



Tuber Crops Based Farming System: A Way forward for Livelihood Options of Nicobari Tribes in Andaman & Nicobar Islands

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Abstract

The Nicobari tribal community is generally conservative as far as food resources are concerned. They mainly rely on coconut, tuber crops, pig and marine fisheries for their livelihood. The traditional method of cultivation and utilization of tuber crops by these people have been acquired from their ancestors. They use the virgin land for establishment of coconut plantations and they rarely practice mixed cropping involving coconut, tuber crops, spices and fruit crops due to lack of planting materials and scientific cultivation practices of tuber crops based farming system. Central Island Agricultural Research Institute (CIARI) has made an effort to impart scientific knowledge on tuber crops cultivation and utilization through participatory mode under All India Coordinated Research Project on Tuber Crops for past two years (2014-15 and 2015-16). The model comprises of 300 m² of fenced area in the vicinity of the tribal settlement and integrated with piggery unit at Harminder Bay, Little Andaman. After sensitization program on tuber crops based farming system under Tribal Sub Plan of AICRP on Tuber Crops, the farmers (15 members) were given the planting materials of elephant foot yam, ginger, poultry chicks and piglets. In addition, they also used their own seed tubers of Nicobari Aloo, Colocasia and setts of Cassava for tuber production. From the tuber crop based farming system the tribal farmers have generated an amount of ₹ 9,870 to ₹ 16,678 from crop component and from Pigs they generated approximately ₹ 21,000 to ₹ 66,500. The total income generated from the system ranged from ₹ 30,870 to ₹ 79,018 at Harminder Bay. From this farming system highest B: C ratio was recorded from pig farming (2.69) followed by ginger cultivation (2.11) and in the combination of pig and crops the B:C ratio was (2.36). The intervention has made visible impact like increase in income, livelihood improvement and employment generation of the tribal farmers and hence, more tribal youths have come forward to adopt the tuber crops based farming system as their livelihood options.

Key words: Tuber crops, Andaman and Nicobar Islands, Nicobari Tribes, farming systems

Introduction

The Andaman and Nicobar Islands comprise 572 Islands and Islets which stretch from Burma in North to Sumatra in the South between 6^o and 14^o N Latitudes and 92^o and 94^o E Longitude with a width of about 150 km. The islands are blessed with tropical warm humid climate with the temperature ranging between 18°C to 35°C.

These islands receive the annual average rainfall of 3100 mm from May to December and the relative humidity is usually 65% to 85% depending on the prevailing weather conditions. About 87 % of the total geographic area of Andaman & Nicobar Islands is under forest cover. Out of the total geographical area of 8249 km, only 6 per cent i.e. 50,000 ha at present is under agriculture. The Nicobarese are the dominant tribe among the 7 tribes

living in A&N Islands and their prime source of livelihood is based on plantation crops and fishing. The population of Nicobarese represents about 85 per cent of total tribal population of Andaman & Nicobar Islands (Sankaran *et al.*, 2015). With regard to food crops, they consider tuber crops viz., greater yam, colocasia, tannia, sweet potato and cassava as the staple food and main source of carbohydrate. Rearing pig and back yard poultry are the traditional activities found in the tribal areas. Farming systems research is considered a powerful tool for natural and human resource management in developing countries like India. It is an integrated approach and very effective in solving the problems of small and marginal farmers. It aims at increasing income and employment from small-holdings by integrating various farm enterprises and recycling crop residues and by-products within the farm itself (Singh *et al.*, 2006). The various enterprises that could be included in the farming system are crops, dairy, poultry, goat rearing, piggyery, fishery, agro-forestry, horticulture, mushroom cultivation etc. The sustainability of integrated crop livestock system relies on the complementarities between crop and livestock and the connectedness of livestock to the land (Wilkins, 2008). Intercropping of root and tuber crops with plantation crops is a common practice in these islands especially in small and medium sized land holdings, in order to augment the net income and employment opportunities. In such farms, the produce from the perennials generates cash income, while the starchy root and tubers partially meet the food requirements of the farm family and the feed needs of farm animals (Sankaran *et al.*, 2014). The Nicobari tribes use the virgin land for establishment of tuhet gardens involving mixed cropping. Tuhet is a joint family system where the land is not individually owned but the family holds the land. The Nicobari tribes clear the forest ground cover by cleaning small trees and shrubs in the field for planting crops in their tuhet garden. However, integration of home gardens with allied enterprises involving mainly tuber crops along with pig may provide a possible solution to meet the demand for various food commodities to improve livelihood and nutritional security of the tribal farmers. Hence, the present study was conducted with an objective to increase income, livelihood improvement and employment generation of the tribal farmers through tuber crops based farming system.

Materials and Methods

An effort was made by the ICAR - Central Island Agricultural Research Institute (CIARI), Port Blair to impart scientific knowledge to tribal farmers on tuber crops cultivation and utilization through participatory mode under All India Coordinated Research Project on Tuber Crops during 2014-16 at Harminder Bay, Little Andaman (Fig. 1). An area of 300 m² (0.03 ha) in the vicinity of the tribal settlement was selected, fenced and integrated with piggyery unit. The selected farmers were sensitized about the tuber crops based farming system through trainings. After imparting training, fifteen tribal farmers have adopted tuber crop based farming system in their homesteads. The farmers were supplied with planting materials of elephant foot yam, ginger, colocasia, poultry chicks and piglets. In addition, they also used their own seed tubers of Nicobari Aloo and setts of Cassava for tuber production. Brief description of the selected village is given below in Table 1.

Table 1. Basic details of the selected village

Particulars	Description
Village	Harminder Bay, Hut Bay, Little Andaman
Latitude	10.56 °N
Longitude	92.54 °E
District	South Andaman
Total area	500 ha
Area under coconut	470 ha
No. of tuhets	15
No. of shelters per tuhet	22
Total population	1352
No. of families	350
No. of male	723
No. of female	629
Percent male population	53.5
Percent female population	46.5
Average size of family	4
Average area of tuhet garden	0.44 ha
No. of families per tuhet (joint family)	15.9

The system components are described below:

Tuber crops: Elephant foot Yam (EFY) var. Gajendra, Ginger (var. Jorhat), Sweet Potato (var. CARI-SP 1), Colocasia (var. Local) and Nicobari Aloo (var. Local)

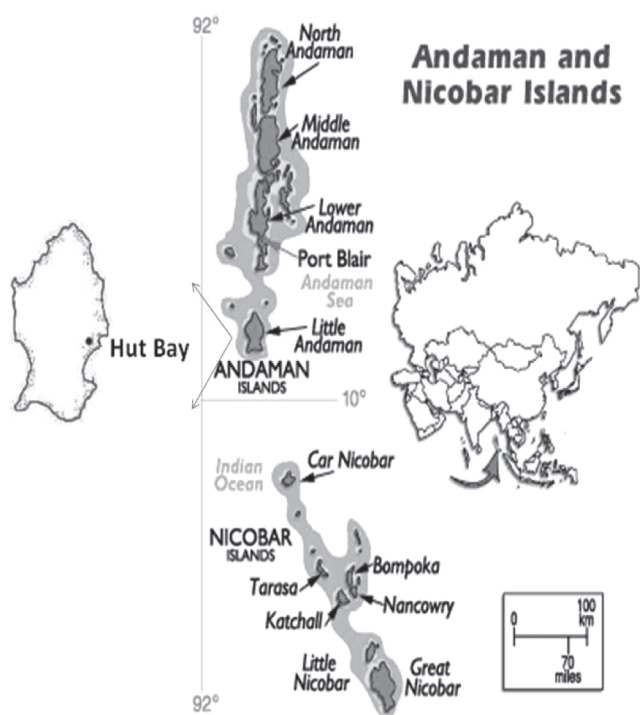


Fig.1. Map showing the study area

Livestock: The livestock component in the present system is Fig (2 to 4 piglets per farmer).

Yield of different crops were recorded at the time of harvest and expressed in kg. The year-wise economic evaluation was done by calculating the gross return, net return and cost of cultivation based upon the prevailing market price of inputs and sale price of commodities.

The Nicobari aloo equivalent yield (NAEY) was calculated by the following formula:

$$\text{NAEY} = \text{Economic yield of crop} \times (\text{Price of crop} / \text{Price of Nicobari aloo})$$

The Production efficiency was calculated by the following formula (Tomar and Tiwari, 1990)

$$\text{Production Efficiency} = \text{Total Nicobari aloo equivalent yield (NAEY)} / \text{Total duration of the crops in the cropping System (days)}$$

The production characteristics of the farmers were descriptively analyzed and described using measures of mean, and percentages, etc.

Results and Discussion

Yield of tuber crops in traditional system vs Tuber crops based farming system

In the traditional system, Nicobari tribes clear the forest ground cover before planting and then plant Nicobari aloo (greater yam) during March- April and allow the vines to trail over the dried branches of the trees and shrubs. They harvest the crop during December - January every year and the harvested produce is distributed among the tuhet (joint family) (Fig.2). However in the tuber crops based farming system, among the different tuber crops, elephant foot yam recorded the highest production of 69.2 kg followed by Colocasia (60.7). This is mainly due to more area under elephant foot yam. Even though the area allocation under elephant foot yam was more (66.7%) as compared to colocasia the yield of colocasia ranged from 45 to 81 kg as the tribes were familiar with colocasia while elephant foot yam was non traditional crop for them and it has been



Fig.2. Traditional System (Tuhet) Vs Tuber crops based farming system

Table 2. Nicobari aloo equivalent yield (0.03 ha) (NAEY) and production efficiency of tuber crops in farmer's field (Mean of two years)

Farmer	Yield of tuber crops (kg)				Nicobari aloo equivalent yield (NAEY) in (kg)				Total NAEY kg	Value of crop based on NAEY (₹)	Production efficiency (kg ha ⁻¹ day ⁻¹)	
	Nicobari Aloo	¹ Ginger	² EFY	³ Colocasia	⁴ Sweet potato	¹ NAEY of ginger	² NAEY of EFY	³ NAEY of Colocasia				⁴ NAEY of sweet potato
Fred Levi	37.5	22.5	75.0	45.0	13.0	90.0	60.0	45.0	15.6	248.1	12405	29.0
Judith Fred	22.5	27.0	75.0	52.5	8.0	108.0	60.0	52.5	9.6	252.6	12630	29.7
Feastus	30.0	27.0	82.5	67.5	9.0	108.0	66.0	67.5	10.8	282.3	14115	33.0
Joab Levi	37.5	30.0	90.0	60.0	11.0	120.0	72.0	60.0	13.2	3-02.7	15135	35.3
Adaliya	45.0	24.0	67.5	60.0	8.0	96.0	54.0	60.0	9.6	264.6	13230	31.0
Sylvamus	22.5	25.5	82.5	45.0	7.0	102.0	66.0	45.0	8.4	243.9	12195	28.7
Henry	30.0	15.0	67.5	60.0	14.0	60.0	54.0	60.0	16.8	220.8	11040	25.7
Niconar	22.5	10.5	60.0	52.5	6.0	42.0	48.0	52.5	7.2	172.2	8610	20.0
Mabel	37.5	21.0	52.5	60.0	7.0	84.0	42.0	60.0	8.4	231.9	11595	27.0
Jaob Titus	31.5	24.0	45.0	75.0	9.0	96.0	36.0	75.0	10.8	249.3	12465	29.0
Lambson Victor	24.0	18.0	52.5	54.0	8.0	72.0	42.0	54.0	9.6	201.6	10080	23.7
Apolus	22.5	24.0	63.0	61.5	6.0	96.0	50.4	61.5	7.2	237.6	11880	27.7
Patrick	27.0	28.5	82.5	76.5	10.0	114.0	66.0	76.5	12.0	295.5	14775	34.7
Leo	45.0	31.5	75.0	81.0	12.0	126.0	60.0	81.0	14.4	326.4	16320	38.3
Timothy	22.5	22.5	67.5	60.0	9.0	90.0	54.0	60.0	10.8	237.3	11865	27.7
Mean	30.5	23.4	69.2	60.7	9.1	93.6	55.4	60.7	10.9	251.1	12554	29.3

Table 3. Economics of the tuber crop based system (0.03 ha)

Farmers	Input cost (₹)				Output put (₹)				Total crop value	Value of pig and Pig	Total Profit (₹)			
	Ginger	EFY	Colocasia	Nicobari aloo	Total	Ginger	EFY	Colocasia				Nicobari aloo	Sweet potato	
Fred Levi	1650	1350	1050	670	17540	5750	3900	2500	1688	840	14678	56250	70928	53388
Judith Fred	1400	1060	860	700	13950	4700	2900	2063	1688	510	11861	35500	47360	33410
Feastus	1350	1160	900	760	17970	4200	3650	2438	1750	480	12518	66500	79018	61048
Joab Levi	2050	1390	1150	850	14290	6500	4800	2625	2063	690	16678	32500	49178	34888
Adaliya	1620	900	1060	900	12030	4400	2950	2125	2250	630	12355	25875	38230	26200
Sylvamus	1450	1350	1030	820	11550	5050	4750	2375	2063	450	14688	22375	37063	25513
Henry	1250	930	980	600	11800	3000	2450	2250	1500	900	10100	42500	52600	36720
Niconar	1650	1160	1000	650	14210	3850	3000	2638	1563	420	11471	38750	50220	36010
Mabel	1420	900	860	700	11730	4000	2550	2125	1688	480	10843	32500	43343	31613
Jaob Titus	1500	1030	1250	900	13200	5900	2600	3100	2125	630	14355	34800	49155	35955
LambsonVictor	1350	950	970	500	10470	3300	2550	2100	1350	570	9870	21000	30870	20400

	1250	1150	1050	800	200	9400	13850	3900	3060	2288	1563	420	11231	35200	46430	32580
Apollus	1750	1300	1160	820	250	8600	13880	5850	3850	3163	1675	630	15168	31550	46718	32838
Patrick	2000	1350	1350	850	280	7200	13030	6650	3400	3400	2288	750	16588	21250	37838	24808
Leo	1550	1150	1150	870	250	8200	13170	5250	3150	2250	2063	690	13403	26500	39903	26733
Timothy	1549	1142	1055	759	258	9020	13783	4820	3311	2496	1821	606	13054	34870	47924	34141
Mean																

Ginger- ₹ 200/kg; EFY- ₹ 40/kg; Colocasia and Nicobar Aloo - ₹ 50/kg; sweet potato = ₹ 60/kg Pig- ₹ 250/kg, Piglet = ₹ 3000/animal* Value in Indian Rupees

Table 4. Comparative economics of traditional and tuber crop based farming system (Mean of two years)

	2014-15						2015-16						Mean of Two years (2014-16)					
	Area (ha)	Yield (kg)	Expenditure ₹	Gross income ₹	Net income ₹	B: C ratio	Yield (kg)	Expenditure ₹	Gross income ₹	Net income ₹	B: C ratio	Yield (kg)	Expenditure ₹	Gross income ₹	Net income ₹	B: C ratio	Employment generation	
Traditional system (Nicobari aloo)	0.03	248	5050	12400	7350	1.46	270	5120	13500	8380	1.64	259	5085	12950	7865	1.55	46	
Tuber crop based farming system																		
Ginger	0.004	23.4	1478	4680	3202	2.17	24.8	1620	4960	3340	2.06	24.10	1549.00	4820.00	3271.00	2.11	8	
Elephant foot yam	0.01	69.2	1125	2768	1643	1.46	96.3	1159	3852	2693	2.32	82.75	1142.00	3310.00	2168.00	1.90	10	
Colocasia	0.006	60.7	1225	3035	1810	1.48	39.1	885	1955	1070	1.21	49.90	1055.00	2495.00	1440.00	1.37	9	
Nicobari aloo	0.005	30.5	750	1525	775	1.03	42.3	768	2115	1347	1.75	36.40	759.00	1820.00	1061.00	1.40	6	
Sweet potato	0.005	9.13	235	548	313	1.33	11.1	281	666	385	1.37	10.12	258.00	607.00	349.00	1.35	4	
Pig	-	144.8	9720	36200	26510	2.74	152	8320	30400	22080	2.65	148.40	9020.00	33300.00	24280	2.69	67	
Combination	0.03	-	14533	48756	34223	2.35	-	13033	43948	30915	2.37	-	13783.00	46352.00	32569	2.36	104	

recently introduced in the system. Highest yield was recorded from the farmer's field of Shri Leo viz., Ginger (31.5 kg), Colocasia (81 kg), and Nicobari Aloo (45 kg). However, the maximum number of pig population was maintained by Shri Fred Levi (11 no's) followed by Feastus (9 no's) respectively (Table 2). In this system, the yield of component crops was converted into equivalent yield of Nicobari aloo. The yield level ranged from 172.2 to 326.4 kg among the farmers with an average yield of 251.1 kg and production efficiency of 29.30 kg ha⁻¹day⁻¹ based on the crop duration (285 days).

Economics of farming system

The economics of the tuber crops in the system shows that the highest value of tuber crop was realized from the farmer's field of Shri. Leo viz., Ginger (₹ 6650.00), Colocasia (₹ 3400.00), Nicobar Aloo (₹ 2288.00) which resulted in total crop value of ₹ 16588.00. This is mainly because of highest yield obtained by the farmer as compared to the other farmers. The highest pig value (₹ 66500.00) was recorded with the farmer Shri. Feastus, which resulted in highest total income of ₹ 79018.00. (Table 3). This is mainly due to their affinity in rearing of pigs traditionally since Nicobari tribes were the last indigenous communities to arrive on these Islands, who brought livestock such as pig and poultry with them and thrived, but depended on the natural ecosystem for feed and fodder (Ghotge, 2006).

The comparative economics of traditional and tuber crop based farming system is given in table 4. In the traditional system, farmers cultivated only Nicobari Aloo from which they could earn ₹ 7865 as a net income with B: C ratio of 1.55. Among the crop component in the tuber crop based farming, ginger fetched highest net income of ₹ 3271 followed by elephant foot yam while the pig rearing recorded highest net income of ₹ 24280. On an average, the farmers fetched about ₹ 32569 as net income from the system with B: C ratio of 2.36 in which the share of animal component was high (75%) compared to crop (25%). Since pig plays an important role in the tribal society to meet the urgent financial need and also for offering during tribal festivals or

ceremonies like marriages etc. The possession of pigs indicate the social status of the households and the number of pigs increases with increasing number of coconut trees owned by individual household (Swarnam *et al.*, 2015).

Employment generation

Highest employment generation of 104 man days was recorded in the tuber crop based farming system which was comparatively higher than the traditional system (46 man days). This system has increased employment generation by 58 man days (126%) as compared to traditional system and offers ample scope for generation of round the year employment opportunities in tribal areas when adopted in large scale.

Conclusion

Initial two years of the study indicated that tuber crop based farming system with integration of pigs is more remunerative and provides sustainable livelihood opportunities which also create great scope for employment generation round the year in tribal areas. Therefore, tuber crop based farming system can be adopted commercially in large scale in tribal areas.

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