

## INTEGRATED FARMING SYSTEM FOR SUSTAINABLE LIVELIHOOD IN TRIBAL AREAS OF NICOBAR ISLAND, INDIA

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### ABSTRACT

An integrated farming system model comprising home garden for growing fruits and vegetables, goat, backyard poultry was evaluated in farmer's field on participatory approach in two tribal villages of Car Nicobar. The model aims at improving livelihood security of the tribal household through improving household nutrition, income and employment generation. From the system about 300 kg of seasonal vegetables, 117 kg of greens, 214 kg of tubers, and 200kg of fruits were produced from an area of 400 m<sup>2</sup>. The egg production has also increased resulting in improved consumption. After the intervention the consumption of vegetables including greens, fruits and egg increased significantly from 50 to 250 % due to on farm production and availability. The consumption of tubers decreased by 25% with increased consumption of other food items indicating a change in dietary pattern more towards balanced nutrition. After consumption the sale of surplus farm produce and goat kids resulted in supplementary household income of about Rs.7500/- from the system. A total of 95 man days were generated by the system viz., 52 man days in home garden, 40 man days in livestock rearing and 3 man days in composting spread throughout the year. Composting of organic residues on farm resulted in effective recycling of farm waste for crop production.

**Key words:** Nicobar Islands, Homestead garden, integrated farming system, backyard poultry, household nutritional security

### INTRODUCTION

Nicobar Islands are situated in the South-east Bay of Bengal between 6° - 10° N latitude and 92° - 94° E longitude more than 2000 km away from Indian mainland and are separated from Andaman group of Islands by 10° channel. There are 22 Islands in Nicobar district, of which only 12 are inhabited. Each Island is isolated from each other as well as from Car Nicobar, capital of the Nicobar district and Port Blair, capital of the Union Territory. So, these Islands are not only remote but also isolated from other areas. Off the total population, 63% are Nicobari tribes mainly concentrating in Car Nicobar and Chowra group of Islands. Only 0.2 % of total geographical area (1840 km<sup>2</sup>) is under agriculture and there is no scope for area expansion due to existing laws. The plantation crops occupy 84 % of agricultural area followed by fruit crops (4 %). There is no substantial area under vegetables except for some tuber crops (Directorate of Statistics 2011). The crops like sweet potato, tapioca, greater yam, pine apple,

banana, papaya and pandanus are grown in home gardens to a limited extent. Rearing pig and back yard poultry are the traditional activity found in the tribal areas. As the food grains like rice, wheat, pulses are not grown in these Islands, are supplied through Public Distribution System (PDS). The tubers, pandanus, coconut and fish are important constituent of their daily diet. However, the consumption of fruits, vegetables and egg are very minimal far below the recommended dietary allowance (ICMR 2010) due to non availability at local level and higher cost. With increasing population and shrinking land resources measures should be developed to produce more from unit area and also to diversify the farm production so as to produce the essential food items at individual household level to ensure livelihood security especially food and nutritional security of the tribal people in these remote and isolated areas.

The promotion of agricultural diversity through integration of different enterprises will have positive

impact on food and nutritional security at household level (Caouette *et al.*, 2002). Integrated farming system provides such an opportunity for diversification of different agricultural activities and it can enhance the productivity and profitability of existing farming systems, to ensure livelihood security of tribal farmers (Ansari *et al.*, 2013; Mahajan *et al.*, 2013; Varughese and Mathew 2009). In areas like Nicobar Islands integration of home gardens with allied enterprises like goat, pig, poultry provides a possible solution to meet the demand for various food commodities to ensure nutritional security of tribal households while supporting the stability of agro-ecosystem existing in these areas.

## MATERIAL AND METHODS

The study was conducted during 2011-13 in two tribal villages of Car Nicobar in a participatory approach. Considering the limited land availability and nutritional requirement of tribal household a homestead based farming system model comprising home gardens, goat rearing, backyard poultry were evaluated in farmer's field. The system components are described below.

### Components of farming system

#### Home gardens (400 m<sup>2</sup>)

In the home gardens 100 m<sup>2</sup> area is used for growing seasonal vegetables *viz.*, okra, brinjal, tomato, green amaranth, cucumber, bitter gourd bottle gourd and sweet corn. In another 125 m<sup>2</sup> area fruit crops like banana, pine apple and papaya were grown. Tuber crops *viz.*, tapioca, sweet potato, greater yam and colacasia were grown in an area of 150 m<sup>2</sup>. Besides, fruit trees of *Pandanus sp.* and *Morinda citrifolia* and guava were grown in corners of the field. *Sesbania grandiflora* (agathi) and *Gliricidia sepium* were grown as border trees to act a biofence besides serving as green fodder and green leaf manure.

### Livestock

The livestock component in the present system includes goat and poultry.

- a. Goat – A total of 2 adults. The green fodder grown as biofence was used as feed.
- b. Poultry: A dual purpose birds (Vanaraja) were reared under backyard condition. A total of 25 birds were housed in temporary night shelters. The birds were fed with rice, coconut, morinda and other leguminous leaves.

### Compost / Vermicompost

Compost tanks were made at a corner of the home garden for composting crop residues and farm wastes. Above the composting unit pandal was made with local materials and perennial crops like coccinia, greater yam were grown. The manure obtained from goat and poultry along with crop residue were used for making compost. This will provide organic manure by utilizing farm wastes.

## RESULTS AND DISCUSSION

The interventions carried out in the tribal areas significantly increased the production of vegetables, fruits, tubers, meat and egg. The results were compared with the production of the said items before intervention. Before intervention, the tribal farmer has a backyard garden of 50 -100 m<sup>2</sup> for growing mainly banana, tuber crops like tapioca and greater yam without proper care and management. No external nutrients were applied and they were practising a form of shifting cultivation having 5 to 7 year cycle. A significant increase in vegetables, greens, fruit and tuber crop production was observed after intervention (Table 1). Though the tribals grow banana, papaya, pineapple and pandanus from time immemorial, improved varieties, application of composts and other management practices increased their fruit yield exceeding their family requirement.

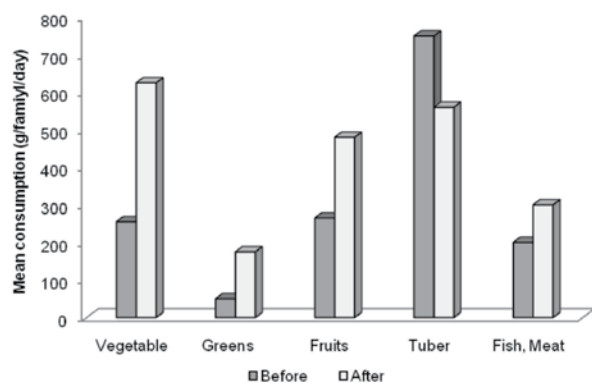
**Table 1. Production of IFS system in selected farmers field**

Name of farmer	Production (kg year <sup>-1</sup> )							Compost produced
	Vegetables <sup>1</sup>	Greens <sup>2</sup>	Tubers <sup>3</sup>	Banana	Pineapple	Kids <sup>4</sup>	Egg <sup>5</sup>	
Kindness	375	98	260	274	19	1	584	600
Margretta	345	169	350	206	23	2	672	800
Sophia	203	91	220	171	13	2	768	600
Shilpa	225	111	190	206	20	4	576	750
Elanthy	375	117	50	69	18	2	521	300
<b>Mean</b>	<b>305</b>	<b>117</b>	<b>214</b>	<b>185</b>	<b>19</b>	<b>2</b>	<b>624</b>	<b>610</b>

<sup>1</sup> Bhendi, brinjal, Lobia, Bitter gourd, Sem, Pumpkin, Raddish, <sup>2</sup>Amaranthus and Sesbania (Agathi), <sup>3</sup> Tapioca, Nicobari Alu and sweet potato, <sup>4</sup>Goat kids, <sup>5</sup> No. of eggs

### Nutritional security

The on farm production of vegetables, greens, fruits and poultry improved the nutritional security of the farm family (Fig 1). The consumption of vegetables, fruits and greens increased 50 - 250 % while consumption of tubers was reduced 25 % after the intervention. The diet diversity also indicates the food and nutritional security where the diet which includes diverse types of foods is internationally considered as a healthy one. The number of food items consumed by the tribal family has increased by inclusion of variety of vegetables, greens, fruits and egg indicating more diversified food consumption ensuring more food and nutritional security.



**Fig. 1. Change in daily intake of specific food items after intervention**

### Supplementary Farm Income

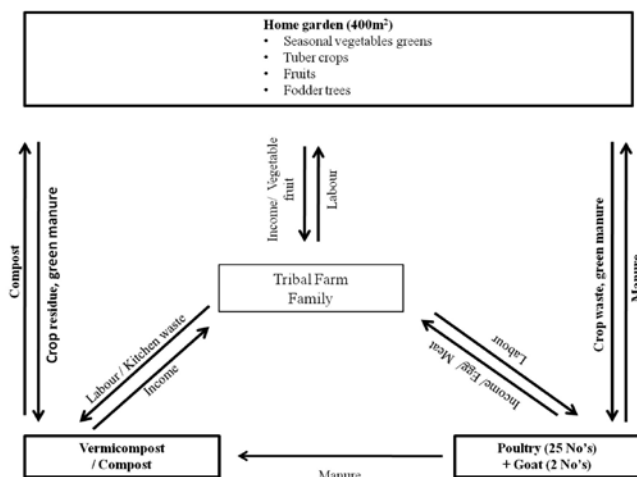
The surplus produce of vegetables and egg was sold in the neighbourhood earning supplemental/additional income of about ₹. 2750. Besides, the sale of kids of goat generated further income of about ₹.5000 resulting in a total supplementary income of ₹. 7750 from the farming system model within the limited resources available. The additional income was reflected in the increased consumption of cereals and pulses enabling the household to improve the share of cereals and pulses in their daily food intake resulting in a more balanced consumption of food.

### Employment generation

The major farm activity in Nicobar Islands is the collection of coconut from plantations and their processing for sale. This drying and copra production is mainly confined to dry season during November to March and mainly done by the tribal men. However, the integrated farming system has generated employment opportunities especially for women and is spread uniformly throughout the year. A total of 95 man days were generated in different components of the system only engaging family labour mainly tribal women. As the farm women were directly involved in the farm activities, enabled them to make decisions on farm operation and the use of surplus produce. The supplementary income generated from the system was at the disposal of the farm women.

## Residue recycling and resource flow

The garden wastes, kitchen waste, green manure crops grown as fence were used for composting along with goat and poultry manure. A total of 610 kg of compost was prepared in a cycle of 2. The compost was used for manuring the crops grown in home garden as no chemical inputs were applied and only organics were used. Earlier the farmers used to shift their home garden once in 5 to 7 years to restore the soil fertility. The surplus produce of tubers to the extent of 170 kg was used for feeding goat. The synergistic interaction of the farming system in terms of labour, resources and residue recycled were depicted in Fig 2.



**Fig.2. Resource flow between components in Integrated Farming System model**

## Conclusion

The small scale homestead based integrated farming system model resulted in increased on farm production of diversified food items resulting in nutrition security of tribal household besides providing additional income and employment opportunities of tribal households especially for women. The composting of farm wastes resulted in residue recycling within the system and to meet the

nutrient requirement for crop production in home garden thereby reducing the dependence on external inputs. Such model can be emulated in other remote, isolated resource scarce areas to improve livelihood of the individual household.

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