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Integrated Fish Farming Methods and Farmers' Socioeconomic Situations: Data from Saharsa, Bihar

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ABSTRACT

This is accomplished by determining the implications of the integration of fish farming in the socioeconomic circumstances of farmers in the Saharsa district, Bihar where both farming and fish production integration have great prospects. Under purposive sampling, three villages that were practicing four integrated models, namely; Fish only and Fish + Paddy, Fish + Duck, and Fish + Horticulture were sampled. The structured interviews and field observations were used to collect primary data on income, employment days, expenditure on education, food security index, productivity and the monthly fish production. Findings indicated that integrated fish farming led to the growth of the annual farmer income of 60.4 percent, employment time of 36.5 percent, education expenditure of 55.8 percent, and household food security of 34.4 percent. Fish + Horticulture had the highest productivity and net returns of 2250 kg/ha/year and Rs 49600/ha/year and adoption decreased with increment in the complexity of integration. The monthly patterns of fish production in individual villages demonstrated a steady increase in production between the period of January and June thereby signifying better management mechanism and seasonal advantage. It is found that integrated fish farming can also be used an effective measure to boost the livelihood, food security and the overall economic sustainability of the rural population but nonetheless, this improved use of fish farming requires appropriate training, financial support as well as policy adjustments to improve overall rural development and the

spread of this practice across the target populations and regions.

Keywords: *Integrated Fish Farming, Socioeconomic Impact, Rural Livelihood, Food Security, Farmer Income, Employment Generation*

INTRODUCTION

Integrated fish farming can be defined as an inclusive agricultural system which links aquaculture to livestock farming, horticultural practice and crop production in a bid to maximize output of a farming unit to produce less waste. The idea of this model is recycling of resources (the by-products and waste of one component being input to another). In India, it has enjoyed popularity in states such as West Bengal, Assam, Odisha and Bihar whereby farmers combine fish culture with duck farming, poultry, horticulture and paddy cultivation to ensure multi-dimensional sources of incomes and reduced agricultural risks. But in the rural India, fish production is still unorganised, traditional with small landholdings and poverty that is still prevalent. The flood-prone Kosi area belonging to the district of Saharsa possesses critical potential of developing aquaculture farms, however, some of the issues that inhibit growth of the same in the area include scant awareness of scientific methods of farming, non-availability of adequate funds, absence of markets nearby, and governmental support. It is vital to assess the socioeconomic status of the fish farmers in Saharsa to have an idea about their fate and their ability to realize the concept of integrated fish farming. This paper seeks to examine several integrated fish farming systems and analyze their socio economic status, present loopholes and chances of implementing integrated fish farming as a feasible way of livelihood in the area.

1.1.Background of Integrated Fish Farming in India

Integrated fish farming is a long term sustainable farming habit that combines fish farming with poultry farming, farmed livestock, horticulture and plant farming. It is the most efficient use of resources, reduces waste and increases productivity of the farms. It is practiced in India in states such as West Bengal, Odisha, Assam and Bihar where small holder farmers diversify their incomes and maintain food security. Nonetheless, the fish farming is not well developed since it is hindered by the infrastructural limitations, lack of accessibility in terms of quality of seed and feed, and lack of technical training. The benefits of the system of

holistic farming are that farms can be able to boost their farms, nutrition standards, and help build work in the rural areas.

1.2.Rationale for Studying Socio-Economic Conditions of Fish Farmers in Saharsa

The district of Saharsa, located in the state of Bihar, presents a problem to its fish farmers as it has poor access to modern farming processes, market access, finance and training. It is essential to know their socio-economic state to define what they are limited in and what the opportunities of integrated fish farming might offer, as well as ways of developing their welfare economically. The proposed research will measure the socio-economic status of fish farmers in terms of the education level; amount of land they own; their income generating activities and knowledge about the integrated farming. It will also compare adoption of different types of integrated processes e.g. fish-cum-duck farming, fish-cum-poultry farming, fish-cum-horticulture and see and determine the results in carrying on the impact to the farm incomes, food security and rural development.

2. MATERIAL AND METHODS

The research author employed the purposive sampling technique to sample farmers in three villages in Saharsa of the Bihar State of India and to capture data using structured interviews on social and economic and productivity parameters and also through records verification. To determine productivity, economic returns, adoption rates and livelihood outcomes, the data were analysed using descriptive statistics and excel graphs.

2.1.Study Area

The experiment was carried out at Saharsa district of Bihar that lies within the Kosi river basin and is endowed with rich alluvial soils adaptable to both agriculture and aquaculture integration. The region possesses a subtropical climate (warm summers and average amount of rainfalls) which has resulted in an ideal environment to support the practice of integrated fish farms.

2.2.Selection of Respondents

There was a purposive sampling with the selection of farmers who

engaged in integrated fish farming. Three villages (Village A, Village B, and Village C) that had been noted as having taken up something related to integrated models of farming had been identified through consultation with the local fisheries and agriculture extension officers. In these villages, farmers who were fish-only farmers and Farmers in diversified integrated fish models (Fish + Paddy, Fish + Duck and Fish + Horticulture) were represented.

2.3.Data Collection

The structured interviews and field observations were conducted with the help of the pre-tested questionnaire focusing on the different aspects including:

- Pre- and post-Adoption income yearly
- The number of days of work per year
- The domestic spending on education
- Household a food security index
- Outputs (kg/ha/year) and net returns (Rs/ha/year) associated with the farms models
- The record of fish production per month January to June

To certify reliability and validity, the data was cross-checked with farm diaries and local cooperative data/information and contributions of Panchayat fisheries records Our results show that 68 percent of total fish were in good condition having no health complications and only seven percent of the overall fish were in bad condition with health complications It is clear that a significant percentage of fish reported was in good condition with no health complications.

2.4.Data Analysis

Collected data were integrated and analysed with descriptive statistical methods, such as the mean, standard deviation, and percentage rise/fall to determine the difference in socioeconomic variables and productivity performance. This was graphically presented (in bar graphs and line graphs) to be more easily interpreted in understanding the trends in monthly production. The analysis of all of the results was done on Microsoft excel to produce tabular and graphical representations in a systematic manner.

2.5.Integrated Farming Models Considered

The research selected 4 integrated culture of fish farming which are commonly practiced in the region namely Fish only, Fish + Paddy, Fish + Duck and Fish + Horticulture. These models were assessed to determine their productivity, economic returns and adoption level, and the general impacts on household livelihood indicators in the Saharsa, Bihar.

3. RESULTS

The research indicates that the practice of integrated fish farming has enhanced the socioeconomic status of Bihar farmers (Saharsa). Annual income of farmers rose by 60.4 percent, days per year engaged in employment by 36.5 percent, education expenditure by 55.8 percent and 34.4 percent increment in household food security. More diverse models such as Fish + Paddy, Fish + Duck and Fish + Horticulture were more productive and returning. Nonetheless, the rate of adoption became lower as the complexity of integration and the demands in resources increased. The trend in production in the chosen villages in the period January to June was upward, and this pointed out that integrated fish farming does not only increases income and food security, but also increases efficiency in production and resource use and therefore can be a constructive strategy in the economic development of the rural areas and nutritional security.

3.1.Impact of Integrated Fish Farming on Income and Livelihood Status

The statistics as shown in Table 1 shows that the integrated fish farming had a great positive effect on the socioeconomic status of the farmers in Saharsa Bihar. Again, this showed a tremendous growth of nearly 60.4 percent as the average annual earnings of farmers rose to Rs 72,500 as compared to 45,200 before which is a significant boost in financial security and employment stability at large.

Table 1: Income and Livelihood Status of Farmers Practicing Integrated Fish Farming

Parameter	Before Adoption (Mean ± SD)	After Adoption (Mean ± SD)	% Increase
Annual Income (Rs in '000)	45.2 ± 4.8	72.5 ± 6.3	+60.4%
Employment Days/Year	145 ± 12	198 ± 15	+36.5%
Expenditure on Education (%)	9.5 ± 1.2	14.8 ± 1.6	+55.8%

Household Food Security Index	0.61 ± 0.05	0.82 ± 0.04	+34.4%

The mean employment days per year rose by 36.5 percent to 198 days compared to 145 days signifying better utilisation of labour and less seasonal joblessness. Household spending on education also increased significantly by 55.8 percent upsurge in the spending on education by them in terms of percentage counting upped only 9.5 percent to 14.8 percent, which indicated that family members were now able to spend more resources in educating their children considering improved income. Moreover, household food security index was rise to 0.82 that implies food security has risen by 34.4 per cent in the availability of food and its quality. Altogether, the results served very clear indication that integrated fish farming plays an important role in enhancing income, employment, education, and food security of the rural farming families in the region.

3.2.Productivity and Economic Outcomes of Diversified Farming Models

The analysis given in Table 2 shows the productivity, economic advantages of various models of integrated fish farming in Saharsa, Bihar. The highest adoption levels were that of the fish only system, which registered 100 percent and a productivity of 1340kg/ha/year with a net return of Rs 29500/hectare/year and this was accompanied by the lowest input requirements and simplicity of the system.

Table 2: Productivity and Diversification Outcomes

Component	Productivity (kg/ha/year)	Net Return (Rs/ha/year)	Adoption Rate (%)
Fish only	1340 ± 85	29,500 ± 1,500	100
Fish + Paddy	1860 ± 90	41,200 ± 2,100	62
Fish + Duck	2100 ± 95	45,800 ± 2,300	47
Fish+Horticulture	2250 ± 110	49,600 ± 2,500	38

The research discovered that the integrated fish farming models generate a lot of productivity and economic returns. The adopted system of Fish + Paddy had 1860 kg/ha/year productivity and net return of Rs 41, 200 at 62% adoption level. The productive capacity of the system was 2100 kg/ha/year with net returns of Rs 45,800 and the level of adoption was lower at 47 per cent since it had additional management skills and input costs. It was found that the most productive was the fish + horticulture model which was 2250 kg/ha/year and lowest adoption of the model was 38%.

3.3.Trends in Monthly Fish Production Across Selected Villages

The trend as demonstrated in the graph shows that the production of fish is consistently high across Village A, Village B, and Village C but with the Village A situated at the top in terms of production all the time beginning with 120 kg in January rising steadily at intervals of 10 kg to 170 kg in June, which shows that it is doing well in terms of production and has good farming trend.

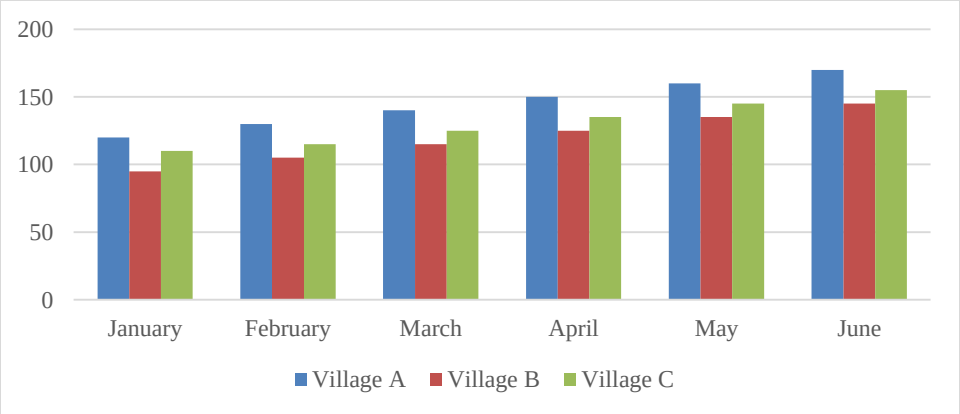

Figure 1: Monthly Village Comparison

Village B had the least production in the months; however, it has a moderate growth in the number of production as observed in January of 95 kg to June of 145 kg indicating continuous improvement regardless of the lesser quantities at the beginning. Village C also recorded moderate production with an upward trend during the six months as it increased in January, with its production level standing at 110 kg and recorded production level of 155 kg in June. The data shows the overall month on month many rise in fish production within all villages; these are seasonal gains, increased management and perhaps increase availability of feed and water for the flock during these months. These trends have shown that the implementation of integrated fish farming methods has managed to promote and ensure the improvement of sustained production in the region.

3.4.Discussion

The results of the research reveal clearly, that the aspect of integrated fish farming has brought about a life changing wave in terms of socioeconomic and nutritional issues of the farmers in Saharsa, Bihar. It is evident in the

significant increase in earnings per year by more than 60% once integrated fish farming is embraced, which means that the systems provide a sustainable tool to increase the earnings of farmers, making them more financially stable and less vulnerable to impacts of economic changes. This increase in income has been associated with gratifying rise in employment days indicating that integrated farming gives an opportunity to work throughout the year, therefore alleviating the situations of seasonal unemployment and underemployment, generally experienced in the rural regions. Also, this greater spending of families on education is an indication of their enhanced abilities to invest in the development of their human capital that would, in future, end the poverty cycle within the successive generations. The increase in the household food security index shows rise in access to nutritious elements of food which is quite essential to the health and wellbeing of rural children. Besides, productivity and economic performance of diversified integrated models indicates that fish only farming, although the most widely practiced with ease of practice and low input cost is not as productive and net returns as the integrated systems like fish + paddy, fish + duck, and fish + horticulture exhibited strong productivity as well as high net returns and this fact indicates the economic potential of multi-component farming systems. Nevertheless, there are indications of existing barriers like requirements of larger initial investment, absence of technical know-how, and whatever the cause of risk aversions may be among farmers being, which calls at least the need of target training, capacity building and institutional support to these diversified models. The trend of the monthly fish production by the various villages further corroborates the effectiveness of integrated fish farming, which is the progressively increasing production by all the villages by the end of six months with Village A being the first almost throughout the six months which may indicate variation in resource endowment, practices in management, and efficiency of adoption. All in all, what the results reveal is that, integrated fish farming is not only a productive/profitable venture but also a means towards the rural development, food security, better education and employment generation in the area so long as proper policy support, awareness programmes and extension services are provided to enable it to be widely adopted and be sustainable in the long term.

4. CONCLUSION

This paper notes that the integrated fish farming has greatly boosted the socioeconomic and nutritional standards of farmers in Saharsa, Bihar, by raising their income, employment, and educational investments as well as improving food security at the household level by a great margin. Instead of developing fish-only farming, diversified integrated farming models were demonstrated such as Fish + Paddy, Fish + Duck, and Fish + Horticulture, with these models showing greater productivity, total returns, and net returns than fish-only farming models, but were not adopted, necessitated by greater resource and management demands. The relative increase in fish production that has been witnessed in an almost steady rate every month in all the villages examined indicates the effectiveness and sustainability of these practices. Integrated fish farming thus can be a game-changer in improving the livelihoods, economic stabilization, and food security in the area when given the necessary technical training, financial assistance and improved extension services.

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REFERENCES

1. Araujo, G. S., Silva, J. W. A. D., Cotas, J., & Pereira, L. (2022). Fish farming techniques: current situation and trends. *Journal of Marine Science and Engineering*, *10*(11), 1598.
2. Aubin, J., Callier, M., Rey-Valette, H., Mathe, S., Wilfart, A., Legendre, M., ... & Fontaine, P. (2019). Implementing ecological intensification in fish farming: definition and principles from contrasting experiences. *Reviews in Aquaculture*, *11*(1), 149-167.
3. Biswas, B., Das, S. K., Mondal, I., & Mandal, A. (2018). Composite fish farming in West Bengal, India: redesigning management practices during the course of last five decades. *International Journal of Aquaculture*, *8*(12).
4. Dhawan, A., & Sehdev, S. (2020). Present status and scope of integrated fish farming in the north-west plains of India. *Integrated fish farming*, 295-306.
5. Francisco, H. R., Fabrício Corrêia, A., & Feiden, A. (2019). Classification of areas suitable for fish farming using geotechnology and multi-criteria analysis. *ISPRS International Journal of Geo-Information*, *8*(9), 394.
6. Hamza, D., Dorgham, S., Ismael, E., El-Moez, S. I. A., Elhariri, M., Elhelw, R., &

Hamza, E. (2020). Emergence of β-lactamase-and carbapenemase-producing Enterobacteriaceae at integrated fish farms. *Antimicrobial Resistance & Infection Control*, *9*, 1-12.

7. Haobijam, J. W., & Ghosh, S. (2023). Integrated fish farming and its influence on farm livelihoods in Manipur, India. *Aquaculture International*, *31*(4), 2011-2034.
8. Kumar, S., Bhatt, B. P., Dey, A., SHIVANI, S., Kumar, U., Idris, M. D., ... & Kumar, S. (2018). Integrated farming system in India: Current status, scope and future prospects in changing agricultural scenario. *The Indian Journal of Agricultural Sciences*, *88*(11), 1661-1675.
9. Poonam, A., Saha, S., Nayak, P. K., Sinhababu, D. P., Sahu, P. K., Satapathy, B. S., ... & Pathak, H. (2019). Rice-fish integrated farming systems for eastern India. *NRRI Research Bulletin*, (17), 33.
10. Sathoria, P., & Roy, B. (2022). Sustainable food production through integrated rice-fish farming in India: A brief review. *Renewable Agriculture and Food Systems*, *37*(5), 527-535.