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Scope and Prospects for Natural Farming: Island perspective

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Abstract

Agriculture intensification with modern chemical inputs has resulted in increasing food production but with negative consequences on the environment. Therefore alternative farming methods like natural farming (NF) is advocated to minimise the negative impact and increase the farmers' income by reducing the input cost. In this context, an assessment of NF potential for island condition was carried out based on the data collected from field experiments, published reports and field survey. The results showed that NF has shown significant yield advantages mainly under rainfed, low input agricultural system than conventional / organic farming. Low input, rainfed crops such as finger millet, sorghum and black gram gave comparable yield in NF. Under island condition NF supplemented with external application of organic manures significantly improved coconut yield and soil biological properties. The study also revealed that integration of livestock component and cultivating spices as intercrops, green fodder and green manure crops as live mulch in coconut plantations along with NF practices such as application of *jeevamrutha* and practising of mulching can play a significant role in increasing the productivity of coconut besides improving soil biological activities in the islands. PCA analysis indicated separation and loading of different farming methods in various quadrants of the PCA plots. NF lacks resource optimization whereas intensive and specialized farming are resource degrading and lack stability. Therefore, it is suggested to combine and optimise some of the best practices of NF and organic farming under various farming situations for different crops without compromising crop yield and farmers income.

Key words: *farming types, crop yield, organic inputs, jeevamrutha ruth, soil enzyme activity,*

Introduction

Modern intensive agricultural practices have played a key role in increasing the productivity of major food crops to extend of 208% for wheat, 109% for rice, 157% for maize, 78% for potatoes, and 36% for cassava that helped to feed the increasing population and overcome chronic food deficits. On the other hand, it also spurred its share of unintended negative consequences, often not because of the technology itself but rather, because of the policies that were used to promote rapid intensification of agricultural systems and increase food supplies (Pingali 2012). Use of high quantity of chemical fertilizers resulted in land degradation in many of the intensive agricultural regions. Alternatively in order to feed the growing population and sustain the agricultural production with minimal negative impact on the ecosystem services several alternative farming practices *viz*., organic farming, natural farming, conservation agriculture and agro-ecological farming are suggested.

Natural Farming (NF) is a unique chemical-free farming method which is based on the philosophy of working with natural cycles and processes of the natural world (Fukuoka, 1985). This also includes crops, trees, livestock and promoting functional biodiversity. Furthering the advantage of NF, Zero Budget Natural Farming (ZBNF) has evolved as a set of farming methods that seeks to bring down the input costs by relying on 'natural products' (*Jeevamrutha, Bijamrita* and *Neemastra)*, adopting intercropping and mulching (Palekar, 2006) rather than spending money on synthetic agrochemicals such as pesticides and fertilisers. Because of this, ZBNF is considered as one of the alternative farming practices for improving the income of small and marginal farmers of India in the backdrop of declining fertiliser response and farm income.

This is more pertinent to the island ecosystem of Andaman and Nicobar islands. In these islands planned agricultural development has started mainly during mid 1980's and except for vegetable cultivation majority of the

cultiated area is under low input agriculture. The major crops grown are rice, coconut, arecanut, vegetable and fruits. Rice and vegetables are grown in coastal plains and intermontane valley areas. The agricultural productivity is below the national average and majority of the food grains and vegetables are transported from mainland to feed its growing population. The timely availability of agricultural inputs is the major concern that affects the agricultural production. Under such circumstances alternative farming strategies such as ZBNF will play a major role in sustaining the island agriculture and livelihood security of the farmers. Therefore, in this study we have evaluated the potential of ZBNF practices and compared it with the existing and similar orgnaic farming practices to suggest the best NF practices and crops for island conditions.

Rationale for Zero Budget Natural Farming

In order to address the negative consequences of input intensive modern agriculture, several alternative farming practices viz., organic farming, permaculture, ecological farming were emerged promising reduced input costs, chemical-free products and improved soil fertility. Natural farming was first popularised by the Japanese scientist and philosopher, Masanobu Fukuoka, who practised it on his family farm in the island of Shikoku. In India, noted agriculturist Subhash Palekar has helped popularise ZBNF practices across the country. Zero Budget Natural Farming (ZBNF) is being promoted as low-input, low risk, climate-resilient type of farming (Babalad et al.2021). ZBNF encourages farmers to use low-cost locally-sourced inputs, eliminating the use of agrochemicals and it is in harmony with nature. The cropping model proposed in the ZBNF is based on polyculture or growing multiple crops on the same piece of land i.e., growing short duration and long duration crops (main crop) together so that the cost of raising the main crops will be recovered from the income generated from the short duration crops resulting in "zero" expenditure for the main crop, because of which it is called as "Zero Budget Natural Farming". Under island conditions the concept appears to be suitable as most of the farmers are resource poor with marginal and small holdings.

Methods of ZBNF

The four pillars that are integral to ZBNF (Table 1) are (i) Jeevamrutha, or a fermented microbial culture made with cow dung, cow urine, jaggery, pulse flour, water and natural /forest soil. The application of which is said to provide nutrients, promote the activity of soil flora and fauna like microbial and earthworm activity, and helps to prevent fungal and bacterial plant diseases. It is suggested that Jeevamrutha is only needed for the first 3 years of the transition, after which the system becomes self-sustaining; (ii) Bijamrita or microbial coating of seeds, seedlings or any plant material using cow dung and urine based formulations; it protects the crops from harmful soil-borne pathogens and young seedlings from soil-borne and seed-borne disease. It also contains growth hormones like IAA and GA3 (Sreenivasa et al., 2010) (iii) Acchadana or mulching (soil, straw and live) applying a protective layer on the soil surface in order to prevent water evaporation, and to contribute to soil humus formation; it also creates microclimate suitable for microbial growth which is essential for humus formation and nutrient transformation. (iv) Waaphasa, or soil aeration through a favourable microclimate by reducing irrigation or irrigation during noon. For plant protection, ZBNF encourages the use of various decoctions made with cow dung, cow urine, lilac and green chillies as a prophylactic spray.

Table 1. The four wheels of ZBNF and perceived impacts

Practices of ZBNF	Proposed or perceived impacts
Jeevamrutha	Both liquid & soil application will increase the soil microbita including earthworks and microbes which will increase the nutrient availability
Bijamrita	Protection from soil and seed borne diease pathogens
Mulching	Soil mulching (no tillage), straw or residue mulching and live mulching i.e intercropping with short duration crops like green manure crops. To protect soil water loss, addition of organic matter and soil fertility for increased microbial activity and soil fauna
Whapasa	Reduced overreliance on irrigation and improved aeration and maintain favourable soil moisture profile

(Bharucha *et al*. 2020)

Though the proponent claims it to be 'Zero Budget Natural Farming' assuming no purchase of any input from market, as every resource has 'opportunity cost' (Kumar et al., 2019), it is logical to consider the ZBNF practice as 'Natural farming' . Therefore, in this paper here onwards we have used 'NF' instead of 'ZBNF'. However, NF can be practiced with significant reduction in input cost as compared to conventional farming.

Materials and methods

The Study area

The Andaman and Nicobar group of Islands lie in the Bay of Bengal (6-140 N lat; 92-940 E long) 1200 km east of mainland India. The climate of Andaman and Nicobar Island is typified by tropical conditions with little difference between mean summer and mean winter temperatures. The annual rainfall varies from 2900 to 3100 mm representing perhumid climate. As these islands are situated close to the equator intensive solar radiation is received resulting in high evaporation especially during dry months which far exceeds the rainfall resulting in water deficit condition. The average relative humidity varies from 68 to 86% and the maximum and minimum temperature is 32°C and 22°C, respectively. The length of growing period is more than 210 days which is long enough to support double cropping and plantation crops grown in the area. As these islands are topographically undulating, characterized by hills and narrow longitudinal valley there is limited scope for surface water storage. Rice is cultivated in the coastal lowlands and plantation crops (coconut, arecanut, banana) are grown in the hill slopes and valleys. Vegetables are grown in the mountain valley and in some places as intercrop in the coconut graden. The soils are mostly acidic, medium to high in orgnaic matter content and low in nitrogen and phosphorus. Moslty agriculture is practised as rainfed with low input use. In the entire Nicobar islands agriculture is practiced without any external input use providing large scope for practicing orgnaic or natural farming.

Field study

Field experiments were conducted to study the effect of different components of NF such as jeevamrutha, and waaphasa on different crops. Jeevamrutha was applied to coconut @ 10L/tree per month since June 2021. The coconut leaves and husk were used as mulch and kept in the basin to prevent moisture loss. Data on yield of coconut was also collected from farmer's field in Andaman and tribal areas for comparison. The data on soil conservation measures like terracing, wapasa or reduced irrigation, mulching (straw and live mulching), application of panchagavya and other organic inputs on okra, brinjal were taken from other experiments conducted during 2016 -2021 and also from published literatures. However, these experiments were conducted at different periods of time, at different locations not in a single experimental field as a NF package. This creates inherent uncertainty on the data for it large scale interpretation.

Data collection and analysis

In this study relevant data from previous studies conducted elsewhere in India that used any one or complete practices of NF were collected from published peer reviewed literature. Data from studies involving other organic inputs and jeevamrutha was collected. Mean and standard deviation were calculated for yield, cost reduction and net returns between NF and conventional systems for major crops after data harmonization. Principal component analysis was carried out using the compiled data collected from different farming systems experiments using SAS software.

Results and Discussion

Effect of NF on different crops in India

Effect of NF on crop yield and farm income is the most debated aspects while evaluating its suitability for different conditions. Though there are several studies conducted in the past, most of them were carried out in the farmer's field who have not followed the complete NF practices. The analysis of data indicated that the additional benefit accrued in NF is mainly due to reduced cost of cultivation and increased market price of the produce. In most of the crops reported the total yield is found to be less than the conventional yield (Fig 1). Another proposed advantage is the cost reduction under NF wherein up to 25% reduction is recorded for rice across the studies, this resulted in enhanced net returns. However, the cost difference is insignificant for rainfed and millets as they are already grown under low input system. Here, the enhanced returns is mainly attributed to the increased market price even up to 50-60% for crops like ragi, millets etc, because of their nutritional value and low carbon diet. It is also found that when NF practices are combined with application of FYM, the yield is enhanced above the conventional systems (Kumar et al.2020). Kumbar and Devakumar (2017) reported that application of *jeevamrutha* at 2000 litres/ha recorded significantly higher green pod yield of french bean with enhanced crude protein and shelf life. Further increase in yield was observed when supplemented with 6% *panchagavya*, (Table 2). Thus, the above observations revealed that NF practices alone did not harnes the best possible potential yield. This means there is further scope for yield increase when combined with other organic practices.

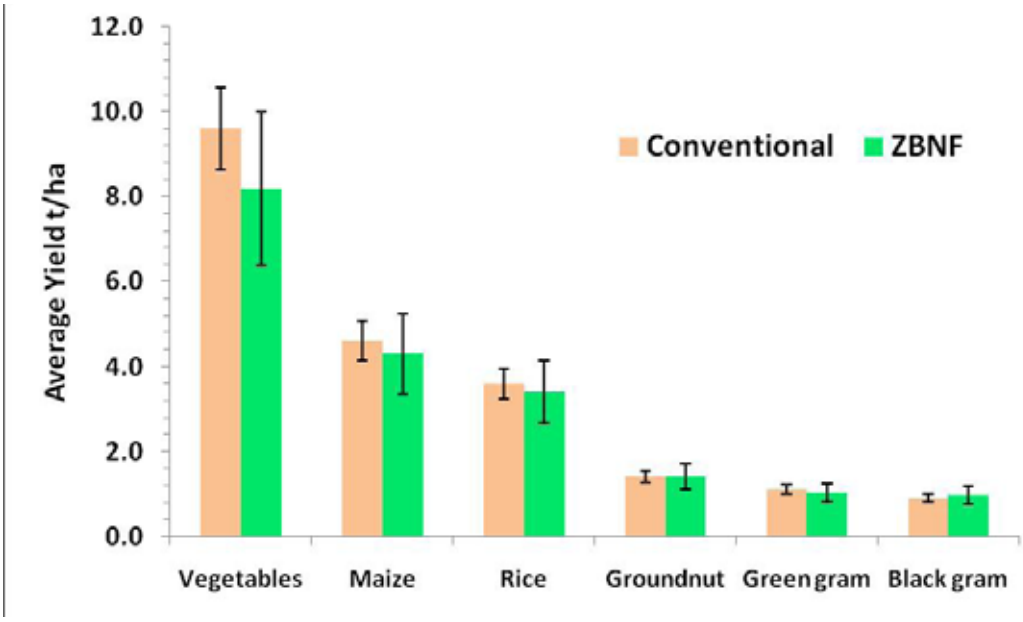


Fig. 1. Crop yield under conventional and ZBNF in India

Table 2: Effect of ZBNF on different crops

Sl. No.	Crop	ZBNF method	Economic Impact	Reason	Reference
1	Paddy	Use of Jeevamrutha	Additional net return of Rs. 20,408 than conventional farming	Reduced cost	Amareswari and Sujathamma 2014
	Paddy	Jeevamrutha Beejamritha FYM Pest controlling solution	12% increase in yield & 9% increase in market price	5% reduction in input cost 129% increase in B:C ratio	Kumar et al.2019
2	Ragi	Use of Jeevamrutha	Additional net return of Rs. 6,395 than conventional farming	Reduced cost	APZBNF, 2018
		ZBNF practices	Up to 25% yield increase over conventional method	Reduced cost, better nutrients	Kumar et al., 2020
		Jeevamrutha Beejamritha FYM Pest controlling solution	35% increase in yield, 50% increase in market price realisation	As low input crop, no significant reduction in input cost	Kumar et al.2019
3	Cotton, Jowar, Soybean Ground nut Maize	Jeevamrutha Beejamritha Mulching	2-6% decrease in yield	Reduced cost mainly under irrigated crops . Cost reduction is less or insignificant for rainfed crop and low input crops	Kumar et al., 2020 Bharucha et al.2020
4	Sugar cane	Jeevamrutha Beejamritha FYM Pest controlling solution	3-4% reduction in yield, 3-4% increase in market price	Reduced cost up to 9-10%	Kumar et al.2019

Performance of different farming practices in the islands

Crop yield and cost saving are the most important criteria for evaluating different methods particularly in farmers point of view. The yield of major crops grown in Andaman and Nicobar islands for different farming situations and different practices which are part of NF such as mulching, reduced irrigation and use of neem is given in table 3. Mulching was found to be beneficial to the extent of 15-20% higher yield than control with an average additional net income of Rs.16000 in vegetable crops. Similar increase in yield was also recorded for table purpose groundnut by mulching under Island condition (Ravisankar et al. 2014) mainly because of favourable soil moisture conditions. Several legumes (*Atylosia scarabaeoides, Centrosema pubescens, Calopogonium mucunoides and Pueraria phaseoloides*) were used as cover crops in interspaces of coconut plantations to enhance the soil biomass C and nutrient availability. The incorporation of leguminous cover crops significantly enhanced soil organic C, total N, P and K besides increasing soil enzyme and microbial activities (Dinesh *et al.* 2004). However, application of irrigation at noon

(Whapasa) especially for vegetables in seedling stage led to high mortality due to emission of heat of wetting as these islands are located closed to the equator and receive intensive solar radiation. This implies that there is no universality of application of NF practices and therefore agro-climatic suitability evaluation should be carried out before large scale adoption of NF. Another important principle is the reduced irrigation to prevent overuse of irrigation water. Irrigation is required mainly during dry season for growing maize, vegetables and pulses. The experiments on providing irrigation at critical crop growth stages recorded significantly higher yield for table purpose groundnut compared to 3 or 4 irrigations under islands (Ravisankar *et al*. 2012). Similar results were also recorded for other crops by Raja *et al.* (2012). As the polyculture is also a component of NF, intercropping of plantation crops like coconut, arecanut with spices, tuber crops recorded higher net returns (Ravisankar *et al*. 2011). The intercropping of red gram and table purpose ground nut in coconut recorded additional benefit (Ravisankar *et al*. 2011; Subramani *et al.* 2015).

Table 3: Comparative evaluation of different practices /method or farming systems under island conditions

S. No.	Method / farming system	Cropping system / crop	Crop yield/ other benefits	Farm income (ha)	Cost saving (ha)	Remarks
	Mulching	Tomato, Bhindi Chilli, Beans	15-20% higher than non-mulch plots	Additional net income of Rs. 14,000 to 16,000	On an average Rs. 12000	Yield increase mainly due to moisture conservation, weed control
		Table purpose Ground nut	Significant increase in yield compared up to 10%	8.9% increase in net returns over no mulch		Other management practices are conventional, Yield increase due to moisture conservation. Ravisankar et al. 2014
	Soil water conservation	Gliricidia hedge rows in coconut & cowpea as cover crop	Reduced soil erosion & less nitrogen and phosphorus loss	-	-	Pandey & Chaudhari 2010
	Land management practices	BBF and its modifications	Increased land use, rain water harvesting, increased yield	5 to 10 times increase in yield compared to rice monocropped area	variable	Conventional input use Velmurugan et al. 2015
	Intercropping or multitier cropping					
	Jeevamrutha	Coconut	Increase of 30-40 nuts/palm	Additional income of Rs. 150-200/ palm	Used in low input rainfed farming	The yield increase was due to fertilizing effect & reduction in nutfall
		Tomato & Okra	5-7% yield reduction if applied alone than conventional or organic farming	Reduction upto 8-11% due to increased pest incidence & nutrient deficiency	7-11% in fertilizer / compost cost	Significant increase in yield if combined with FYM and other organic inputs
	Whapasa- moisture (irrigation during noon)	Vegetables (Cucurbits, Brinjal, tomato)	No significant change	No change	No change	Dying of tomato seedling (3%) if irrigated during hot summer

Reduced irrigation or irrigation at critical stages	Maize, green gram, sesame	Irrigation at different critical crop growth stages, higher yield compared to control or no irrigation	Increased net returns	-	Grown under Conventional nutrient management (Raja et al.2012)
Jeevamrutha + mulching	Vegetables	Up to 18% increase in yield than control	Increase of Rs. 12000 to 15000		Good effect due to moisture conservation & growth promotion by PGPR
Panchagavya	Vegetables (Brinjal, tomato, okra, cucurbis)	Yield increase of 12-18% than control	Additional net increase of Rs. 13000 to 22000 than control	Variable	Significant increase if combined with Compost & pest control measures
	Coconut+Spices	Yield increase of 10-16% than control	Additional net income of Rs.7,000 to 11,000	Variable	Additional income as compared to farmers practice of low input use or no external input use
Organic farming	Coconut + Spices with terracing	Yield increase of 15-21% than farmers practice	Additional net income of Rs.30,000 to 45,000	Variable	Additional income as compared to farmers practice of low input use or no external input use
Integrated Farming system	Crop + Dairy based IFS for lowland	Doubling of yield than rice monocropping	Total net return of Rs. 2.2 lakhs	Variable	Cost saving due to resource recycling , intensive cropping and conventional or organic input application
	Vegetables (with land modifications)	Yield increase of upto 12-21% than low input but lower than chemical fertilizer use	Additional net return of Rs. 21,000 to 30,000	Additional cost incurred	Yield increase due to better growing condition and soil health
Tribal farming	Coconut	Low yield 60-75 nuts/palm	Lower than other methods	Variable	Poor yield due to nutrient deficiency, no management
Complete NF (All the 4 elements)	No study so far				
Conventional farming (inorganic & chemical use)	Rice	8-17% higher yield than organic or NF	Variable	Additional cost incurred	Higher return due to increased yield
	Vegetables	15-28% higher yield than organic or NF	Net income of 1.2 to 1.7 lakh	Additional cost incurred	Higher return due to increased yield
	Arecanut (along with compost)	Upto 12-20% increase than low input or organic farming	Additional net return of Rs. 21000 to 40,000	Additional cost incurred	Higher return due to increased yield & better management

Similarly the application of panchagavya and vermicompost, important organic inputs, was found to increase the yield than control or conventional practices. In vegetables (brinjal, tomato and okra) significant increase in yield by application of panchagavya was reported by Swarnam *et al.* (2016). Further, panchagavya application also increased the total phenolic content (15.7%), total carotenoids (24.8%), DPPH activity (51%) and ascorbic acid (1.1%) compared to control. Similarly application of jeevamrutha with mulching enhanced the coconut yield up to 30-40 nuts/palm resulting in an additional return of Rs.25,000/ ha. It is to be noted that in almost all the cases, the organic manures were applied as basal dose irrespective of the crop. The average productivity of coconut is much below the national average in tribal farming system practised in Nicobar Islands where no external inputs are applied to the palms. These areas hold greater promise for yield increase by the use of jeevamrutha and panchagavya with the basal application of compost or FYM.

Maintaining or restoring soil health is one of the major objectives of NF by promoting the activities of beneficial microorganisms in soil. However it is to be noted that there was no experiment conducted with complete package of practices of NF for any specific crop under island conditions. In order to evaluate the effect of *jeevamrutha and* mulching on soil biological activities, an experiment was conducted using tomato and coconut as test crop (Table 4). The results showed no significant change in soil pH and EC however, most of the soil enzyme activities have increased due to addition of jeevamrutha. More importantly significant increase in bacterial population, soil enzymes like dehydrogenase, urease, phosphatase activities was observed for coconut than tomato. There is a direct correlation between increase in bacterial population and enzymatic activities. This increase might have contributed to higher nutrient mobilization and atmospheric N fixation in the soil that resulted in increased yield. This is in corroboration with the results of Shyam *et al.* (2019) who reported partial improvement in soil health due to increase in soil organic carbon and total nitrogen compared to lands of non-adopters. It can be inferred from the above discussion that the practices proposed in NF like multiple cropping, mulching, application of jeevamrutha and terracing are found to be beneficial for vegetables and coconut when they are combined with conventional practices. In other words, the NF practices augmented with other organic farming methods invariably led to better crop yield and soil health than those from conventional or tribal farming under island conditions.

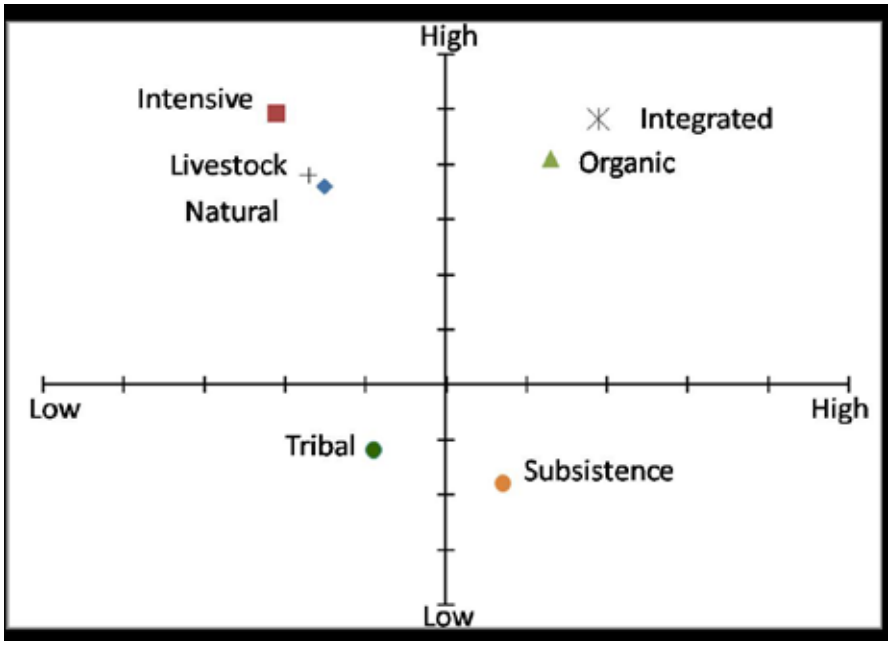
Table 4: Effect of application of *Jeevamrutha, Neemastra* and mulching to tomato and coconut on some soil biological properties

Soil properties	Tomato		Coconut	
	Control	Treated	Control	Treated
Soil pH	6.2	6.4	6.1	6.2
EC (dSm^{-1})	0.21	0.23	0.21	0.22
Total bacterial population (Log_{10} CFU g^{-1} soil)	4.16	5.32	7.56	8.14
Soil Respiration(mg CO_2 h^{-1})	641	802	657	874
Dehydrogenase(mg TPF h^{-1} g^{-1} Soil)	1.54	4.09	1.63	4.18
Urease (mg urea h^{-1} g^{-1} soil)	1.43	2.34	1.40	2.17
Acidic Phosphotase (µg p- nitrophenol $h^{-1}g^{-1}$ soil)	18.92	25.17	20.98	26.19
Alkaline Phosphotase(µg p- nitrophenol h^{-1} g^{-1} soil)	9.79	18.57	8.62	15.35

PCA analysis

In order to compare and analyse the overall performance of different farming practices principal component analysis (PCA) was carried out based on the compiled data on resource use, biodiversity, income, sustainability and stability (Fig. 2). The PCA showed that due to poor resource use, income and stability tribal and subsistence farming falls in the bottom quadrant (lower portion) of the PCA plot. Whereas, intensive farming and specialized livestock farming falls in the top left quadrant

of the PCA plot as they are highly remunerative, resource intensive but low in diversity and sustainability. Whereas NF also falls under the same quadrant, is diversified, sustainable, less resource intensive, provide moderate income but resources are not optimally utilized and plenty of scope for income enhancement. In contrast, integrated farming system and organic farming which fall in the positive side (top right side quadrant) are highly resource efficient, sustainable with higher income. These systems are also diversified and resource use optimized. Under island conditions there is scope for enhancing the income of tribal and subsistence farming either by following OF or NF practices. From the PCA it is evident that in Andaman Islands the best option is IFS models due to higher income, stability and sustainability. Intensive and specialized livestock farming may not be a viable option as they lack stability and sustainability though they are highly remunerative.



- The PCA is based on resource use, diversity, income, sustainability and Stability
- Inherent data uncertainty due to data drawn from different sources, experiment conducted at different period of time, All the recommended practices not followed

Fig. 2. PCA loading for different farming systems

Scope for NF in the Islands

Land and water are the most critical natural resource for agricultural development in the islands. The Islands have only 11,954 land holdings with an average size of only 1.77 ha which is higher than national average. There is a greater pressure on the small and marginal holdings as they accounted for 64.2% of total holdings but cultivating only 28.6% of the total agricultural area. In the tribal areas of Car Nicobar and Nancowry group of Islands, major land use is plantations, home gardens, natural forests and waste lands. However, differences were observed in major crops or farm animals across the islands. Banana, pineapple, tapioca and sweet potato are grown in home gardens besides vegetables with pig and backyard poultry as it is an important component of tribal farming systems.

Coconut is intercropped with spices like black pepper, clove, cinnamon nutmeg and ginger especially in Andaman groups. The coconut is grown under natural management without much external inputs resulting in low productivity (5300nut/ha) which is less than the national average. The intercrops like spices were also grown under minimal nutrient management and except rhinocerous beetle, the prevalence of other pests are not common. Moreover, the mixed farming system is most common with cattle and backyard poultry. The elements favourable for practicing NF in the islands are given in

table 5. The table indicates that there is good scope for practising NF by integrating *desi* (local) cow and growing intercrops like spices, green fodder, green manure crops along with MPTs in boundary that can play a significant role in increasing the productivity of plantation crops besides improving soil fertility in the islands. As the study elsewhere revealed that the ZBNF system performed well for crops like millets and pulses under a rainfed condition, the plantation crops can perform well under NF in the Islands because of the perennial nature, low input requirement, less incidences of major pests and generation of large quantity of organic residue within the system.

Table 5: Elements favourable for practicing NF in the islands

S. No.	Name of the district	Average size of holding	Livestock component and size	Major crops	ZBNF	
					Elements favourable	Possibility
1	South Andaman	53% medium & 35% small	Cattle (53%), goat (42%)	Rice, vegetables, coconut	Demand for chemical free products from tourists, low input use, Crops are suitable	Specialized NF clusters, market support, NF practice for coconut & spices
2	N&M Andaman	61% are medium farmers	Goat (46%) and cattle (46)	Rice, vegetables, arecanut	Medium to high organic matter, livestock population, low input use, diversified farming	NF suitable for medium farmers, provide training and financial support, plantaion crops (arecanut & spices) are suitable for NF
3	Nicobar (tribal areas)	58 % are small farmers	Pig (67%), goat (30%)	Coconut, tubers	Bio-diversity in tubers, fruits and local vegetables, No chemicals used, Easy to practice by tribals	Conversion of tradition into NF easy, large contiguous land for NF. Lack of desi cows or cattle population may be a constraint in adoption of NF

Way Forward

Natural farming practices involve use of jeevamrutha, beejamritha, wapasa and mulching besides some natural plant protection methods. In most of the cases, natural farming is practised by small and marginal farmers from Andhra Pradesh, Karnataka and Maharashtra and encouraging results were recorded for low input crops grown under rainfed condition like millets and ragi. The advantage is of increased market price of the product as it is popular for low carbon diet and reduced input cost. Among the prescribed practices in natural farming, the most adopted and popular practice among the farmers is the use of jeevamrutha, beejamrita and other plant protection materials, while mulching and wapasa are not gained popularity among the farmers in the mainland.

Under island condition, the moisture conservation practices like terracing, mulching, intercropping were reported to have positive effect and will be most suitable for coconut and spices as they are mostly found on side slopes. As most of the plantations are maintained with low input use, application of jeevamrutha will certainly increase the yield besides improving soil health. Low input use and generation of 7-8 t ha^{-1} y^{-1} organic residue in coconut plantations are major advantages for practicing NF in the islands. However, most of the livestock found in the islands are not of *desi* (*Bos indicus*) breed which may limit the actual adoption of NF per se. It was also observed that farmers and under experimental conditions adoption of NF practices along with compost / FYM addition gave better result than NF alone. Despite this NF

practices have significant impact on the soil biological properties essential to sustain or improve soil health.

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