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Impact of Agroforestry Practices on Livelihood Improvement of Farmers in Ichak Block of Hazaribagh District, Jharkhand, India

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A B S T R A C T

In Ichak block of Hazaribagh district farmers are adopting different land use practices (viz. agriculture and agroforestry systems) on their land. The present investigation was conducted to identify the existing agroforestry practices and livelihood status of farmers. For conducting the study a total of 160 households from four panchayats and eight villages (two villages from each panchayat) were selected through multistage random sampling. Data were collected through survey and by interview of head of the household on pre-tested and pre-structured questionnaire as well as group discussions with villagers. The results revealed that majority of households (98.12%) were headed by male member having age between 40-60 years. All the respondents practice different type of agroforestry practices on their farm. About 80 percent household practices agroforestry on 0.5 to 1.0 acre size of farm land. The prevalent existing agroforestry practices in the area were found to be Homestead (84.38%), Trees on Field Bunds (8.12%), and Silvipasture (7.50%). 25.00 % household had maximum monthly income ranged between Rs. 9001-11000 followed by 16.87 % of more than Rs. 11000 and Rs.1001-3000. Therefore, the rural people should make some strategy for the implementation of agroforestry model with suitable combination of trees and field crops.

Introduction

Agroforestry have two main objectives: first, to increase the efficiency of the use of rural resources by reducing or eliminating ecologically destructive land-use practices and by introducing new or improved agroforestry enterprises in order to produce sustainable increases in incomes and living standards, and second, to provide for social equity (Mercer, 1993). Agroforestry is combination of trees and shrubs with crops and/or livestock which can result in elevated income of rural people and forest production along with conserving natural resources (Molua, 2005). Agroforestry can act as a solution to address low land productivity and soil erosion. Economic benefits and helping farmers to meet their food requirements are of the most important and positive social and economic aspects of this intensive land management system (Saxena, 1994; Thapa and Weber, 1994). Rural families' livelihood strategies encompass multiple objectives in

maximization of land utilization, like secure provision of food and subsistence goods, cash for purchase of goods and services and savings for future needs (Scher, 1995). Households choose a mix of activities that contributes most towards their multiple objectives and yields greatest utility. Agroforestry is as old as agriculture itself. Many of the anecdotal agroforestry practices, which are time tested and evolved through traditional indigenous knowledge, are still being followed in different agro-ecological zones. The traditional knowledge and the underlying ecological principles concerning indigenous agroforestry systems around the world have been successfully used in designing the improved systems. The global community has to recognize the potential benefit of many underexploited systems to address the most intractable land-management problems, such as food and nutrient security, climate change mitigation and adaptation, biodiversity conservation, and rehabilitation of degraded ecosystems. As we move forward to vigorously exploit these potential benefits, we will witness the involvement of agroforestry and its progress for solving these problems and be able to ensure food and environmental security at global level (Dagar, 2016). Agroforestry, which is the inclusion of woody perennials in farming systems, 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).

Materials and Methods

The experiment was conducted at Ichak block of Hazaribagh district of Jharkhand which is lies between 85°22'E longitude and 23°21'N latitude in agro climatic zone IV. The selection criteria for study of villages were their geographical distribution under districts and presence of agroforestry in that area using random sampling. The study was observed through household survey with the help of questionnaire, house hold interviews, focus group discussions and participatory rural assessment using random sampling technique. Data collection on socio-economic status, land use characteristics, resources/supporting services, general awareness and participation with respect to various agroforestry activities. Thus, 160 random selected households in the villages were surveyed to determine gender, cast, literacy, average land holding size, area under different land uses, trees, shrubs and crops used for various purposes and income generation.

Results and Discussion

Details of the household

The details of the household study area are shown in Table 1. Perusal of the table indicated that 98.12 % male and 1.88 % of female respondents was found in area. According to (Rocheleau, 1985 and Thakur *et al.,* 2018) family composition affects both household and individual needs and priorities for agroforestry interventions. Kamanaga (1998) suggested that gender of household's headship may influence the accessibility to farm resources. The maximum number of household found in 40-50 age profile 39.38 % followed by 50-60 age class 35.00 % and minimum were 20-30 age class 1.25 %. Varied relationship between age of the farmers and innovation adoptions has been reported by (Rogers and Svenning 1969, Glover *et al.,* 2013) commented that younger farmers accept change and adopt innovations more readily compared to older farmers. The caste of the study area was maximum found in OBC 88.12 % followed by SC 10.00 % and minimum in GEN 0.62 %. Maximum 31.88 % of Literacy

found in high school followed by no school 22.50 % and minimum were found in Intermediate13.75 %. Farmers with lower education levels are considered to be low adopters and risk averse. (Rogers and Svenning, 1969; Himshikha, 2016) asserted that the education level decreases from innovators to late adopters, and persons with a higher level of education are supposedly more capable of understanding the innovation. Korsching *et al.,* (1983) showed that education relates directly to innovation. The higher the level of education the more likely landowners are to be interested in adopting new practices like agroforestry. Older farmers are viewed as less flexible, more risk averse, and less willing to engage in innovative farm technology (Thacher *et al*., 1997). The farm experience and education (both formal education and informal training) of the farmer are important characteristics that influence decisions made in farm tree growing (Adesina and Chianu, 2002). Aturamu and Daramola (2003) reported that adoption of agroforestry increased with the rise in level of farmer education. Dorr (2006) found impact of education level significant in silvopasture and not significant in windbreaks, alley cropping, riparian buffers and forest farming. Maximum 98.12 % of household found in Hindu community followed by 1.88 % of Muslim community (Himshikha, 2016; Thakur *et al.,* 2018). In primary occupation maximum 88.75 % of households doing farming work followed by 6.25 % doing private job and minimum were 0.62 % doing construction worker. In secondary occupation maximum 31.88 % of households doing stone crushing followed by 28.75 % doing agricultural labour and minimum were 1.88 % doing Poultry. According to Kumar *et al.,* (2018) almost all households (99.17%) were engaged in farming as a primary occupation and 38.33% as agricultural labour and 26.67% in construction works and only 14.17% were engaged in private job in Gumla district of Jharkhand.

Total land holding details of households (in ha)

Total land holding of the households (in ha) is shown in Table 2. Perusal of data showed that maximum 25% of people had 2.1 – 2.5 ha followed by 23.12% of people had 1.51 -2.0, ha and minimum 4.37% had 3.1-3.50 ha land. Nahar (2009) studied on agroforestry and observed that the average size of the homestead in the study area was 0.12 ha which increased with the increased of farm size. The trade-off between agricultural production and tree growth is an important factor in the farmers' allocation of family land and labour. The positive effect of landholding size on farm level tree growing has been reported by Salam *et al.,* (2000) in Bangladesh and Dwivedi *et al.,* (2009) in India. They argued that when land becomes scarce, the overriding need to produce food takes precedence over the long-term value of trees thereby implying a decreasing likelihood of growing trees with decreasing size of landholding. The present finding is in line with the findings of (Kumar *et al.,* 2017; Singh and Oraon, 2017; Thakur *et al.,* 2018; Lakra *et al.,* 2018).

Land use practices

Different type of land use practices doing in the study area like agroforestry, bamboo, horticulture, agriculture is shown in Table 3. The data indicated that maximum 80 % of households doing agroforestry in 0.5 to 1 acre land where as 77.50 %, of household grow bamboo in less than 0.5 acre land. The horticulture crop grows maximum 68.75 % households in the area of 0.5 -1.0 acre lands where as 40 % of household doing agriculture 1.1-2.0 acre lands. The similar finding is in the studies of Kumar *et al.,* (2017) and Thakur *et al.,* (2018) conducted in Gumla, and Giridih district of Jharkhand.

Existing agroforestry modules in the village

The existing modules in the village are shown in Table 4. The data showed that silvi-pasture system, bund plantation and home garden agroforestry systems was found in the study area. The data showed that 84.37% respondents were practicing home gardening system followed by 8.12% trees on field bunds and 7.50% on silvipasture system. Dagar (2016) reviewed research developments in agroforestry during past four decades. He stated that the tress that are grown in agricultural fields or on fields bunds are also often and usually grown on farm boundaries. Pathak *et al.,* (2014) and Korwar et al., (2014) have also dealt in detail the plantations on bunds for Rain-fed areas and Indo-gigantic plains of India.

Total number of livestock

Perusal of data indicated that maximum 90.62 % of households have bullock followed by 78.12 % cow and minimum were 0.62 % of duck and improved breed Table 5. Livestock contribute significantly to the household income of small-scale homegardens in many developing countries, while fulfilling many social and cultural needs (Wilson, 1995).

Livestock utility

The livestock utility such as manure, draft power, milk and meat are shown in Table 6. Perusal of data showed that 100% respondent's uses manure and draft power followed by 88.12 % of milk and minimum were 21.88 % of meat.

Monthly income from livestock is shown in Table 6. Perusal of table showed that the maximum monthly income was found maximum in 30.62 % of 501-1000 followed by 20.62 % of <100 and minimum were 1.25 % of 2501-3000. In some of the very small gardens, where land is a constraint to production, livestock are sometimes the main income generators, serving as cash buffers and capital reserves (Devendra and Thomas, 2002) and also contributing to the nutrient cycling in the system (Thorne and Tanner, 2002).

Component distribution in different agroforestry system

The component distribution in different agroforestry system and in Ichak block is presented in Table 7. The data has indicated that the tree species and agricultural crops combination reflects the different in agroforestry system. In trees on field Bunds system the tree species were *Gmelina arborea* (Gamhar), *Dalbergia sissoo* (Sissoo), *Swietenia mahagoni* (Mhagoni), *Madhuka indica* (Mahua), *Tectona grandis* (Teak), *Syzygium cumini* (Jamun), *Ziziphus mauritiana* (Ber), *Mangifera indica* (Mango) and *Artocarpus heterophyllus* (Kathal) where as agriculture species were *Solanum melongena* (Brinjal), *Solamum tuberosum* (Potato), *Lycopersicon esculentum* (Tomato), Zingiber *officinale* (Ginger), *Phaseolus vulgaris* (Bean), *Brassica oleracea capitata* (Cabbage), *Brassica oleracea appetite* (Cauliflower), *Capsicum annuum* (Chilly) *Triticum aestivum* (Wheat), *Oryza sativa* (Paddy), *Brassica nigra* (Mustard) and *Zea mays* (Maize). In Silvipastoral system tree species were *Dalbergia sissoo* and *Ziziphus mauritiana*, where as grasses species were *Cynodon* dactylon and Cyperus *scariosus* (Grasses). In Homegarden system tree species were *Gmelina arborea*, *Tectona grandis, Mangifera indica Moringa oleifera*, *Psidium guajava* and *Artocarpus heterophyllus* where as agriculture species were *Solanum melongena*, *Solamum tuberosum*, *Lycopersicon esculentum, Brassica oleracea appetite, Phaseolus vulgaris* and *Capsicum annuum.* Similarly, Hemrom and Nema (2015) the different agroforestry system perform by

the people existing in Baster region are agrisilviculture with combination of tree like *Shorea robusta, Tectona grandis, Acacia spp.* etc. in agrisilvopastural with combination crop with tree like *Albizia Spp., Leucaena leucocephala, Ficus racemosa* etc. In agrihoritsilvcultural practices with many fruit trees and multipurpose trees like *Cocos nucifera, Caraya papaya, Musa acuminate, Mangifera indica, Anacardium ocidentale, Embellica officinalis* etc. and in homegarden species like Dalbergia latifolia, *Mangifera indica, Moringa oleifera, Leucaena leucocephala, Artocarpus heterophyllus, Anacardium occidentale* etc. In Manipur, under different agroforestry practices the agriculture crops like *zea mays, Cajanas cajan, Vigna* ungulcuate are grown with fodder grasses *Pemphis purpureum, Teosinte changing* etc, and the tree species are *Parkia roxburghii, Litsea polyantha, Alnus nepalensis, Albizia lebbeck, Artocarpus,* Ficus etc, (Singh *et al.*1996).

Table.1 Details of the Household

Details of the Household		Total (N=120)	(%)
Gender	Male	157	98.12
	Female	03	1.88
Age Profile	20-30	02	1.25
	30-40	19	11.88
	40-50	63	39.38
	50-60	56	35.00
	Above 60	20	12.50
Caste	GEN	01	00.62
	OBC	141	88.12
	SC	16	10.00
	ST	2	1.25
Literacy	No Schooling	36	22.50
	Elementary	27	16.88
	High School	51	31.88
	Intermediate	22	13.75
	College	24	15.00
Religion	Hindu	157	98.12
	Muslim	3	1.88
Primary occupation	**Farming**	**142**	**88.75**
	Constructionb Worker	**01**	**00.62**
	Stone Crushing	**02**	**01.25**
	Private Job	**10**	**06.25**
	Government job	**05**	**03.12**
Secondary occupation	Agri Labour	46	28.75
	Poultry	03	01.88
	Non Farm (Wage Carrier)	40	25.00
	Stone Crushing	51	31.88
	Private Job	20	12.50

Table.2 Total Land holding details of Households (in ha)

Sl. No.	Total Land holding details of Households (in ha)	Total N=160	%
1	>0.50	16	10.00
2	0.51 -1.0	14	08.75
3	1.1 – 1.50	28	17.50
4	1.51 -2.0	37	23.12
5	2.1- 2.50	40	25.00
6	2.51 – 3.0	09	05.62
7	3.1 – 3.50	07	04.37
8	3.51 – 4.0	09	05.62
Figure in parentheses indicate percentage of the respective parameters			

Table.3 Land use practices

Land use practices in (Acre)	Total	% N=160
Agroforestry		
< 0.5	32	20.00
0.5 – 1	128	80.00
Bamboo		
< 0.5	124	77.50
0.5 – 1	36	22.50
Horticulture		
< 0.5	31	19.38
0.5 – 1.0	110	68.75
1.5 – 2	16	10.00
2.5 – 3	03	01.88
Agriculture		
0.1-1.0	37	23.13
1.1-2.0	64	40.00
2.1-4.0	55	34.38
4.0<	04	2.50

Table.4 Existing agroforestry modules in the village

Sl. No.	Existing modules agroforestry in the village	Total N=160	%
1	Silvipasture system	12	07.50
2	Trees on Field Bunds	13	8.12
3	Home gardening	135	84.37

Table.5 Total number of livestock

Livestock utility	Total number of Livestock	Total (N=160)	%
Bullock	1 -2	145#	90.62
Cow	1 – 5	125#	78.12
	Above 5	06#	03.75
Buffalo	1 - 5	08#	05.00
She buffalo	1 - 6	28#	17.50
Goats	1 – 4	19#	11.88
	Above 5	10#	06.00
Poultry	1 – 5	11#	06.88
Pig	1 -5	03#	01.88
Duck	1 – 5	01#	00.62
Improved breed	1 -2	01#	00.62
#Multiple answer			

Table.6 Livestock Utilities and Monthly income from livestock

Sl. No.	Livestock utility	Total (N=160)	%
1	Manure	160#	100.00
2	Draft power	160#	100.00
3	Milk	141#	88.12
4	Meat	35#	21.88
#Multiple answer			
Sl No.	**Monthly income livestock utility**	**Total (N=160)**	**%**
1	<100	33	20.62
2	100 – 500	25	15.62
3	501 – 1000	49	30.62
4	1001 - 1500	19	11.88
5	1501 – 2000	19	11.88
6	2001 – 2500	13	08.12
7	2501 - 3000	02	01.25

Table.7 Component distribution in different agroforestry system

Agroforestry system	Tree species	Agricultural crop	Grasses
Trees on Field Bunds	*Gmelina arborea, Dalbergia sissoo, Swietenia mahagoni, Madhuka indica and Tectona grandis, Syzygium cumini, Ziziphus mauritiana, Mangifera indica and Artocarpus heterophyllus*	*Zea mays, Solanum melongena, Solamum tuberosum, Lycopersicon esculentum, Zingiber officinale, Phaseolus vulgaris, Brassica oleracea capitata, Brassica oleracea appetite, Brassica oleracea appetite, Capsicum annuum, and Lycopersicon esculentum, Triticum aestivum, Oryza sativa and Brassica nigra*	
Silvipastoral system	*Dalbergia sissoo and Ziziphus mauritiana*		*Cynodon dactylon*
Homegarden system	*Gmelina arborea, Tectona grandis, Mangifera indica, Moringa oleifera, Psidium guajava and Artocarpus heterophyllus*	*Solanum melongena, Solamum tuberosum, Lycopersicon esculentum and Capsicum annuum, Brassica oleracea appetite, Phaseolus vulgaris*	

Table.8 Monthly income of household

Sl No.	Monthly income	Total (N=160)	%
1	**Below 1000**	**02**	**01.25**
2	**1001-3000**	**27**	**16.87**
3	**3001-5000**	**21**	**13.12**
4	**5001- 7000**	**22**	**13.75**
5	**7001-9000**	**23**	**14.37**
6	**9001-11000**	**40**	**25.00**
7	**> 11000**	**25**	**16.87**

The people of Kumharia village of Ranchi district are adopting agrisilviculture practices with tree components included Eucalyptus, Subabul, Ghmhar, Shisham and Chakundi whereas Kurthi and Sarguja as agriculture crops. In Silvipastoral system the tree species are Akashi, and Ghmhar along with the indigenous grass species such as Kher and Dub grasses. In homegarden the tree species planted were Eucalyptus, Bakain and Ghmhar along with vegetables crops such as Potato, Caoliflower, Pea, Tomato and Cabbage (Oraon *et al.,* 2005) and in Mandi district the agrosilvicultural, agrosilvihorticultural, silvipastoral, agrohortisilvicultural, hortiagricultural, and hortisilvicultural systems found in traditional agroforestry (Sood, 2006). Similar observation find in

Singh *et al.,* 2017, Kumar *et al.,* 2017, Lakra *et al.,* 2018.

Monthly income of household

Monthly income of households from agroforestry system, vegetable production, livestock and other source are shown in Table 8. The maximum monthly income 25.00 % of 9001-11000 followed by 16.87 % of more than 11000 and 1001-3000 and minimum were in 1.25 % of below 1000 of households. Fregene (2007) found on-farm monetary benefit to be positively and significantly associated with agroforestry adoption. It was observed that respondents that have achieved on-farm monetary benefits of agroforestry were five times more likely to adopt agroforestry. Examined adoption of traditional agroforestry in relation to economic and farming conditions of households and found increased agroforestry adoption among households with higher off-farm, agricultural, and total incomes (Sood 2006).

In conclusion agroforestry can improve the status of the farmers with appropriate tree-crop combination in the study area and they can get better their livelihood and socioeconomic status. Medium land size is the most dominating land holding types followed by small type of landholding size. The farmers reported that they practice agroforestry to get food, fuel wood, fodder and fruit for family consumption and maximizing the income. Therefore, it suggests for considered extension of agroforestry for overall socio-economic development of the farmers and nature of agroforestry for future efforts should be directed at participating on-farm research.

References

Adesina., A.A. and Chianu, J. (2002). Determinants of farmers‟ adoption and adaptation of alley farming technology in Nigeria. *Agroforestry Systems*, 55: 99-112.

Aturamu, O. A. and Daramola, A.G. (2003). An economic analysis of the adoption of agroforestry based technologies in Oyo state Nigeria.

Dagar, J. C. and Tewari, J. C. (2016). Agroforestry research developments: anecdotal to modern science. In: Agroforestry Research Development. Nova Publishers, New York. pp. 1-45

Devendra, C. and Thomas, T. (2002). Crop-animal systems in Asia: Importance of livestock and characterization of agro-ecological zones. *Agricultural Systems* 71: 5-15.

Dorr, H.R. (2006). “Non Operator and Farm Operator Landowners Interest in Agroforestry in Missouri.” Thesis Presented to the Faculty of the Graduate School, University of Missouri.

Dwivedi, P., C. S. Rathore and Dubey, Y. (2009). Ecological benefits of urban forestry: The case of Kerwa Forest Area (KFA), Bhopal, India. Applied Geography, 29(2): 194-200.

Fregene, E.O. (2007). Policy and program incentives and the adoption of agroforestry in Missouri. M.Sc. Thesis, Faculty of the Graduate School, University of Missouri-Columbia, 95p

FSI (2011). India State of Forest Report, Forest Survey of India, Govt. of India, Dehradun, India.

Glover E. K, Ahmed H. B and Glover M. K. (2013).Analysis of socioeconomic conditions influencing adoption of agroforestry practices. International Journal of Agriculture and Forestry. 3(4):178-184.

Hemrom, A. and Nema, S. (2015). A study on traditional agroforestry practices existing at Bastar region of

Chhattisgarh. *International Journal of Multidisciplinary Research and Development*, 2(3):56-64.

Himshikha. (2016). Assessment of socioeconomic status of agroforestry farmers in Haridwar, Uttarakhand International Journal of Farm Sciences. 2016; 6(4):87-94

Kamanga, B.C.G., (1998). Impact of existing and introduced soil management technologies on smallholder food production. M.Sc Thesis, Bunda College, University of Malawai.

Korsching, P. F., Stofferahn, C.W., Nowak, P.J. and Wagener, D.J. (1983). "Adopter Characteristics and Adoption Patterns of Minimum Tillage: Implications for Soil Conservation Programs." *Journal of Soil and Water Conservation*, 38: 428-431.

Korwar, G.R., Prasad, J.V.N.S., Rajeshwara Rao, G., Venkatesh, G., Pratibha, G., and Venkatesheshwarlu, B. (2014) Agroforestry as a strategy for livelihood security in the rainfed areas: Experiences. In: *Agroforestry Systems in India: livelihood security & Ecosystem services, Advances in Agroforestry 10* (eds. J.C. Dagar, A.K. Singh and A. Arunchalam). Springer. Pp. 117-154

Kumar, A., Sah, R. B., Singh, B. K. and Oraon, P. R. (2017). Tree Species Preferences on Agroforestry Practices in Bishunpur Block of Gumla District, Jharkhand. *Trends in Biosciences* 10(40), 8508-8516

Kumar, A., Sah, R. B., Singh, B. K. and Oraon, P. R. (2018). Socioeconomic Analysis of Tribal Farmers in the Gumla District of Jharkhand from Existing Agroforestry Practices *Int. J.Curr.Microbiol. App.Sci* (2018) *7*(6): 595-604

Lakra, T, S., Siddiqui, M. H. Chakraborty, A.K., Oraon, P. R. and Malik, M. S. (2018). Agroforestry Practices Followed in West Singhbhum District, Jharkhand. *Trends in Biosciences*, 11(4): pp 400-406

Mercer D.E (1993) A framework for analyzing the socioeconomic impacts of agroforcstry projects. Southeastern Center for Forest Economics Research, Research Triangle Park, NC.FPEI Working Paper No. 52, 34 pp

Molua EL., (2005). The economics of tropical agroforestry systems: the case of agroforestry farms in Cameroon. For Policy Econ 7(2):199–211

Nahar, N. (2009). Studies on homestead agroforestry and its impact on the socioeconomic conditions of the selected farmers in the Kashiani upazila of Gopalgonj District, Department of agroforestry B.A.U. Mymensingh

Oraon. P. R., Yadav, M. S. and Siddiqui, M. H. (2005). Comparative performance of Agroforestry in Kumharia Village of Ranchi District. *Indian Journal of Agroforestry*. Vol. 7 No. 2: pp 19 -24

Pathak, P.S., Dagar, J.C., Kaushal, R. and Chaturvedi, O.P. (2014) Agroforestry inroads from the traditional two-crop systems in heartlands of the Indo-Gangetic *plains In: agroforestry Systems in India: Livelihood Security and Ecosystems Services*. *Advances in Agroforestry*, Vol. 12 (eds. J.C Dordrecht. Pp. 87-116

Rocheleau, D.E. (1985). Land use planning with rural farm households and communities: participatory agroforestry research. Working Paoper No. 36, ICRAF, Kenya: 46p

Rogers, E. M. and Svenning, L. (1969). Modernisation Amongst Peasants, The Impact of Communication, Holt, Rinehart and Winston, New York and

London.

Salam, M. A., Noguchi, T., Moike, M. (2000). Understanding why farmers plant trees in the homestead agroforestry in Bangladesh. *Agroforestry Systems*, 50: 77-93.

Saxena, S.K (1994). Traditional agroforestry systems in agroecological zones of western Rajasthan. Annals of Arid Zone 33(4): 279–285

Scherr, S. J. (1995). Economic Factors in Farmer Adoption of Agroforestry: Patterns Observed in Western Kenya. *World Development* 23(5): 787–804.

Singh B. K. and Oraon, P. R. (2017). Growth and Yield of Trees and Intercrops under Different Agroforestry System in Lohardga District of Jharkhand, *Bull. Env. Pharmacol. Life Sci.*, Vol 6 (12) November: 53-58

Singh, B. K., Oraon, P. R., Kumar, A. and Malik, M. S. (2017). Traditional Agroforestry practices existing at Lohardaga District of Jharkhand. *Trends in Bioscience*.10 (23): 4651-4654.

Singh, R.; Simte, L. L. and Singh, T. H. R. (1996). Existing Agroforestry systems and practice in Manipur. *Indian Forester*, 122 (7):598-600.

Sood K.K. (2006). The influence of household economics and farming aspects on adoption of traditional agroforestry in Western Himalaya. *Mountain Research and Development*, 26(2):124-130.

Thacher T., Lee, D. and Schellas J. (1997). Farmer Participation in reforestation incentive programs in Costa Rica. *Agroforest Systems.*

Thorne, P. J. and Tanner, J.C. (2002). Livestock and nutrient cycling in crop-animal systems in Asia. *Agricultural Systems* 71: 11-126.

Thakur, P. K., Malik, M. S., Singh, B. K. and Oraon P. R (2018). Assessment of socioeconomic status of agroforestry farmers in Giridih District, Jharkhand Journal of *Pharmacognosy and Phytochemistry* SP1: 929-932

Thapa, G. B. and Karl Weber (1994). Prospects of Private Forestry around Urban Centers a study in upland Nepal. *Environmental Conservation* 2(4): 297–307

Wilson, R.T. (1995). *Livestock Production Systems*. ICTA, Macmillan, UK.

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