Case Report

INTEGRATED FARMING SYSTEM (IFS) FOR SUSTAINABLE AGRICULTURE: A CASE STUDY IN KARAIKAL, UNION TERRITORYOF PUDUCHERRY

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ABSTRACT

In India, small and marginal farmers, comprising 85% of the farming community, are pivotal to the rural economy. Addressing the rising demands amidst agricultural resource scarcity requires a holistic approach like Integrated Farming System (IFS). This method combines crop production, livestock, fishery, waste management, and poultry production synergistically. IFS boosts productivity, utilizes resources efficiently, and enhances food production, stabilizing income and ensuring nutritional security. A study in Karaikal district, Union Territory of Puducherry, which was an agricultural land and the entire farm revealed a benefit-cost ratio of 1.75, demonstrating IFS's potential in overcoming population growth and resource challenges.

Keywords: Integrated farming system, eco-friendly, sustainability

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INTRODUCTION

The Integrated Farming System (IFS) is a comprehensive farm management approach designed to promote more sustainable agriculture, aligning with the broader goal of ensuring the responsible use of natural resources for the benefit of both current and future generations. This system seamlessly integrates various agricultural activities within a designated land unit, encompassing agriculture, horticulture, fisheries, livestock farming, poultry farming, mushroom cultivation, and biogas production, among others (Gill *et al*., 2005).

In Karaikal, a region where agriculture is the predominant occupation, traditional single-crop cultivation posed significant risks

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due to the inherent uncertainties associated with seasonality and irregular employment patterns for farmers. Recognizing the need for a more resilient and diversified approach, the IFS strategy was adopted (Behera *et al*., 2013). This holistic approach offers numerous advantages, including increased economic yield per unit area over time, a pollution-free environment, enhanced profitability, sustainability, and a consistent income throughout the year.

The focus of the present study is on an exemplary farmer from Karaikal who serves as an innovative role model, particularly for the younger generation. This individual stands out for their self-confidence and courage in embracing the IFS model, showcasing how such integrated farming practices can not only mitigate risks but also contribute to the overall well-being of the farming community (Jayanthi *et al*., 2006).

MATERIALS AND METHODS

i. Location of the study:

Karaikal, one of the four regions of the Union Territory of Puducherry in India, situated on east coast of India (Fig.1). The region lies between 10°49' and 11°01' northern latitude about 150 kms and 79°43' and 79°52' eastern longitude about 150 kms in the deltaic region of Cauvery and has an area of 161 sq.km. Karaikal town is situated about 16 kms north of Nagapattinam district, 9 kms south of Mayiladuthurai district, on the west by Tiruvarur district of Tamil Nadu state and east by Bay of Bengal. It's made of 6 Commune Panchayats (Fig.2).The district receives an annual rainfall of 126cm in 55 rainy days. Karaikal being in the deltaic region of Cauvery river mainly depends on canal water for irrigation of crops. About 45% of total population of the district depends directly or indirectly on farming.

ii. About the Farmer and the Farm:

An innovative, progressive farmer Mr.I. Paneer Selvam, addressed from Karaikal district of UT of Puducherry. Name of the farm – Able Integrated Farm, located in Nedungadu Commune of Karaikal. Total area of the integrated farm is 1.72 ha and the soil type is Clayey.

iii. Components of the farm:

The farm was personally interviewed by visiting his farm and data, details were collected with pre-interviewed schedule. Components in the farm are store room, farm pond for fish cultivation, goat unit, poultry unit and dairy unit. The schematic representation of the farm components are depicted in Fig.3

Fencing: The entire farm was enclosed by metal fencing, while a section on its northern side was covered with a brick wall to ensure effective protection against trespassing. A period of at least 5 to 10 years is recommended for calculating the annual increase. This duration helps in capturing sufficient data to understand trends and mitigate the effects of short-term anomalies.

RESULTS AND DISCUSSION

The farmer practicing integrated farming system owns a land area of 1.72 ha. On his farm, he owns 6 crossbred cows, 25 does, 100 desi chicken. The farm has machinery like milking machine, chaff cutter, power tiller, sprayer, spade, crow bar, hand hoe. The contents and overall economic analysis of various components of Integrated Farm (IF) in detail are

i) Horticulture crop

In a 25-cent area, brinjal was cultivated with a spacing of 60 x 60 cm, taking 140-150 days for the entire cultivation cycle. The yield of brinjal amounted to 2.5 tons per 25 cents, with a sale price of Rs.10 per kilogram. The income from brinjal cultivation experienced a 15% annual increase, while expenses incurred rose by 10% each year.

Simultaneously, bhendi was cultivated in the same 25-cent area, with a spacing of 45 x 30 cm. The yield of bhendi was 1.5 tons per 25 cents, sold at Rs.10 per kilogram, and the harvesting duration lasted for 90 days. Similar to brinjal, the income from bhendi cultivation also saw a 15% annual increase. Moving on to orchard and border crops, coconut serves as the primary crop in this cropping system. The orchard includes 100 tall coconut plants and 100 dwarf plants. The sale prices for tall and dwarf coconut plants are Rs.10 per nut. Additionally, around 50 jackfruit plants were grown, sold at Rs.75 per fruit. Mango trees, numbering 10, produce fruits sold at Rs.20 per kilogram (50 kg per tree per year). Other horticultural crops include 10 sapota plants, 10 guava fruits, 10 custard apples, and 5 lime plants, all contributing to a considerable income. The benefit-cost ratio for these horticultural crops is calculated at 1.95. Given the annual increase in income (15%) and expenses (10%) for brinjal and bhendi, as well as the perennial nature of coconut, jackfruit, mango, and other fruit trees, a minimum of 5 years would be appropriated to observe these trends (Rangasamy *et al*., 1996). The income-expenditure of horticulture component presented in Table 1.

ii) Animal components

Dairy unit: It comprises 6 crossbred cows, with 3 animals having female calves and 3 in a pregnant condition. The average daily milk yield is 10 litres. The sale price of milk is Rs.42 per litre. The feeding regimen includes concentrate at Rs.20 per kilogram (4.5 kg), green fodder (20 kg), and dry fodder (5 kg), with a total daily feed cost of Rs.90. Regular veterinary checkups are conducted monthly, and milking is efficiently managed using a milking machine. The entire dairy unit is effectively handled by a single laborer as per the farm management design. The total lactation period is 240 days, with a dry period of 65 days. With lactation period and dry periods, data over 5 years could insights into milk production and economic viability.

Goat unit: In the stall-fed goat farming unit, approximately 25 does and 2 bucks of Tellichery breeds are reared. All does were purchased while pregnant and are nourished with a diet comprising jackfruit leaves, mango leaves, etc. They were also provided with

concentrate, with does receiving 6.75 kg per month and bucks receiving 7.5 kg per month. The sale of bucks, typically done at 11 months, is priced at Rs. 350 per kilogram, while does were sold at Rs.300 per kilogram. This system ensures a comprehensive approach to the breeding and sale of Tellichery breed goats in an organized and efficient manner. On income and expenses (10%), a period of 5 to 10 years could helpful in understanding the profitability and sustainability.

Poultry unit: In the semi-intensive rearing system, approximately 100 desi chickens were raised for a period of 72 weeks. The cost of day-old chicks is Rs.30 each. After the 72-week period, culling is done, and the sale price per bird is Rs.250. Additionally, eggs were sold at Rs.6 per egg. Both egg and chicken sales see a 15% annual increase, while expenditures rose by 10% each year. Although the standard egg production level is 180 to 220 eggs per bird per year, the economic analysis is based on 150 eggs per bird.

The cost of feed for the brooder stage is Rs.16 per kilogram, for the grower stage it is around Rs.14 per kilogram, and for the layer stage, it is Rs.15 per kilogram. The benefit-cost ratio for the animal components in this system is calculated at 1.80, indicating a positive economic outcome. The annual income increase of 15% and expense of 10 % for animal components. The income-expenditure of animal components presented in Table 2.

iii) Fish culture

The aqua pond unit, with an ideal area of 0.5-2 hectares but usable even at 0.02 hectares, is characterized by an ideal depth of 1.5-2 meters and water pH in the range of 7.5-8.5. This farm incorporates a combination of Katla, Rohu, and Mrigal, the latter being bottom feeders. The stocking density is set at 3000 fingerlings per acre, with the cost of seed at Rs.3 per fingerling (Singh and Ravisankar, 2015).

The feeding strategy involved using rice bran at Rs.10 per kilogram and oilcake at Rs.20 per kilogram. Cost of fertilizer (Exclu. cow manure) is around Rs.1400. The average annual yield reaches approximately 3 tonnes per acre per year, sold at a price of Rs.150 per kilogram. Income saw a 10% annual increase, paralleled by a 10% rise in expenditure. Considering, annual yield and annual increase in income and expenses (10%), a period of 5 years could help in accurately assessed the long term viability. The average annual income is estimated at Rs.4.5 lakhs, with expenditures amounting to Rs.2, 47, 900 per year. Consequently, the net income stands at around Rs.2, 02,100 per year. The benefit-cost ratio for this aqua pond unit is calculated at 1.81.

iv) Agriculture crop

In the cultivation area of 67 cents, paddy cultivation was practiced with a spacing of 12.5 x 10 cm, requiring approximately 110-120 days for harvest. The average yield of paddy was around 1.4 tonnes, and the sale price was Rs.1410 per quintal. Concurrently, green fodder cultivation covered an area of 50 cents with a spacing of 60 x 50 cm. This

perennial cultivation yields an average of 75 tons per year through seven harvests. The sale of rooted slips fetched Rs.2 per slip, with a seed rate of 8000 rooted slips. The annual income increase for paddy and green fodder were 10% and expenses 5 % respectively. For paddy and green fodder, which have shorter growth cycles, a period of 5 years could help in understanding yield trends and market conditions. The total income from paddy was Rs.18,800, incurring an expenditure of Rs.12,000, resulting in a net income of Rs.6,800 (BC ratio – 1.56). For green fodder slips, the total income is Rs.32,000, with an expenditure of Rs.24,210, leading to a net income of around Rs.7,790 (BC ratio – 1.32). The overall benefit-cost ratio on agriculture crop is calculated at 1.44 indicating a favorable economic outcome (Ponnusamy and Devi, 2017). The projected income – expenditure of all components over a period of five years were mentioned in the Table 3.

Additionally, the farm produced approximately 5 tonnes of vermicompost and sold at Rs.10 per kilogram in a year. Due to market demand for high-quality organic fertilizer in the local market, the farmer decided to sell the produced vermicompost. The overall benefit cost ratio of the entire integrated farm was estimated to 1.75. This diversified approach contributed to the overall economic viability and sustainability of the farming system (Sunil *et al*., 2023).

CONCLUSION

The integrated farming system (IFS) case study presented here showcased a comprehensive and sustainable approach to agriculture, combining diverse components such as crop cultivation, livestock rearing, and aquaculture. Mr. I. Paneer Selvam's farm, with its judicious integration of dairy, poultry, goat farming, horticulture, and aquaculture, exemplified the benefits of a well-designed IFS model.

In the dairy unit, the strategic management of crossbred cows not only ensures a consistent milk supply but also reflects economic prudence through efficient feed utilization and timely veterinary care. Similarly, the semi-intensive rearing system for desi chickens demonstrated an organized approach, with attention to factors such as feed cost, culling, and egg production. The inclusion of stall-fed goat farming with Tellichery breeds added another layer to the farm's diversification, focusing on efficient breeding practices and targeted sales strategies. The horticultural component, with a variety of fruit trees and plants, contributed not only to the economic aspect but also enhanced the overall ecological balance of the farm. Furthermore, the aqua pond unit emphasized sustainable aquaculture practices, considering factors like stocking density, feed costs, and market dynamics. The calculated benefit-cost ratio for each component indicated the economic viability of the entire integrated farming system. The farm's success is not only measured in financial terms but also in its contribution to environmental sustainability, resource optimization, and resilience to market fluctuations. The case study underscored the importance of a holistic and diversified

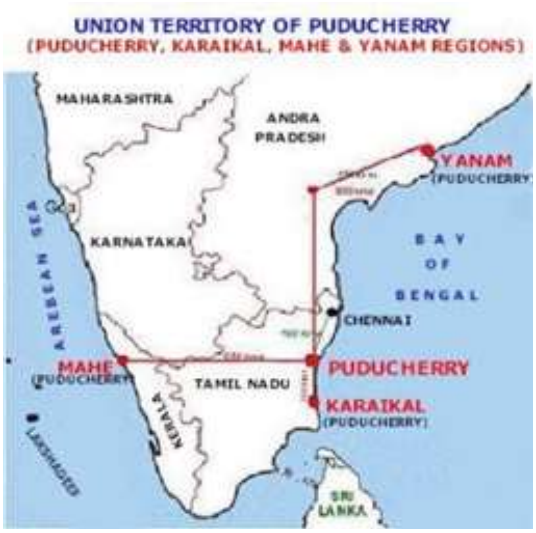

Fig.1. UT of Puducherry

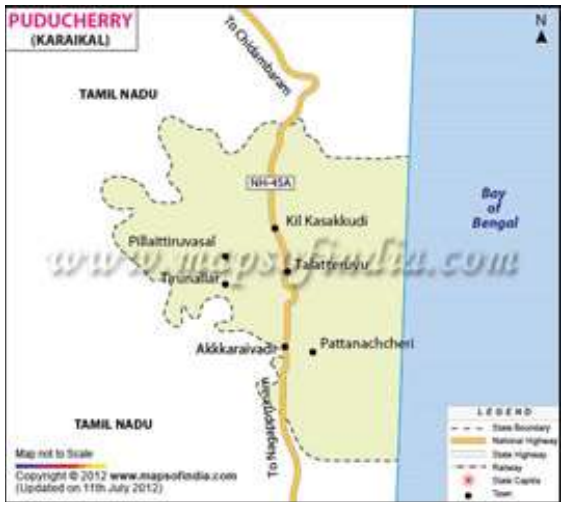

Fig.2. Outline of Karaikal district

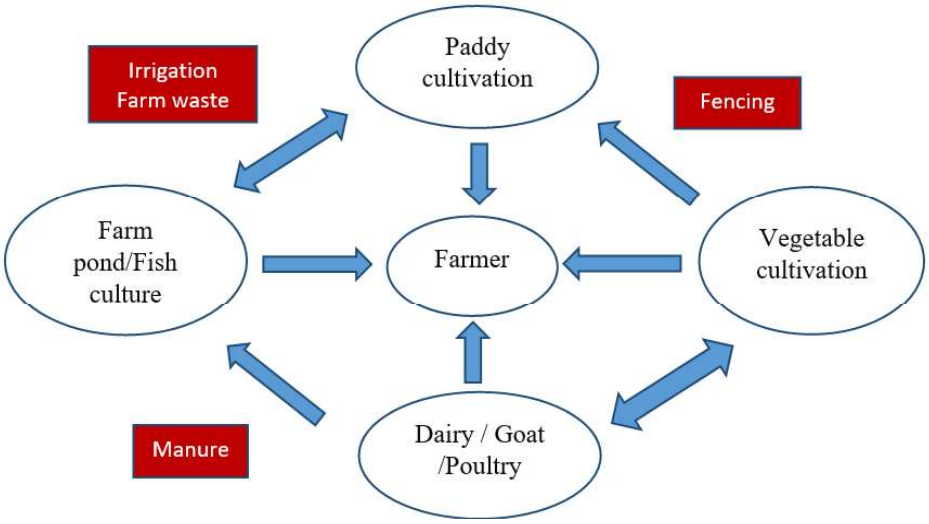

Fig.3. Schematic representation of components of the farm

Table 1. Income-Expenditure of crop components

Crops	Total income (Rs.)	Total expenditure (Rs.)	Profit (Rs./ year)	BC Ratio
Coconut	2,60,000	1,40,664	1,19,336	1.84
Brinjal	50,000	25,970	24,030	1.92
Bhendi	30,000	23,270	6,730	1.28
Jackfruit	2,65,600	81,049	1,84,551	3.27
Mango	10,000	4,750	5,250	2.10
Sapota	57,640	44,125	13,515	1.30
TOTAL	**Rs. 6,73,240**	**Rs. 3,19,828**	**Rs.3,53,412**	**1.95**

Table 2. Income-Expenditure of animal components

Animals	Total income (Rs.)	Total expenditure (Rs.)	Profit (Rs./year)	BC Ratio
Crossbred cows	3,03,840	1,30,890	1,72,950	1.75
Tellichery goat	1,68,750	80,427	88,323	2.09
Desi chicken	1,35,200	85,100	50,100	1.58
Total	**Rs. 6,07,970**	**Rs. 2,96,417**	**Rs.3,11,373**	**1.806**

Table 3. Income – Expenditure of all the components over a period of 5 years

Components	1st year		2nd year		3rd year		4th year		5th year	
	Income	Expenses	Income	Expenses	Income	Expenses	Income	Expenses	Income	Expenses
Brinjal	50000	25970	57500	28567	66125	31424	76043	34566	87450	38022
Bhendi	30000	23270	34500	25597	39675	28157	45626	30973	52470	34070
Crossbred cows	303840	13089	334224	137435	367646	144307	404400	151522	444852	159098
Tellichery goats	168750	80427	185625	84448	204188	88670	224606	93103	247067	97758

Desi chicken	135200	85100	155480	93610	178802	102971	205622	113268	236466	124595
Fish culture	450000	247900	495000	27269	544500	299959	598950	329955	658845	362950
Paddy	18800	12000	20680	12600	22748	13230	25022	13891	27524	14586
Green fodder	32000	24210	35200	25421	38720	26692	42592	28027	46851	29428

approach to farming, presenting a model that can inspire other farmers and contribute to the advancement of sustainable agriculture practices.

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