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Study of *Acacia auriculiformis* based agroforestry practices in coastal district of Bhadrak, Odisha

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Abstract
The present investigation was carried out on *Acacia auriculiformis* based agroforestry practices in 15 different treatments (0.2,0.4,0.6,0.8,1.0,1.2,1.4, 1.6,1.8,2.0,2.2,2.4,2.6, 2.8, and 3.0 acres of land) in coastal district of Bhadrak, Odisha during 2014 – 2015. It was observed that in *Acacia auriculiformis* based Agroforestry practices the no. of intercrops increased from 4 to 7 nos., no. of trees increased from 15 to 260 nos. in 10-15 m. height class when land holding increased from 0.2 acre to 3.0 acre. Acacia plants were raised in a regular manner with proper layout and design in which non woody components cultivated. *Acacia auriculiformis* based agroforestry systems are also complementary to other crop production enterprises, as they provide green manure, fodder, and fuel. The species was valued also for its timber and high quality chemical pulp and as a profitable land use option.

Keywords: Agroforestry, Floral composition, Stratification

1. Introduction
Agroforestry system of land use is rapidly gaining importance in the recent years for meeting the dual objectives of achieving food security and environmental sustainability. Agroforestry is the judicious integration of woody perennials with crops and/or animals on the same unit of land for meeting the multiple need of the community like food, fodder, fire wood, timber and other ancillary benefits. It has been evolved along with the development of human civilization and continues to play a vital role in maintaining the sustainability of rural livelihoods through indigenous agroforestry systems such as home gardens, scattered trees on farm lands or field bunds and fodder trees for green fencing etc which offer a wide range of goods and services and insulate them from the climatic uncertainties. In Odisha diverse traditional agroforestry systems exist in different areas. i.e. in the drought prone western parts *Acacia nilotica and Butea monosperma* based farm forestry, in the central inland districts *Madhuca latifolia* and *Scleichera oleosa* based agroforestry, in the coastal areas tree species like Palms, *Albizia lebek, Gmelina arborea, Pongamia pinnata, Erythrina indica, Samanea saman, Terminalia spp, Bambusa strictus* etc are maintained by the farmers along with their agricultural crops. Generally the backyard home gardens are multi-tier systems characterized by a high density and diversity of plant species consisting of trees/ palms, shrubs, climbers and seasonal crops that meet the multifarious need of the rural households from small piece of land. However, over the years these traditional agroforestry systems are rapidly disappearing in all the eco-systems in general and coastal environment in particular due to high population pressure and subsequent land fragmentation and diversion of land for habitat purpose. It has now been well recognized that agroforestry can address some of the major land –use problems of rainfed farming systems in Bhadrak and that can be modified by improving the indigenous systems. These practices need to be further improved with suitable technological interventions considering need of the local people so that socio-economic status of the farming community will be increased.

There has been a growing realization of the benefits of tree crop integration systems in the coastal areas and since 1980s there is a widespread interest in planting of a species of Acacias that is native to Australia in the home garden, farm boundaries and permanent fallows. Agroforestry models adopted by farmers in coastal district of Odisha are highly lucrative thus attracting farmers in a big way. In these areas *Acacia auriculiformis* planted on agricultural fields and field boundaries is harvested at 10 to 12 years, and the average economic return of *Acacia auriculiformis* based agroforestry systems are high compared to that of sole agriculture crop. In spite of multiple benefits from agroforestry practices, majority of farmers have been hesitant to adopt these systems on large scale primarily because of certain apprehensions about the tree component such as long rotation, reduction in gross area of crop etc.

With this background, present investigation was an attempt to assess the condition and effect acacia based agroforestry system in Bhadrak district of Odisha.

2. Materials and Methods

The experiment was carried out in a randomized block design (RBD) with three replications. For this the district was divided into three regions, each region represented one replication. The region- I covered the Northern part of the Bhadrak district comprising two blocks, the region –II covered the central part of the district comprising 3 blocks and the region - III covered the southern part of the district comprising 2 blocks. In each region 15 different sizes of Acacia based Agroforestry practices were studied. The 15 treatments studied were: T_1- improved Agroforestry System of 0.2 acre, T_2- improved Agroforestry System of 0.4 acre, T_3- improved Agroforestry System of 0.6 acre, T_4- improved Agroforestry System of 0.8 acre, T_5- improved Agroforestry System of 1.0 acre, T_6- improved Agroforestry System of 1.2acre, T_7- improved Agroforestry System of 1.4 acre acre, T_8- improved Agroforestry System of 1.6 acre, T_9- improved Agroforestry System of 1.8 acre, T_{10}- improved Agroforestry System of 2.0 acre, T_{11}- improved Agroforestry System of 2.2 acre, T_{12}- improved Agroforestry System of 2.4 acre, $T1_3$- improved Agroforestry System of 2.6 acre, T_{14}-improved Agroforestry System of 2.8 acre, T_{15}-improved Agroforestry System of 3.0 acre. The study areas were selected first on the revenue map on the basis of their central location in each region(replication). From each replication 45 sample plots were selected (3 for each treatment) from four different villages located closely and made into 15 composite samples, one for each treatment. The selected Indigenous and improved agroforestry practices were visited and following observations were recorded- floral Composition, height (different height classes of 0-5m,5m-10m,10m-15m,>15m),diameter(0-5cm,5cm-10cm,10cm-15cm, >15cm), plant species stratification (top story, middle story, lower story and ground story), spatial arrangement of plants (regular and irregular), numbers of trees. The quantitative data on various observations were analysed as per the standard statistical procedure prescribed.

3. Results and Discussion

i. Floral Composition

The floral composition in terms of woody component species, non woody component species, total number of trees, total number of non woody component species/ intercrops were studied and presented in Table-2. It was observed that in *Acacia auriculiformis* based Agroforestry practices in 0.2 acre to 3.0 acre the only 1 woody component of *Acacia auriculiformis* and 4 to 7 numbers of non woody components/ intercrops were found. Number of trees gradually increased from minimum of 20 to maximum of 318 with increased land holdings of 0.2 acre to 3.0 acre, respectively. Non woody components of 4 numbers such as Paddy, Pumpkin, Brinjal and Tomato were found in holding sizes of 0.2 acre to 0.6 acre. The additional 2 numbers of intercrop species of Chilly and Okra were found in holdings of 0.8 acre. Again the number of intercrop species increased to 7 numbers (Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra and Potato) from holdings of 1.0 acre to 3.0 acre. The results were similar in findings on study of plantation crop food/forage crop combinations besides plantation of crop food/forage crop combinations in homesteads by Nair and Sreedharan (1986) [4].

ii. Number of trees in different height and diameter classes

The number of tree raised in different sizes of *Acacia auriculiformis* based Agroforestry practices differed significantly in different holdings which were presented in Table-1. No *Acacia auriculiformis* trees were found in height classes of 0-5m height in the study. Number of trees varied significantly in the height class of 5m -10 m. In height class of 5 m – 10 m, no of Acacia trees were 5, 8 and 10 in holdings of 0.2, 0.4 and 0.6 acre respectively. Again same 10 numbers of trees were found in holding sizes of 0.8 acre. From 1.0 to 1.2 acre, number of trees increased to 18 and 20 nos respectively. Number of trees decreased to 15 in each in holdings of 1.4 acre and 1.6 acre. But number of trees were 13, 18, 30 and 26 numbers in holdings of 1.8, 2.0, 2.2 and 3.0 acre respectively. Again the number of Acacia trees increased to 30 and reduced to 26 numbers in holdings of 2.2 acre and 2.4 acre respectively. Maximum number (58) was seen in holding size of 3.0 acre in the height class of 5 m -10 m.

In height class of 10 m-15m number of Acacia plants found were 15, 27, 44, 65, 75, 105, 120, 141, 157, 177, 197 and 219 numbers with increased holding sizes from 0.2 acre to 2.4 acre respectively. Number of plants recorded were 218, 248 and 260 numbers in holdings of 2.6 acre, 2.8 acre and 3.0 acre respectively in height class of 10 m-15m. No Acacia trees were found in height class > 15 m. It was observed that most Acacia trees were found in height class of 10 m- 15 m and number of trees increased with increased holdings from 0.2 acre to 3.0 acre.

All the *Acacia auriculiformis* trees were found in the diameter class of 5 cm -10 cm. No trees were recorded between diameter classes of 0- 5 cm, 10 cm -15 cm and > 15 cm from land holding sizes of 0.2 ac to 3.0 acres. Trees were found in diameter classes of 0-5 cm, which varied from 20, 35, 54, 75 93 125, 135, 156, 170, 195, 227, 245, 260, 295, and 318 nos respectively in holding size of 0.2 to 3.0 acre. Number of trees in diameter class of 5 cm-10 cm increased gradually from minimum 20 to maximum 318 nos in 0.2 acre to 3.0 acre, respectively.

Plants have attained different ranges of height and diameter classes due to competition for light, nutrition and space between the plants. Similar studies have also been reported by Rahman *et al*. (2013) [7], Nair (2008) [5] and Fernades *et al*. (1984).

Table 1: Number of trees in different height and diameter classes in *Acacia auriculiformis* based Agroforestry systems

Treatments	Number of trees in different height and diameter classes										
	Total number of Woody Species	Total number of trees	Total number of Non-Woody species	Height classes				Diameter classes			
				0-5m	5m - 10m	10m-15m	>15m	0-5cm	5cm - 10cm	10cm-15cm	>15cm
1	4	5	6	7	8	9	10		11	12	13
T_1(0.2 acre)	1	20	4	0	5	15	0	0	20	0	0
T_2(0.4 acre)	1	35	4	0	8	27	0	0	35	0	0
T_3(0.6 acre)	1	54	4	0	10	44	0	0	54	0	0
T_4(0.8 acre)	1	75	6	0	10	65	0	0	75	0	0
T_5(1.0 acre)	1	93	7	0	18	75	0	0	93	0	0
T_6(1.2 acre)	1	125	7	0	20	105	0	0	125	0	0
T_7(1.4 acre)	1	135	7	0	15	120	0	0	135	0	0
T_8 (1.6 cre)	1	156	7	0	15	141	0	0	156	0	0
T_9(1.8 acre)	1	170	7	0	13	157	0	0	170	0	0
T_{10}(2.0 acre)	1	195	7	0	18	177	0	0	195	0	0
T_{11}(2.2 acre)	1	227	7	0	30	197	0	0	227	0	0
T_{12}(2.4 acre)	1	245	7	0	26	119	0	0	245	0	0
T_{13}(2.6 acre)	1	260	7	0	42	218	0	0	260	0	0
T_{14}(2.8 acre)	1	295	7	0	47	248	0	0	295	0	0
T_{15}(3.0 acre)	1	318	7	0	58	260	0	0	318	0	0
SE_m (±)	0	13.767	0.320	0	2.274	3.775	0	0	13.827	0	0
$CD_{(0.05)}$	0	18.778	3.691	0	4.284	9.57	0	0	29.59	0	0

iii. Plant Species Stratification

Plant species stratification in different sizes of ***A****cacia auriculiformis* **b**ased improved agroforestry practices are presented in Table-2.It was observed that in 15 sizes of holdings the plants were categorized into 4 strata i.e. more than 10 m, 5-10m, 2-5m and less than 2m height from ground level which can be designed as top storey, middle storey, lower storey and ground cover respectively. In the top (more than 10m) storey more nos of plants were found from minimum of 15 nos to maximum 260 nos in holdings of 0.2 acre to 3.0 acre. In diameter class of top storey no of plants increased with increased holdings expect 218 nos in holding size of 2.6 acre. Similarly fewer no of trees were found in 5 m-10 m height class from minimum number of 5 trees to maximum of 58. Different plants have occupied different strata may be due to their growth rate, light requirement and arrangement made by the grower to intensity the land use systems and explore maximum benefit.Similar studies have also been reported by Rahman *et al.* (2013) [7], Nair (2008) [5], Fernades *et al.* (*1*984) and Panda (2013).

iv. Spatial arrangement

Spatial arrangement of woody component and non woody component species differed from each holdings and presented in Table-2. In *Acacia auriculiformis* based agroforestry systems in 0.2 acre to 3.0 acre holdings, Acacia plants were raised in a regular manner with proper layout and design. Similarly non woody components were planted in regular manner. But in case of paddy it was transplanted in line as well as in irregular manner. woody and non woody components were grown in regular manner. The results are in line with the findings of John and Nair (2002) [3] and Ahmed and Rahman (2004) [1].

Table 2: Plants species stratification and Spatial arrangement of plants in *Acacia auriculiformis* based agroforestry systems

Treatments	Plant species stratification				Spatial arrangement of plants			
	Top storey	Middle storey	Lower storey	Ground storey/ floral composition	Woody component Species		Non-Woody component Species	
	(>10m)	5m -10m	2m -5m	< 2m	Regular	Irregular	Regular	Irregular
1	2	3	4	5	6	7	8	9
T_1(0.2 acre)	15	5	0	Paddy, Pumpkin, Brinjal, Tomato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato	Paddy
T_2(0.4 acre)	27	8	0	Paddy, Pumpkin, Brinjal, Tomato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato	Paddy
T_3(0.6 acre)	44	10	0	Paddy, Pumpkin, Brinjal, Tomato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato	Paddy
T_4(0.8 acre)	65	10	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra	Paddy
T_5(1.0 acre)	75	18	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_6(1.2 acre)	105	20	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_7(1.4 acre)	120	15	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_8 (1.6	141	15	0	Paddy, Pumpkin, Brinjal,	Acacia	0	Paddy, Pumpkin,	Paddy

acre)				Tomato, Chilli, Okra, Potato			Brinjal, Tomato, Chilli, Okra, Potato	
T_9(1.8 acre)	157	13	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_{10}(2.0 acre)	177	18	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_{11}(2.2 acre)	197	30	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_{12}(2.4 acre)	119	26	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_{13}(2.6 acre)	218	42	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_{14}(2.8 acre)	248	47	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Paddy
T_{15}(3.0 acre)	260	58	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	Acacia	0	Paddy, Pumpkin, Brinjal, Tomato, Chilli, Okra, Potato	paddy
SE_m (±)	3.775	2.274						
$CD_{(0.05)}$	9.57	4.284						

4. Conclusion

The major factors for adoption of improved agroforestry was assured income and biodiversity conservation. Over the times **i**ndigenous agroforestry practices, have not been static but rather have been constantly modified by farmers to meet demands of society at each point in time. In recent times however, the loss of soil fertility and biodiversity, frequent occurrence of natural calamities among others threaten the farming communities and leads to commercialization of improved agroforestry practices. *Acacia auriculiformis* based agroforestry practices were comparatively profitable than the indigenous/conventional agroforestry practices in Bhadrak district. The contribution of the trees in the farming systems certainly added to the diversity dimension by way of income and employment to the farm households besides fulfilling the household requirements of farming communities. Both forms of agroforestry practices have specific roles to play in the livelihoods and environmental development, which have to be carefully implemented in rapidly changing scenario.

5. References

1. Ahmed, MFU and Rahman, SML. Profile and use of multi-species tree crops in the homesteads of Gazipur District, Central Bangladesh. Journal of Sustainable Agriculture. 2004; 24(1):81-93.
2. Fernandes ECM, O'kting'ati A, Maghembe J. The Chagga homegardens: A multistoried agroforestry cropping system on Mt. Kilimanjaro, Northern Tanzania. Agroforestry Systems. 1984; 2:73-86.
3. John J, Nair MA. Differences with holding size in the composition of coconut based homesteads of Southern Kerala. Indian Coconut Journal. 2002; 33(5):7-10.
4. Nair MA, Sreedharan C. Agroforestry farming Systems in the Homesteads of Keral, Southern India. Nisha-Arvind. And rakesh, D. 2003. Arecanut and spices in the homestead agro forestry system in Kerala. Indian Journal of Arecanut Spices and medicinal Plants. 1986; 5(1):23-30.
5. Nair PKR. Structure and function of Home gardens. An Introduction to Agroforestry (eds. Nair, PKR). 2008, 91-94.
6. Panda NK. Studies on Structure and Function of Homestead Agroforestry System in Balasore District of Odisha. MSc. Thesis. College of Forestry, OUAT, Bhubaneswar, Odisha, 2013.
7. Rahman SA, Baldauf C, Mollee EM, Al-Pavel MA, Al-mamun MA, Toy MM, *et al*. Cultivated plants in the Diversification Homegardens of Local Communities in Ganges Valley, Bangladesh Science Journal of Agricultural Research and Management. 2013, 6. Article ID sjarm-197.