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A comprehensive analysis of an integrated farm in Kerala

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Abstract

This case study examines the implementation and success of an Integrated Farming System (IFS) in Kerala, focusing on a 3-acre farm in Thrissur district. Small and marginal farmers in India, constituting a significant portion of the rural community, often struggle with limited resources and face challenges in earning a sustainable livelihood. The study explores how IFS, which integrates livestock and crop production, addresses these challenges by fostering a symbiotic relationship among different components, leading to enhanced economic viability and sustainability. The farm showcases a diverse range of agricultural activities, including pig farming, dairy farming, poultry farming, duck rearing, fish rearing, and fodder crop production. Through the integration of these components, the farm not only maximizes output while minimizing expenses but also contributes to environmental sustainability. Noteworthy features include an efficient organic waste recycling system, a sprinkler irrigation system, composting, biogas production, water harvesting pond, and an aquaponics unit for fish cultivation. The study evaluates the economic viability of each component, such as crop cultivation and livestock considering both income and expenditure. The results indicate that the Integrated Farming System has significantly contributed to the overall profitability of the farm, showcasing positive outcomes in terms of income generation, resource utilization, and environmental responsibility. The findings suggest that integrated farming can serve as a key driver of prosperity, sustainability, and recognition in the agricultural sector, offering inspiration to other farmers seeking innovative and sustainable practices for enhanced income and community well-being.

Keywords: Integrated farming system, sustainable agriculture, farm profitability, resource recycling, Kerala

Introduction

In recent years, the agriculture sector has faced numerous challenges, including climate change, natural resource degradation, declining productivity, and issues related to landholding size and profitability (Agovino *et al.*, 2019) ^[1]. The conventional practice of monocropping has contributed to lower farm productivity, ecosystem degradation, soil health deterioration, and a decline in biodiversity (Panklang *et al.*, 2022) ^[4]. Research conducted in India and globally highlights that focusing solely on single-commodity development efforts has not yielded the desired results in terms of sustainability. To address these challenges, there is a pressing need for crop diversification, which has been identified as crucial for improving profitability, soil fertility, and resilience to climate change (Mishra *et al.*, 2022) ^[3]. Dairy farming, regardless of the type of animals and breeds involved, has been a fundamental aspect of prevailing agricultural systems in the country. Integrated farming system (IFS) models, incorporating elements such as Dairy, Duckery, Poultry, Horticulture, Apiary, and Fishery, have demonstrated increased profitability compared to sole cropping (Channabasavanna *et al.*, 2009) ^[7]. IFS involves the integration of crop production with livestock, fishery, and other components in a sustainable and holistic manner. This approach, encompassing both crop and livestock diversification, enhances soil fertility, fosters synergies among different components, and promotes resource

recycling, leading to higher crop production and economic returns (Palsaniya *et al.*, 2022) ^[8]. IFS models exhibit greater resilience against extreme weather conditions, reduce dependence on external inputs, and efficiently utilize natural resources while fostering positive interactions between crops and livestock (Walia *et al.*, 2019) ^[6]. Incorporating agroforestry, agri-silvi-horti-pastoral, or horticulture components in IFS contributes to reducing soil erosion, sustaining soil health, and ensuring food security (Choudhury *et al.*, 2022) ^[2]. Furthermore, IFS plays a role in biodiversity conservation by cultivating and integrating diverse crops, indigenous livestock breeds, and regional bird species, ultimately contributing to food and nutrition security (Paramesh *et al.*, 2022) ^[5].

Materials and Methods

In the ongoing investigation, a deliberate choice was made to focus on a farm situated in the Thrissur district of Kerala, owned collectively by three brothers: Biju, Juby, and Bijoy. This particular farm, serves as a noteworthy model for enhancing farmer income through the seamless integration of diverse agricultural practices. The range of activities includes pig farming, dairy farming, poultry farming, duck rearing, fish rearing, and fodder crop production. Spanning across a 3-acre expanse, the farm stands out for its distinctive features, notably the implementation of an efficient organic waste recycling system and sprinkler irrigation system. These

sustainable practices not only contribute to the farm's productivity but also reflect a commitment to environmental responsibility.



Recognizing the exceptional efforts and achievements of the three brothers, the Animal Husbandry Department bestowed upon them a prestigious award for being the best-integrated farm in the district. To gain insights into the success story, an in-person interview with the farmer was conducted during a visit to the farm. The data collected during this interaction was gathered using a semi-structured interview schedule, allowing for a comprehensive understanding of the integrated farming practices and the unique strategies employed by the brothers to achieve agricultural excellence in their 3-acre domain.

Results and Discussions

Modern farmers aim to reduce expenses while maximising output. Three brothers Biju, Juby and Bijoy together practising Integrated Farming System (IFS), owns land of 3 acres with several livestock and fodder crops. On his farm, he also owns 20 cent pond with fish rearing with irrigation capacity, along with 48 cattle (HF and jersey breed cows), 200 gramasree, 25 Ducks, 2 Goose, 150 pigs etc. For the past 23 years (started on the year 2000), the 3-acre farm has been under organic cultivation. The farm also has machinery like grass chopper. The certain other unique features of the farm were an organic waste recycling system, sprinkler irrigation system, composting, biogas production, water harvesting pond, and aquaponics unit for fish cultivation. Let's look at the various Integrated Farming System (IFS) components of the farm in detail:

Crop component

The primary crop in the cropping system on a 2-acre organic cultivation land is Fodder (super napier). The cultivation involves a unique approach where washing from the cow shed and slurry from the biogas unit are combined in a tank to create organic fertilizer for the fodder. Planting of stem is carried out every three years, incurring a labor charge of 40,000 rupees. The stems for recultivation are sourced from the farm itself. Sprinklers are employed for irrigation, drawing water from a fish rearing pond. Irrigation is performed once every three days for a duration of three hours. The entire yield of 2,70,000 kg of fodder annually is utilized to feed the cattle on the farm, with a daily collection rate of 750 kg to meet the animals' daily requirement of 15 kg each. While typically sufficient for the livestock's roughage needs,

there is a shortage of fodder during the summer, leading to the purchase of conventional feed like pineapple stems from external sources.



The field also hosts 60 coconut plants, mainly for household use, yielding limited coconuts due to diseases. Additionally, there are 50 banana plantains for household consumption. 25 nutmeg plants yielding an annual income of 1,50,000 Rs. A dedicated laborer tends to nutmeg collection, irrigation, fertilization of fodder, and packaging dried cow dung, earning a monthly salary of 18,000 rupees. If the gathered forage is sold at a price of 4 rupees per kilogram, the resulting revenue amounts to 180,000 rupees.

Type of crop	Total income	Total expenditure	Profit
Supper Napier	1,80,000	13,333	1,66,667
Nutmeg	1,50,000	54,000	96,000

Animal components

Cattle farming

The dairy unit consists of 40 crossbred cows of Holstein Friesian (HF) and Jersey, along with 8 calves. Four laborers are assigned to manage various tasks in the cattle shed, each responsible for the well-being of 10 cows, including feeding, collecting fodder, washing, and maintaining cleanliness. The annual salary for these four laborers amounts to 8,64,000 Rs. To ensure the cattle have access to pure drinking water, an automatic drinker system is in place. Green grass is cut using choppers, and the farm cultivates fodder, providing 15 kg per day for each cow. The monthly concentrate feed provided to each cow consists of 6kg of pellets and a combination of 1.5kg coconut oil cake and cotton seed cake.



Additionally, each cow receives 30ml of liver tonic, 50ml of mineral mixture, and 20g of soda bicarbonate. The monthly

cost for this feed for all cattle amounts to 259,550, resulting in an annual total feed cost of 3,114,600.

The dairy unit yields an average of 380 liters of milk per month, resulting in 1,36,800 liters annually. Milk is sold at a rate of 43 Rs/liter, generating an annual income of 58,82,400 Rs. Additional income is derived from dairy byproducts such as curd and paneer, sold at 65 Rs/liter and 400 Rs/kg, respectively. Currently, a daily production of 30 liters of milk is allocated for the generation of byproducts. This distribution involves using 15 liters of milk for curd production and another 15 liters for paneer production. The curd production yields 15 liters of curd, generating a monthly income of 975 Rs. Simultaneously, the paneer production, resulting in 200g of paneer per liter of milk, yields a monthly income of 1125 Rs (75 Rs per liter of milk). The collective annual income from these dairy byproducts amounts to 25,200 Rs. To enhance byproduct production, plans are underway for more dairy items like sweets.

Hygiene in the shed is maintained by permanently fixing mats to the concrete floor, preventing the accumulation of mastitis-infected milk and dirt. Fans are installed for a comfortable environment.



Regular veterinary check-ups, including artificial insemination, treatment, medicines, and vaccination, incur a monthly expense of 30,000 Rs, totaling 3,60,000 Rs annually. Calves are sold at 5-6 months, with female calves fetching 5000 Rs and male calves 2000 Rs. Shed washing is used as organic fertilizer for fodder, while cow dung is initially stored above ground to undergo partial drying. Subsequently, it is spread over the ground for further drying.



Poultry is raised in the area to facilitate the breakdown of cow dung into finer particles, and the resulting dried powder is

sold in 50 kg bags at 200 Rs/bag. Each cow produces approximately 30 kg of manure per day, totaling 432,000 kg per year. Revenue generated from the sale of cow dung is obtained through both local sales and transactions with companies that subsequently distribute it to nurseries. The distribution ratio between local sales and sales to companies is 50:50. The total income from cow dung amounts to 1,728,000 Indian Rupees, derived from the sale of 8,640 bags.

Pig

The pig farming unit comprises 150 pigs, which are a crossbreed of Duroc, Large White Yorkshire, and Landrace. These pigs are purchased at the age of 2 months for a buying price of 2000 Rs each, resulting in a total cost of 300,000 Rs per year for acquiring piglets. The pigs are sold at the age of 10 months, weighing 130 kg, at a selling price of Rs 6000. The sales occur every 2 months, allowing for 25 pigs to be sold throughout the year, generating an annual income of 900,000 Rs. The sales take place in the local market, conveniently located 3 km away, where the demand for pork is high.



To maintain biosecurity and prevent the entry of diseases such as African Swine Fever, only designated vehicles are permitted to enter the farm premises. The feed for the pigs is sourced from hotel waste, obtained at no cost, and collected from a location 15 km away using the farm's vehicle. The sole expense related to the feed is the fuel cost, amounting to 114,480 Rs per year. Additionally, kitchen waste can be utilized as an alternative feed source for the pigs.

One laborer is assigned to carry out various tasks within the pig farming unit, incurring a salary expense of 216,000 Rs per year for their services. Overall, the pig farming venture seems economically viable, with a focus on cost-effective feed sources, regular sales intervals, and adherence to biosecurity measures for disease prevention.

Poultry farming

The poultry unit follows an open-rearing system, primarily focusing on the Gramasree breed with a population of approximately 200 birds. The primary goal of poultry rearing in this context is the efficient drying of cow dung. The birds are housed in a well-fenced open area, where cow dung is spread to expedite the drying process. The poultry's natural digging behavior contributes to faster drying, and they also benefit from consuming the protein-rich worms found in the cow dung.

On a daily basis, the poultry unit yields around 20 eggs, averaging a yearly output of 240 eggs. The birds are fed with expired chapathi from a local bakery, procured at a cost of Rs 5 per kg. The daily feed requirement amounts to 12 kg, resulting in an annual expenditure of Rs 21,600.

The eggs and meat obtained from the poultry are primarily utilized for household consumption. However, if these products are sold, it can generate an income of Rs 43,200 from egg sales and Rs 36,000 from meat sales.

Goose

Two geese were raised with a focus on ornamental value rather than profit. The main objective was not centered around generating income. Currently, a couple of geese are nurturing on the farm. If the female goose laid eggs and successfully hatched them, the resultant goslings were sold at the age of two months, fetching a price of 1500 Rs per pair.

Fish

The aquaponics system comprises an artificial pond spanning a 20-cent area. Approximately five years ago, tilapia fingerlings were introduced and successfully developed through intensive cultivation. The primary feed for the tilapia consists of expired bread, with a daily consumption rate of 10 kg. The cost of the bread amounts to 5 Rs per kilogram, resulting in an annual expenditure of 18,000 Rs for fish feed. Harvesting is conducted when the tilapia reaches a weight of half a kilogram, and the fish are then sold at a rate of Rs 120 per kilogram, based on market demand. The income generated from the fisheries sector is estimated to be around 27,000 Rs annually.



Notably, the pond water serves a dual purpose: it is utilized for cleaning cattle sheds and pigsties, as well as for the irrigation of fodder. To facilitate these activities, two motors have been installed in the pond. This integrated approach enhances the overall sustainability and productivity of the aquaponics unit.

Type of animal	Total income	Total expenditure	Profit
Cattle	7635600	3561000	4074600
Poultry	79200	21600	57600
Pig	900000	630480	269520
Fish	18,000	27,000	9000

Biogas plant

A biogas production facility with a 25-cubic-meter capacity

and the ability to process 250 kg of dry waste utilizes pig manure and washing from the pig sty. A well-established pipe network facilitates the process smoothly. The produced biogas serves as a cooking fuel for three farmhouses and is also used for preparing meals for laborers, as well as cooking in a local house. The residual waste from the biogas unit is incorporated into the organic recycling system.



The slurry derived from biogas, combined with washing from cow dung, is employed as an organic fertilizer for cultivating fodder.

Compost pit

The hotel waste intended for pig feed is utilized, while the undesirable portion is placed in an on-site compost pit. This material is allowed to remain in the pit for a duration of two months to undergo the composting process.

Conclusion

In conclusion, the farm owned collectively by Biju, Juby, and Bijoy in the Thrissur district of Kerala stands as a remarkable example of successful and sustainable integrated farming practices. Through their commitment to diverse agricultural activities such as pig farming, dairy farming, poultry farming, duck rearing, fish rearing, and fodder crop production, the brothers have not only enhanced their own income but have also set a high standard for agricultural excellence in the region. These sustainable practices not only contribute to the farm's productivity but also highlight a broader commitment to the well-being of the local ecosystem. The in-person interview conducted with the farmers provided valuable insights into the unique strategies employed by Biju, Juby, and Bijoy to achieve agricultural excellence on their 3-acre farm. Their success story serves as an inspiration for other farmers, demonstrating that through innovative and sustainable practices, it is possible to not only enhance income but also contribute to the overall well-being of the environment and the community. This Thrissur district farm stands as a shining example of how integrated farming can be a key driver of prosperity, sustainability, and recognition in the agricultural sector.

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