Eco. Env. & Cons. 29 (May Suppl. Issue) : 2023; pp. (S432-S434)
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ISSN 0971–765X

DOI No.: http://doi.org/10.53550/EEC.2023.v29i03s.074

Integrated fish farming system: a way towards sustainability and prosperity of farmers

Gyan Chandra[1]*, Pramod Kumar Chaudhary[2] and Manoj Kumar[2]

[1]*Department of Fisheries Resource Management, College of Fisheries, Kishanganj 855 107, Bihar Animal Sciences University, Patna, India
[1]KVK, Supaul 852 111, Bihar Agricultural University, Sabour, Bhagalpur, India

(Received 10 December, 2022; Accepted 22 February, 2023)

ABSTRACT

Aquaculture is an important source of income, employment, and nutrition in rural areas. An integrated fish farming system is very much beneficial for farmers. Technology is climate resilient and supports good income compared to crop production and fish farming alone. It is efficient in providing regular income and recycling agricultural waste. Krishi Vigyan Kendra, Supaul, conducted the study in NICRA village Sadanandpur to estimate fish production, disease occurrence, and economic profitability of the integrated fish farming system. The generated data were used to calculate the gross return, net return, and ultimate B: C ratio; the integrated fish farming system witnessed higher fish production and economic return. The B: C ratio of paddy, wheat, fish, and integrated farming system are 2.7, 1.78, 3.7, and 4.3, respectively. Thus, farmers can get a higher financial return by adopting an integrated fish farming system with a complete package and practice.

Key words: *Integrated farming system, Profitability, Waste-recycling, Regular income*

Introduction

Fish farming is an important activity in the Koshi region, and plenty of water availability supports aquaculture. The area is characterized by its fertile land, abundant water resources, and warm climate, all ideal for fish farming. In recent years, fish farming in the Koshi region has grown significantly, with the introduction of new technologies and practices that have improved the productivity and efficiency of the industry. However, there is still ample scope for fisheries development in the area, which is lacking in many aspects. The Bihar government is also committed to developing the Koshi region's fish farming industry through various programs and initiatives, including providing financial support for farmers to purchase equipment, constructing the pond, upgrading their facilities, and promoting sustainable fish farming practices. Despite these efforts, some challenges still need to be addressed; these include a lack of access to quality seed stock, inadequate infrastructure, market access, and the need for better disease management and water quality control. Koshi area is also very vulnerable to various climatic factors such as flood and drought. There is a river network in the Koshi area, and the river also supports fisheries activities. But, the capture fisheries in the rivers are adversely affected by wanton fishing methods and exploitations. Thus, sustainable management of these vulnerable fisheries resources must be considered (Chandra *et al*., 2010; Chandra and Saxena, 2013; Chandra and Saxena, 2014; Chandra and Fopp-Bayat, 2021). Overall, fish farming in the Koshi region of Bihar can significantly con-

tribute to the local economy and food security, but it will require continued support and investment to address these challenges and achieve its full potential. Aquaculture provides good returns and protein security in comparison to agriculture alone. Fish is an excellent source of digestible protein and helps in fighting malnutrition. Aquaculture is one of the fastest-growing food-producing sectors in the world, and correspondingly, aquaculture commodities are likely to witness an increase in demand and importance in the coming future (Pedini and Shehadeh, 1997; FAO, 2002; Delgado *et al*., 2003).

Integrated fish farming is an aquaculture system that combines raising fish with other agricultural practices, such as crop cultivation or livestock rearing. The goal of integrated fish farming is to create a more sustainable and efficient system by utilizing the waste produced by one component of the system as a resource for another. For example, in an integrated fish and crop farming system, the waste produced by the fish is used as fertilizer for crops, while the crops provide feed for the fish. The technology will help to reduce the need for commercial fertilizers and feed; it can also help to minimize waste and improve water quality parameters. Integrated fish farming can also involve the integration of fish farming with livestock production. Integrated fish farming has many potential benefits, including improved water management, reduced waste, and increased food security. It is also seen as a more sustainable form of aquaculture, as it mimics natural systems and reduces the need for inputs from external sources. However, integrated fish farming can be complex and requires careful management of the different components of the system. Furthermore, there may be challenges in finding the right mix of crops, livestock, and fish species that are compatible and can coexist effectively. Overall, integrated fish farming is a promising approach to aquaculture, but it requires careful planning, management, and monitoring to ensure its success. Integrated fish farming technology is straight forward, cost-effective, and requires less initial capital. The system is also very efficient as most of the waste is recycled, and thus technology is very much climate resilient. Considering the facts, the study was conducted in NICRA village Sadanandpur, Supaul, Bihar, to evaluate the performance of an integrated fish farming system and compare it with crop production and fish farming for 03 years.

Materials and Methods

Krishi Vigyan Kendra, Supaul, conducted the study in NICRA village Sadanandpur, Supaul, Bihar. Various training programmes, visits, frontline demonstrations (FLD), and on-farm trails (OFT) were conducted to motivate the farmers to adopt an integrated fish farming system. The study was conducted for three years, and various data such as cost of cultivation, gross return, net return, and B: C ratio were obtained fromeach farming system, i.e., integrated fish farming system, fish farming, and crop production. The generated data were used to calculatethe gross return, net return, and ultimate B:C ratio. Net return was calculated using the formula Net return: Gross Return – Cost of Production, and the B: C ratio was calculated using the formula B: C Ratio: Gross Return/ Cost of Production.

Results and Discussion

The results obtained from the farmer'sfield showed that an integrated farming system is very beneficial and gives good income to the farmers. Farmers also got good returns from crop production (paddy, wheat) and fish farming, but it was low compared to the integrated fish farming system. Apart from that, an integrated farming system also ensures regular income and recycling of generated agricultural

Table 1. Comparison of different parameters among integrated fish farming, fish farming, and crop production.

Category	Yield (qt/ha)	*Economics of intervention (Rs/ha)			
		Gross Cost	Gross Return	Net Return	**BCR
Paddy (R.M-1)	35	27000	56000	29000	2.7
Wheat (DBW-14)	28	23500	42000	18500	1.78
Fish	17.1 qt/ha	68,000	256500	18500	3.7
Integrated fish farming system (fish, dairy-two cows, banana on pond bandh)	17.5qt/ha (fish) + 1500 lit. (milk) + Bunch of bananas 600	81000	351500	270500	4.3

waste. Farmers obtained good returns when they adopted an integrated fish farming system with complete package and practice. The B:C ratio of paddy, wheat, fish, and integrated farming system are 2.7, 1.78, 3.7, and 4.3, respectively.

Different farming systems' B: C ratio indicates that an integrated approach is very profitable. Biswas *et al*., (2016) also conducted a similar study; they observed better production and sustainable economic return could be achieved through integrated farming, i.e., duck-cum- fish culture and vegetable cultivation on the dykes.

Conclusion

It can be concluded that an integrated fish farming system gives better returns than crop production and fish farming alone. The integrated fish farming system is very beneficial for marginal farmers with lesser land holdings and capable of providing year-round income. Integrating fish farming with other agricultural practices can help to increase overall food production and provide a reliable source of food, especially in areas where arable land is limited; it can create new income and job opportunities for farmers, especially in rural areas with limited employment options. Integrated fish farming can increase the resilience of farming systems by providing a backup source of food and income in the event of a crop failure.

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