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Enhancing rural livelihoods through small scale duck farming in flood-prone districts of Assam

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ABSTRACT: A study was conducted to estimate economic contribution of small-scale duck (15 *Pati* ducks under backyard system) farming towards rural livelihood in two flood prone districts of Assam. Two development blocks *viz*., Jonai and South-Salmara were selected from Dhemaji and Dhubri district respectively for the study. A total of six villages (three from each development block) were selected purposively to conduct the study. Altogether 120 small-scale duck farmers (20 from each village) were selected on the basis of their experience and who had kept minimum of 15 ducks in their household under backyard system. The study revealed that the total capital expenditure incurred was INR 10, 133.00 included fixed cost of INR 1, 000.00 and variable cost of INR 9, 133.00. Among the variable costs, labour costs were the largest component, accounting for 56.20% of the total variable cost followed by feed cost (29.83%) of the total variable cost. The cost of ducklings, at INR 750.00 (8.21%) and medicines and vaccines at INR 300.00 (3.28%) were relatively small. The income breakdown revealed 50.26% revenue generated from the sale of eggs, followed by sale of spent ducks and drakes (26.18%) and sale of surplus drakes (23.56%). The study also indicated that rearing 15 ducks could generate 34.22 man-days of employment over the 18-month period among rural farmwomen. Further the benefit-cost ratio of 1.56 was recorded by rearing of 15 ducks under backyard system, indicated substantial returns for each rupee spent. Therefore, small-scale duck farming has the potential to boost rural livelihoods, ensure food security and empower women, making it a sustainable and low-cost option for flood prone areas of Assam.

Key words: Assam, flood-prone areas, *Pati* duck, rural livelihoods, small-scale duck farming

Assam, a state crisscrossed by the mighty Brahmaputra River and its over 50 tributaries, is highly vulnerable to recurrent floods. These floods cause widespread destruction, severely impacting lives, field crops, livestock and overall rural productivity. As a result, farmers in flood-prone districts face declining agricultural yields and income, pushing them to seek diversified livelihood sources that are resilient to climatic disasters. In this context, small-scale duck farming emerges as a viable and adaptive option. Duck farming is particularly suited for flood-prone areas because ducks thrive in waterlogged environments where other agricultural practices and livestock might fail. Additionally, Assam, being a rice-growing state, predominantly cultivates rice in low-lying areas that are often flooded during the rainy season. This creates a unique opportunity to integrate duck farming with rice and fish cultivation. Such integrated farming systems can enhance productivity and offer a sustainable solution to the challenges posed by floods. The Food and Agriculture Organization (FAO, 2020) has also recommended integrating duck farming with lowland rice production as a crucial climate adaptation and mitigation strategy. Assam holds the second-largest duck population in India after West Bengal, with approximately 11.74 million ducks (BAHS, 2023), most of which are local Pati ducks (85.6%) reared under traditional backyard systems (Islam *et al.*, 2002). Small-scale duck farming, involving 5 to 20 ducks, is a common and long-standing practice in rural Assam, particularly among small and marginal farmers. This practice can act as a supplementary source of income, especially in flood-prone areas where agricultural crops suffer regular losses. In many developing countries, small-scale duck farming plays a vital role in household economies, food security and nutrition enhancement (FAO, 2009). Beyond economic contributions, small-scale

duck farming in Assam has the potential to efficiently utilize family labor, empower rural women and foster social equity. Ducks are reared for both egg and meat production, which are in high demand in Assam, fetching premium prices. The presence of abundant water bodies—rivers, ponds, canals, *beels (lakes)* and marshlands—across the state further supports the potential for duck farming. However, despite the significant presence of backyard duck farming, no systematic study has been conducted to assess its economic impact on the livelihoods of smallholder farmers in flood-prone districts of Assam. This study aims to bridge that gap by evaluating the economic contributions of small-scale duck farming to rural livelihoods, particularly under the challenging conditions of frequent flooding.

MATERIALS AND METHODS

Location of the study

The study was carried out from January 2023 to June 2024 in two flood-prone districts of Assam: Dhubri and Dhemaji. These districts are regularly affected by seasonal flooding due to their geographical proximity to the Brahmaputra River and its tributaries.

Sampling technique

A stratified sampling approach was adopted for this study. Two development blocks, Jonai from Dhemaji district and South-Salmara from Dhubri district, were purposively selected as they are frequently impacted by annual floods. A total of six villages (three villages from each block) were randomly chosen based on their exposure to flooding. A sample size of 120 respondents was finalized, with 20 respondents from each village. Respondents were selected based on their experience in duck farming (minimum 5 years) and their maintenance of at least 15 ducks throughout the year. Special consideration was given to selecting women as respondents, as they are predominantly engaged in duck farming in the study areas.

Management of ducks

The villages selected for the study were characterized by low-lying areas, rivers, tributaries and marshy lands, which provided a natural

Sl. No.	Techno-economic parameters	Assumptions
1	Flock size	15
2	Male: Female	8: 7
3	Breed	*Pati* duck
4	Rearing period	18 months
5	Land	Farmers' own land
6	Labour for 18 months (Family labours were engaged daily ½ hour for feeding, cleaning of shed etc.)	34.22 Man days (273.75 hours ÷ 8)
7	Duck shed (night shelter): The night shelter was constructed with locally available materials viz., bamboo, wooden planks, unused GI sheet etc. and floor was mud floor	Rs. 1000.00 (L/S)
8	Equipment cost (Used plastic cane, earthenware etc.)	None
9	Cost of day-old duckling	Rs. 50/- per duckling
10	Age at first egg	6 months
11	Duration of egg production	12 months
12	Average annual egg production	80 eggs per duck
13	Cost of feed: Broken rice @ Rs. 10/- per kg	
14	a) Average 0.5 kg broken rice daily for 6 months	Rs. 900.00
15	b) Average 0.5 kg broken rice daily for 12months	Rs. 1, 825.00
16	Cost of medicines, vaccines etc. for 24 months (L/S)	Rs. 300.00
17	Age of selling surplus drakes	6 months
18	Sale price of surplus drake at 6 months	Rs. 450.00 per drake
19	Sale price of duck egg	Rs. 12.00 per egg
20	Sale price of spent duck	Rs. 500.00 per duck
21	Survivability % up to 18 months	90 %

environment for ducks to forage during the day. The ducks were let out in the morning to scavenge for food in these waterlogged areas and were housed in shelters during the night. Supplemental feeding of ducks typically occurred in the evening and consisted of broken rice, cooked rice, rice polish and kitchen waste.

Techno-economic assumptions

The study aimed to estimate the costs and returns from maintaining a flock of 15 ducks under a free-range system over a period of 18 months. The following assumptions were made while estimating the cost and return:

Several economic metrics were calculated as follows:

Labour costs

Labour costs were calculated based on an 8-hour working day, defined as one man-day (MD). The total labour cost was determined by multiplying the number of MDs required for duck farming by the prevailing local wage rate.

Total capital expenditure

This included both fixed and variable costs incurred during the duck farming period.

Gross income

Gross income was calculated by summing all revenue streams from the sale of eggs, surplus drakes and spent ducks.

Gross profit

Gross profit was derived by subtracting the variable costs from gross income.

Net profit

Net profit was calculated by subtracting the fixed costs from gross income.

Benefit-cost ratio

The B: C ratio was calculated by dividing the gross income by the variable cost, providing an indicator of the overall profitability of the duck farming practice.

Analysis of data

The data collected from the respondents were organized into tables and subjected to statistical analysis following the methodology outlined by Snedecor and Cochran (2002). Appropriate statistical tools were employed to evaluate the economic contributions of small-scale duck farming in flood-prone areas.

RESULTS AND DISCUSSION

This study explored the economics of small-scale duck farming with 15 Pati ducks under a free-range scavenging system, focusing on cost and return estimation over an 18-month period. The findings are summarized in Tables 1 and 2.

Cost analysis

Table 1 shows the total fixed and variable costs for rearing 15 *Pati* ducks over 18 months. The total capital expenditure was INR 10, 133.00, comprising of fixed cost of INR 1, 000.00 for a low-cost duck shed and variable cost of INR 9, 133.00, which included costs for ducklings, feed, labor, medicine and depreciation on the duck shed. Among the variable costs, labour costs were the largest component, accounting for 56.20% of the total variable cost (INR 9, 133.00). This aligns with other studies, such as Roy *et al.* (2017) and Uddin *et al.* (2013), which also highlighted labour as the highest cost in backyard poultry systems. Feed costs constituted 29.83% of the total variable cost. Similar studies by Jha and Chakrabarti (2017) and Islam *et al*. (2022) also found that feed was a major expenditure in backyard duck farming. The cost of ducklings, at INR 750.00 (8.21%) and medicines and vaccines at INR 300.00 (3.28%) were relatively small. Depreciation on the duck shed was calculated at INR 225.00 (2.46%). The feed cost and labour cost constituted 42.17 and 2.26% respectively of the total cost in backyard duck farming in Bangladesh (Sheheli *et al.*, 2023).

Income and profitability analysis

The gross income from the sale of eggs, surplus drakes and spent ducks was INR 13, 370.00 (Table 2). The income breakdown revealed 50.26% from

Table 1: Estimated cost of production of small-scale *Pati* duck farming under backyard system

Sl. No.	Particulars	Cost of rearing (Rs.)
I.	Fixed cost	
a.	Land	Available with farmers
b.	Low-cost duck shed made with locally available materials (LS).	1, 000.00
c.	Cost of drinker and feeder (Used plastic cane, earthenware *etc*.)	00.00
A.	Total fixed cost (a+b+c)	1, 000.00
II.	Variable cost	
1.	Cost of day-old duckling @ Rs. 50.00	750.00(8.21) *
2.	a) Cost of feed upto 6 months of age @ 0.5 kg daily (0.5 Kg×180 days × Rs. 10/-)	900.00(9.85)
	b) Cost of feed for remaining 12 months @ 0.5 kg daily (0.5 Kg × 365 days × Rs. 10/-)	1, 825.00(19.98)
3.	Labour cost (34.22 man-days @ Rs. 150/- per man-day)	5, 133.00(56.20)
4.	Cost of vaccine, medicine, feed supplement @ Rs. 20.00 per duckling (Rs. 20 ×15 ducklings)	300.00(3.28)
5.	Depreciation cost on duck shed @15% annually	225.00(2.46)
B.	Total variable cost upto 18 months of age (1+2+3+4+5)	9, 133.00(100.00)
C.	Total capital expenditure (A + B)	10, 133.00

*Figures in parenthesis indicates percentage

Table 2: Estimated returns from small-scale *Pati* duck farming under backyard system

Sl. No.	Particulars	Amount (Rs.)
III.	Gross income	
p.	Income from sale of eggs from 7 ducks @ 80 eggs per duck i.e. 560 eggs @Rs. 12 per egg. (560 eggs × Rs. 12).	6, 720.00(50.26)*
q.	Sale of 7surplus drakes at 6 months of age @ Rs. 450.00 per duck	3, 150.00(23.56)
r.	Sale of 6 spent ducks and one drake @ Rs. 500 per duck (considering mortality of one duck)	3, 500.00(26.18)
D.	Total gross income (p+q+r)	13, 370.00(100.00)
E.	Gross profit (D-B)	4, 462.00
	Gross profit per duck	297.47
F.	Net profit (E-A)	3, 237.00
	Net profit per duck	215.80
G.	Benefit Cost Ratio (BCR) (D÷B)	1.56

*Figures in parenthesis indicates percentage

the sale of eggs, which brought in INR 6, 720.00. This reflects the high demand for duck eggs, as noted by Roy *et al.* (2017) in a similar study; 23.56% of the income came from the sale of surplus drakes (INR 3, 150.00) and 26.18% from the sale of spent ducks and one drake (INR 3, 500.00), accounting for a mortality rate of one duck. Gross profit was calculated as INR 4, 462.00 and net profit after accounting for fixed costs was INR 3, 237.00. On a per-duck basis, the gross profit was INR 297.47 and the net profit was INR 215.80. The Benefit-Cost Ratio (B: C) for small-scale duck farming was found to be 1.56, indicating that the income generated was 1.56 times higher than the expenses, making the enterprise profitable. This is comparable to findings by Zannat *et al.* (2018) in Bangladesh, where the B: C ratio ranged from 1.68 to 1.74 depending on farm size. Kalangi *et al.*, (2023) reported that the revenue-cost (R/C) ratio of duck farming using ready-laying ducks (R/C=1.59) was more than the ducks farming using day-old-ducks (R/C =1.48). The benefit-cost (B: C) ratio in Vanaraja and local chicken were recorded as 2.60 and 2.27 respectively under backyard system (Islam *et al.*, 2015).

Employment Generation

The study also estimated that rearing 15 ducks could generate 34.22 man-days of employment over the 18-month period (Table 1), emphasizing the potential of duck farming to provide livelihood opportunities, particularly for rural women who were often involved in duck rearing.

CONCLUSION

The study concludes that small-scale duck farming under a free-range scavenging system is a viable and profitable livelihood option for smallholder farmers in Assam's flood-prone areas. With modest investment and labor, farmers could achieve a benefit-cost ratio of 1.56, meaning substantial returns for each rupee spent. The farming system also generates 34.22 man-days of employment, particularly benefiting rural women traditionally involved in duck rearing, thus promoting gender-inclusive economic development. Duck farming thrives in Assam's waterlogged environments, offering a resilient source of income when conventional farming is disrupted by floods. The majority of income comes from egg sales, followed by the sale of spent ducks and drakes, underscoring the flexibility of ducks for both egg and meat production. The availability of natural water bodies further reduces costs while enhancing productivity. Despite challenges such as high labor costs and reliance on traditional management, systematic support through training, improved breeds and veterinary services can increase profitability. Ultimately, small-scale duck farming has the potential to boost rural livelihoods, ensure food security and empower women, making it a sustainable and low-cost option for rural development in Assam.

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