input cost for crops	85000
Total Costs	97250
Return from trees	201000
Return from crops	185000
Total returns	386000
Net returns for the rotation	288750
Annual average net return	28875
B:C ratio (discounted at 10 %)	2.96

Mango based Agrihorticulture System

The system wise economic analysis of agroforestry considering the rotation period, cropping pattern and the actual number of farmers who have the produce in the past ten years was done for the agrihorticulture systems separately for the major tree species. Mango based systems with the average population maintained per ha, the B: C was worked out. The costs benefit analysis of agrihorticulture system of mango plantation with 20 year rotation in Table 3. The cropping pattern considered for the system was Ginger, Chilly, Kacchu,

Brinjal, Pea and Tomato. It may be noted that the B:C (discounted at 10 %) worked out to 2.00. The average annual net returns were to the tune of Rs.23050/- at current prices. Anjulo (2009) [1] studied the apple based agroforestry in Kullu district of Himachal Pradesh, the average cost of cultivation of apple was Rs. 3,88,850.70 ha^{-1} and the average net benefit from the orchard by selling fruit was Rs. 10,45,523 ha^{-1}.

Table 3: Cost-benefit analysis of Mango based agrihorticulture system

Particulars	Value / amount (Rs/ha)
Input cost for trees	44000
Input cost for crops	79000
Total Costs	123000
Return from trees	173000
Return from crops	172500
Total returns	345500
Net returns for the rotation	230500
Annual average net return	23050
B:C ratio (discounted at 10 %)	2.00

Shisham based Silvipastoral System

The system wise economic analysis of agroforestry considering the rotation period, cropping pattern and the actual number of farmers who have the produce in the past ten years was done for the silvipastoral systems separately for the major tree species. Shisham based systems with the average population maintained per ha, the B: C was worked out. The costs benefit analysis of silvipastoral system of Shisham plantation with 20 year rotation in Table 4. The cropping pattern considered for the system was *Cynodon dactylon* and *Cyperus scariosus.* It may be noted that the B:C (discounted at 10 %) worked out to 2.44.The average annual net returns were to the tune of Rs.6655/- at current prices. Pandit and Bhattarai (2014) [6] observed high income benefit is mainly associated with introduction of various fodder trees and grasses Nepalese hills. In Indonesia economically complex buffer zone agroforests provide farmers sustainable animal fodder (Retnowati, 2003) [8].

Table 4: Cost-benefit analysis of Shisham based Silvipastoral System

Particulars	Value / amount (Rs/ha)
Input cost for trees	12250
Input cost for crops	15000
Total Costs	27250
Return from trees	58800
Return from crops	35000
Total returns	93800
Net returns for the rotation	66550
Annual average net return	6655
B:C ratio (discounted at 10 %)	2.44

Teak based Home garden System

The system wise economic analysis of agroforestry considering the rotation period, cropping pattern and the actual number of farmers who have the produce in the past ten years was done for the Homegarden systems separately for the major tree species. Teak based systems with the average population maintained per ha, the B: C was worked out. The costs benefit analysis of Homegarden system of Teak plantation with 20 year rotation in Table 5. The cropping pattern considered for the system was Chilly, Mustard, Potato, Pea, Ginger, Tomato, Onion, Brinjal and Maize. It may be noted that the B: C (discounted at 10 %) worked out to 3.047. The average annual net returns were to the tune of Rs.27520/- at current prices.

Table 5: Cost-benefit analysis of Teak based Homegarden System

Particulars	Value / amount (Rs/ha)
Input cost for trees	14000
Input cost for crops	75500
Total Costs	89500
Return from trees	234000
Return from crops	130700
Total returns	364700
Net returns for the rotation	275200
Annual average net return	27520
B: C ratio (discounted at 10 %)	3.07

Conclusion

There is a great scope for developing different agroforestry system in the Lohardaga district. By the proper implementation of agroforestry practices with proper tree-crop combination the people of study area can improve their livelihood and socioeconomic status. There are some of the major problems is lack of agroforestry knowledge about agroforestry. Beside this, many educated and skilled farmers are planting trees inside and outside their farm and practicing different Agroforestry practices like agrisilviculture, agrihorticulture, silvopastural and homegarden and getting optimum production and also improving their soil fertility. They also fulfilling their basic requirements from Agroforestry practices like food, fodder, and fuel etc. and also getting extra benefit or income.

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