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Economic Analysis of Production Cost and Returns of Small Scale *Kamrupa* Chicken Farming under Different Systems of Management

Rafiqul Islam[1*], Shafiqul Islam[1], Mustafizur Rahman[2] and Ranendra Nath Barman[1]

[1]*Biswanath College of Agriculture, AAU, Biswanath Chariali, Biswanath, Assam, INDIA*
[2]*SCS College of Agriculture, AAU, Dhubri, Assam, INDIA*

[*]*Corresponding author: R Islam; E-mail: rafiqul.islam@aau.ac.in*

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ABSTRACT

A study was conducted to assess the costs and returns of small-scale rearing *Kamrupa* chicken under different systems of management. A total of 300 straight run day old *Kamrupa* chicks were reared in deep litter system and were fed with chick mash up to 8 weeks of age. At 9th week, the birds were equally divided into three equal groups and were reared in intensive (T_1), semi-intensive (T_2) and scavenging (T_3) system of management up to the age of 72 weeks. In T_1 and T_2 groups, the birds were offered commercial feeds *ad lib* and 50% of their requirement respectively, while in T_3 group, no supplemental feeds were offered to the birds. The results indicated that feed costs accounted for 57.49 per cent followed by chick costs (25.12%), labour costs (10.21%), medicine and vaccine costs (4.49%) and miscellaneous costs (2.69%) of the total variable costs during chick phase. During growing and laying phase also, higher feed costs incurred in T_1 group followed by T_2 and T_3 groups. The gross returns up to 72 weeks showed a diminishing trend from T_1 to T_3 groups respectively and corresponding values in T_1 and T_2 groups were 1.61 and 1.37 times higher than the T_3 group respectively. The benefit: cost ratios were calculated as 1.04, 1.45 and 3.87 in T_1, T_2 and T_3 groups respectively. So, small scale *Kamrupa* chicken farming under scavenging system is more remunerative than intensive and semi-intensive systems.

HIGHLIGHTS

- The net returns recorded in scavenging system were 11.01 and 1.73 times higher than intensive and semi-intensive systems respectively.
- Scavenging system was more profitable than intensive and semi-intensive systems.

Keywords: Cost of production, variable costs, returns, *Kamrupa*, Cost: Benefit ratio

Backyard poultry keeping is one of the most important tools for poverty alleviation among resource poor rural people across the globe. They are accessible to vulnerable group of the society, and provide households with income and nutritionally rich food sources (Wong *et al.,* 2017). The backyard poultry is mostly characterized by rearing of small flock of indigenous chicken for subsidiary sources of income of the rural households (Chakravarthi *et al*., 2014; Reetha *et al*., 2016; Patra and Singh, 2016; Islam *et al*., 2021). However, the performances of indigenous chicken under backyard system are inferior in terms of meat and egg production in comparison with intensive poultry production system. The growth of commercial poultry production is also faster and tends to fulfill the growing demand of eggs and meat in India. However, 75% of the total poultry produce could fetch only 25% of the total population of country living in urban/sub-urban areas. Hence, the remaining 75% of the total population in India are facing severe animal protein deficiency leading to malnutrition among rural women and particularly growing children. In order to improve the productive

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efficiency of chicken under backyard system and also to support livelihood and nutritional security in rural India, various ICAR and SAU institutes developed various improved dual type chicken which were suitable for small and marginal farmers under backyard system. *Vanaraja* was the first chicken of such kind developed by Project Directorate on Poultry, Hyderabad. Similarly, *Kamrupa* is an improved dual type backyard chicken and is developed by College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati-22. *Kamrupa* chicken produces 125 eggs per year and attains a body weight of 1.8 Kg at 40 weeks of age under free-range condition (Kalita *et al*., 2016). *Kamrupa* chicken is popular in Assam as well as in other North-eastern states and is being reared under system of management without considering the economic outlook. For profitable farming, it is imperative to work out the cost of production and returns of *Kamrupa* chicken farming under different system of management. The assessment of production cost and returns under different system of management would assist the researchers to suggest a suitable production system for the rural farmers. Hence, the present study was undertaken to work-out different components of production costs and returns under different management systems to find out the profitable production system under field condition.

MATERIALS AND METHODS

A total of 300 straight run day old *Kamrupa* chicks were procured from the College of Veterinary Science, AAU, Khanapara, Guwahati and were reared under same management condition and were fed with chick mash up to the age of 8 weeks of age. At 9th week, the birds were equally divided into three treatment groups *viz*. T_1 (Intensive system), T_2 (Semi-intensive system) and T_3 (Scavenging system) as follows with 3 replicates each:

(a) T_1 (Intensive system): One third of the birds were maintained at Instructional Poultry Farm, BNCA, AAU, Biswanath Charialiin deep litter system and were fed with commercial grower crumbs (9 to 20 weeks) and layer crumbs (21 to 72 weeks) respectively as per their standard requirements. At 21st week, the male birds were separated and were sold and female birds were kept up to 72 weeks for egg production and finally sold as spent hen.

(b) T_2 (Semi-intensive system): Another one third of the birds were also maintained at Instructional Poultry Farm, BNCA, AAU, Biswanath Chariali under deep litter and were allowed to move outside as and when they need for feeding and were supplemented with commercial feed viz. grower and layer crumbs @50% of their actual requirement. At 21st week, the male birds were separated and were sold and female birds were kept up to 72 weeks for egg production and finally sold as spent hen.

(c) T_3 (Scavenging system): The remaining birds were kept at farmers' field of nearby village of the institute. Three farmers were selected randomly and the birds were equally distributed among themselves. In this system, the birds were housed during night time only in deep litter and were allowed move freely outside the shed for feeding. The shed was surrounded by crop field, fodder field, livestock farms etc. from where the birds could consume insects, earthworms, weeds, left over seeds etc. No supplemental commercial feeds were provided. The male birds were separated and were sold at 21st week and female birds were kept up to 72 weeks for egg production and then sold as spent hen.

The birds were vaccinated against *Ranikhet*, Gumboro and fowl pox diseases as per standard schedule. The costs of production were calculated separately for chick, grower and layer phases. The fixed costs included poultry shed and equipment only. The variable costs comprised of chick costs, feed costs, medicine and vaccination costs, labour costs and miscellaneous costs. The costs under different heads were obtained on the basis of prevailing market prices. The returns included sale proceeds like egg, surplus male, spent hen, feed bag and manure sale.

Definition of concept used

Low-cost poultry shed: The shed was made of locally available low-cost materials such as bamboo, wooden planks, plastic sheets, nylon nets etc. and the floor was mud floor.

Feed cost: The feed cost was calculated by multiplying quantity of feed required with actual market price of the particular feed. The total feed requirements were assumed to be 1.8 kg, 5.5 Kg and 40 Kg per bird during chick, grower and laying phases respectively.

Miscellaneous cost: It included the cost incurred for brooding, electricity, water and other routine expenses etc.

Labour costs*:* Eight hours of working was considered to be one man day (MD). The labour cost was calculated by multiplying number of MD with prevailing market rate of wage of the labour.

Gross costs*:* It was obtained by adding all the cost components including fixed cost and variable costs.

Gross returns: Gross returns were obtained by adding all sale proceeds including sale of eggs, surplus males, spent hens, feed bags and litter materials.

Net returns: Net returns were calculated by subtracting gross costs from gross returns up to 72 weeks of age.

Benefit-cost ratio: The B: C ratio was obtained by dividing gross returns by gross costs up to 72 weeks of age.

The data recorded on various parameters during the experimental period were worked out by Completely Randomized Block design as described by Snedecor and Cochran (2002) and were analyzed by using SPSS (Windows version 25) software.

RESULTS AND DISCUSSION

Variable costs during chick phase (0 to 8 weeks)

During chick phase, all birds were reared together and the total variable costs up to 8 weeks of age recorded as ₹ 33,436.50 (Table 2). The results indicated that feed costs alone contributed the highest (57.49%) followed by chick costs (25.12%), labour costs (10.21%), medicine and vaccine costs (4.49%) and miscellaneous costs (2.69%) of the total variable costs during chick phase. In agreement with the present findings, Preetam *et al.,* (2018) also recorded that feed costs contributed the major share of variable costs during chick phase followed by chick costs. It was found that chick phase created an employment opportunity of 10.5 MDs for the family labourers.

Variable costs during growing phase (9 to 20 weeks)

The results indicated that variable costs during growing phase was found to be higher in T_1 (₹ 21,617.10) followed by T_2 (₹ 11,626.30) and T_3(₹ 1,638.75) group (Table 3). The higher variable costs incurred in T_1 and T_2 groups than T_3 group might be due to involvement of higher feed costs. Similarly, Preetam *et al.* (2018) also indicated higher feed costs resulted in higher variable costs during growing phase in intensive farming of *Rajasri* chicken. In the growing phase, feed costs alone contributed 84.53 and 78.58 per cent of total variable costs in T_1 and T_2 groups respectively, while in T_3 group, there was no feed cost. However, there was a reverse trend of contribution of labour costs in the total variable costs during growing phase. The labour costs accounted for 11.85, 14.68 and 52.16 per cent of the total variable costs in T_1, T_2, T_3 groups respectively (Table 3). Uddin *et al.* (2013) also recorded that the labour costs comprised the highest per cent of total cost in rearing of

Table 1: Fixed costs of *Kamrupa* chicken farming

Items	T_1	Cost (₹)	T_2	Cost (₹)	T_3	Cost (₹)
Land	Existing	Nil	Existing	Nil	Existing	Nil
Low-cost poultry shed	L/S	5,000.00	L/S	3,500.00	L/S	2,000.00
Equipment	L/S	1,000.00	L/S	1,000.00	None	00.00
Total fixed cost (A)	—	6,000.00	—	4,500.00	—	2,000.00

Table 2: Variable costs of *Kamrupa* chicken farming during chick phase

Items	Quantity	Rate (₹)	Amount (₹)
Chick cost	300 nos. of chicks	28.00/chick	8,400.00
Feed cost (Chick mash)	540 Kg (1.8Kg/bird)	35.60/Kg	19,224.00
Medicine and vaccine cost	300 nos. of chicks	5.00/chick	1,500.00
Miscellaneous cost	300 nos. of chicks	3.00/chick	900.00
Labour cost	10.5 MD (1.5 hours/day for 56 days)	325.00/MD	3,412.50
Total cost of production during chick phase			₹ 33,436.50

Table 3: Variable costs *Kamrupa* chicken farming up 20 weeks

Items	Quantity	T_1	T_2	T_3
No. of chicks survived	294 nos.	98 nos.	98 nos.	98 nos.
Feed cost (@ ₹ 33.90/Kg)	For 294 birds	₹ 18,272.10 (5.5 Kg/ bird)	₹ 9,136.05 (2.75 Kg/ bird)	0.00 (No feed)
Medicine and vaccine cost (@ ₹ 5/bird)	For 294 birds	₹ 490.00	₹ 490.00	₹ 490.00
Miscellaneous cost (@ ₹ 3/bird)	For 294 birds	₹ 294.00	₹ 294.00	₹ 294.00
Labour cost (@ ₹ 325/MD)	For 84 days	₹ 2,561.00 (45 minutes/day = 7.88 MD)	₹ 1,706.25 (30 minutes/ day =5.25 MD)	₹ 854.75 (15 minutes/ day =2.63 MD)
Total cost of production during growing phase (₹)		₹ 21,617.10	₹ 11,626.30	₹ 1,638.75
Total cost of production during chick phase (₹)		₹ 11,145.50	₹ 11,145.50	₹ 11,145.50
Total cost of production up to 20 weeks (₹)		₹ 32,762.50	₹ 22,771.80	₹ 12,784.25

Table 4: Variable and gross costs of *Kamrupa* chicken farming up to 72 weeks

Items	Quantity	T_1	T_2	T_3
No. of birds survived	281 nos.	95 nos.	96 nos.	90 nos.
Liquidation of male birds	137 nos.	46 nos.	46 nos.	45 nos.
No. of layer birds	144 nos.	49 nos.	50 nos.	45 nos.
Feed cost (@ ₹ 33.90/Kg)	For 144 birds	₹ 66,444.00 (40 Kg/ bird)	₹ 33,900.00 (20 Kg/ bird)	₹ 0.00 (No feed)
Miscellaneous cost (@ ₹ 3/ bird)	For 144 birds	₹ 147.00	₹ 150.00	₹ 135.00
Labour cost (@ ₹ 325/MD)	For 364 days	₹ 7,393.75 (30 minutes/day = 22.75 MD)	₹ 7,393.75 (30 minutes/day = 22.75 MD)	₹ 3,698.50 (15 minutes/ day = 11.38 MD)
Total cost of production during laying phase (₹)		₹ 73,984.75	₹ 41,443.75	₹ 3,833.75
Total cost of production up to 20 weeks (₹)		₹ 32,762.50	₹ 22,771.80	₹ 12,784.25
Depreciation on poultry shed and equipment @ 15 % per year for 1.5 year		₹ 1,350.00	₹ 1,012.50	₹ 450.00
Total variable cost up to 72 weeks (B)		₹ 1,08,097.25	₹ 65,228.05	₹ 17,067.75
Gross cost up to 72 weeks (A+B)		₹ 1,14,097.25	₹ 69,728.05	₹ 19,067.75

native chicken in Bangladesh under backyard system. The total MDs required during growing phase recorded as 7.88, 5.25 and 2.63 MDs in T_1, T_2, T_3 groups respectively, which indicated the small-scale chicken farming also provided employment opportunities for the family labourers. It was also found that the total variable costs incurred to produce pullets was higher in T_1 (₹ 32,762.50) followed by T_2 (₹ 22,771.80) and T_3 (₹ 12,784.25).

Variable costs incurred during laying phase (21 to 72 weeks)

The trend of variable costs observed during growing phase continued in laying phase also (Table 4). The variable costs involved during laying phase were higher in T_1 (₹ 73, 984.75) followed by T_2 (₹ 41,443.75) and T_3 (₹ 3,833.75). The feed costs accounted for the major share of the total gross costs during laying phase. The highest variable costs recorded in T_1 group were also due to contribution of higher feed costs followed by T_2 group. The labour costs accounted for 9.99, 17.84 and 96.47 per cent of variable costs in T_1, T_2 and T_3 groups respectively, during laying phase (Table 4). Islam *et al.* (2015) worked out labour costs as 70.10 and 58.48 per cent of total variable costs in *Vanaraja* and indigenous chicken respectively under backyard system of management. The total variable costs incurred in T_1 group up to 72 weeks were 6.33 and 3.82 times higher than T_2 and T_3 groups respectively. The gross costs up to 72 weeks were found to be Rs. 1,14, 097.25, ₹ 69,728.05 and ₹ 19,067.75 in T_1, T_2 and T_3 groups respectively.

Table 5: Gross returns and net returns of *Kamrupa* chicken farming up to 72 weeks

Items	Quantity	T_1	T_2	T_3
No. of layer birds	144 nos.	49 nos.	50 nos.	45 nos.
Sale of eggs (@ ₹ 8/egg)	For 144 birds	₹ 72,520.00 (185 eggs/ year)	₹ 64,000.00 (160 eggs/ year)	₹ 43,200.00 (120 eggs/ year)
Sale of surplus male (@ ₹ 350/ Kg)	137 nos.	₹ 19,320.00 (Av. body wt. 1.2 Kg/ bird)	₹ 16,100.00 (Av. body wt. 1.0 Kg/ bird)	₹ 13,387.50 (Av. body wt. 0.85 Kg/ bird)
Sale of spent hen (@ ₹ 275/ Kg)	144 nos.	₹ 21,560.00 (Av. body wt. 1.6 Kg/ bird)	₹ 20,625.00 (Av. body wt. 1.5 Kg/bird)	₹ 17,325.00 (Av. body wt. 1.4 Kg/ bird)
Sale of feed bag (@ ₹ 20/Bag)	81 nos.	₹ 1,080.00 (54 nos. of bags)	₹ 540.00 (27 nos. of bags)	₹ 0.00
Sale of litter (@ ₹ 500/Qntl.)	920 Kg (43 Kg/ 1000 Kg live wt. daily)	₹ 4,600.00	—	—
Gross returns up to 72 weeks		₹ 1,19,080.00	₹ 1,01,265.00	₹ 73,912.00
Net returns up to 72 weeks		₹ 4,982.75	₹ 31,536.95	₹ 54,844.25
Net returns/bird		₹ 52.45	₹ 321.81	₹ 559.64
Benefit: cost ratio		1.04	1.45	3.87

Returns

The gross returns up to 72 weeks showed a diminishing trend from T_1 towards T_3 groups respectively and the values recorded in T_1 and T_2 groups were 1.61 and 1.37 times higher than the T_3 group respectively (Table 5). While the net returns showed a reverse trend of the gross returns, which indicated that T_3 group was more remunerative than other two groups. The net returns per bird worked to be ₹ 52.45, ₹ 321.81 and ₹ 559.64 in T_1, $T_2$and T_3 group respectively. The net returns recorded in T_3 group were 11.01 and 1.73 times higher than T_1 and T_2 groups respectively. Similarly, Islam *et al*., (2015) obtained net returns per bird in *Vanaraja* and indigenous chicken of Assam as ₹ 272.40 and ₹ 412.80 respectively under backyard system. In contrary to the present findings Preetam *et al.* (2018) recorded much lower net returns per bird while studied up to 60 weeks in *Rajasri* chicken. Major portions of the gross returns were obtained from sale of eggs in T_1 (60.90%), T_2 (63.20%) and T_3 (58.45%) groups, while sale of birds (surplus males and spent hens) also contributed a substantial portion towards the gross returns of T_1 (34.33%), T_2 (36.27%) and T_3 (41.55%) groups. The present findings corroborated the findings of Islam *et al.* (2015), who also reported that majority of the gross returns obtained from selling of eggs and birds (surplus males and spent hens) in *Vanaraja* and indigenous chicken of Assam under backyard system of management. The benefit: cost ratios were calculated to be 1.04, 1.45 and 3.87 in T_1, T_2 and T_3 groups respectively, which further postulated that T_3 group was more profitable than other two groups (Table 5). The cost: benefit ratios of broiler and layer farms under intensive system recorded as 1.15 and 1.10 respectively in Bangladesh (Masud and Real, 2013). A comparatively higher benefit: cost ratio of 4.28 was obtained in *Kaveri* chicken in Orissa under backyard system (Banja *et al*., 2017).Similarly, Nath *et al.* (2013) recorded benefit cost ratio as 1.73 in scientific backyard poultry farming in Sikkim.

CONCLUSION

From the above study it is imperative that the gross costs worked out for intensive and semi-intensive system is much higher than scavenging system. Similarly, the net returns/profits accounted in scavenging system are higher than that of intensive and semi-intensive system of management. So, small scale *Kamrupa* chicken farming under scavenging system is more remunerative than intensive and semi-intensive systems.

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