Costs and Profit Assessment of Layer Eggs Farming in Punjab, India

Abstract

A study was conducted with primary data collected from 100 layer producers chosen by proportion probability sampling technique distributed across all the regions of Punjab. The results showed that the educational status of the head of the family was observedin 41 per cent of layer farmerswho got the above matric standard.The variable and fixed costs accounted for 96.66 and 3.34 per cent, respectively of the total costs. Poultry feed followed by pullets feed was found to be the most important item of variable cost to the extent of 657.19(US $7.83) in absolute terms and accounted for 65.42 per cent of the maintenance cost of layer production. The gross returns from poultry farming were`1093.55(US $13.04)per bird. The output-input ratio on layer farms was 1.09 which revealed that poultry is a profitable enterprise and based on output-input ratios, large poultry farms were more efficient as compared to medium and small. While comparing the mortality rate across categories the large layer farmers were found efficient due to better management and adequate needed infrastructure. On the whole, it can be concluded that poultry production is a profitable venture and eggs production a most favoured subsidiary enterprise among the Punjab farmers.

Keywords: Fixed cost, layer production, mortality, output-input ratio, poultry and variable cost

JEL Codes:C83, C93, D13, D24, E20, E49, Q18

Introduction

India being the world's second-largest emerging economy after China has a huge and fast-growing commercial poultry industry with an annual growth rate of 6 per cent in egg production and 12 per cent for broiler production (Karthikeyan & Nedunchezhian, 2013; Chatterjee & Rajkumar, 2015). Besides, this industry contributes nearly 6 per cent of India's Gross Domestic Product and 25 per cent to the Agricultural GDP (Rawat et al., 2015).

Livestock products have very high-income elasticity and this has ushered in a 'livestock revolution' in developing countries (Delgado et al., 2001). In developed countries, about 50 per cent of protein is obtained from red and white meat, while in developing countries, it is between 15 and 20 per cent and the rest comes from plant sources. Poultry production in developing countries can provide a reliable protein source for growing populations and its development can signal a country's transition to a modern agricultural base. Poultry production is currently

increasing in developing countries through the usage of small-scale production facilities and increased poultry husbandry skills (Elsiddeg, 2009). Egg production is a highly competitive business that involves a substantial investment of capital and considerable risk. Approximately 80 per cent poultry provide employment directly and 20 per cent worker engaged in the provision of feed, pharmaceutical, equipment and other types of services (Subha and Mallika, 2021). Demand for eggs is inelastic so relatively small changes in total egg production can cause a sharp decline in the egg price.

There has been significant growth in egg production in all the egg-producing states of the region. Punjab witnessed a higher growth rate of 3.12 per cent per year during 1999-00 and 3.03 per cent per the year 2000-01, followed by Himachal Pradesh (3.03 and 2.94 %), Haryana (2.98 and 2.96, %) and U.P. (2.80 and 2.86 %) (Vetrivel & Chandrakumarmangalam, 2013). The place of Punjab for poultry is no more in the backyard as some entrepreneurs have not only entered commercial poultry farming but also have found it highly remunerative. The productivity of layers in the state is also highest (280 eggs per annum) during 2010-11.

Besides, the climatic conditions in Punjab are suitable for commercial poultry rearing. The farmers of the state have successfully adopted many subsidiary occupations; such as dairying, piggery, beekeeping, etc. All these basically land-based enterprises, are the best suited for the rural masses. These activities not only provide additional income to the farmers but also generate new avenues for self-employment (Rao *et al.*, 1993). It is with this background, the present study has been carried out in Punjab with the following specific objectives:

i. Socio-economic characteristics of poultry layer production on different sized categories
ii. to estimate the cost and profitability of eggs production on different-sized poultry farms;
iii. to study technological gaps in the eggs production on different-sized poultry farms;

Materials and Methods

The primary data were collected through personal interview schedulesfrom all the districts of Punjab by applying the proportion probability sampling technique on the total number of layer birdsduring the year 2019-20. The sample of 100 layer poultry farmers was selected randomly from all districts of Punjab state and further categorized into three groups namely small, medium and large by using the Cumulative Square Root Frequency Method ($\sqrt[2]{f}$) based on the numbers of birds kept on the farms.

The classification of layer poultry units the small categories of layer farmers having up to 20000 birds, an absolute of 42 layer farms were chosen and having average flock size was 10410 per unit. The medium categories layer unit had 20001-45000 birds, the total number of 33 layer farms selected and the average flock size which was accountedfor 30242 per unit. The large categories of layer poultry units kept above 45000 birds and the 25 layer farms selected from the sample and the average flock size of large layer unit was 36951 per unit.

Straight-line method of depreciation

The straight-line method determined the deprecation on fixed assets at a diverse rate of 7 per cent per annum. The interest on fixed capital items was charged @ 6.80 per cent per annum for layer farming. The interest on working capital was charged @ 6.80 per cent per annum for half the accounting period for layer farming (Pruitt, 2012).

The costs and returns were estimated following standard procedures as given below:

Total cost = Depreciation on all fixed assets + Interest on fixed capital + Variable cost on different items + Interest on working cost for half a year.

Gross return = Sum of return from eggs + Return from culled bird + return from manure + return from empty bag

Net return over variable cost = Gross return – Total variable cost

Net return over fixed cost = Gross return –Total fixed cost

Net return over total cost = Gross return-Total cost

Output-input ratio

The output-input ratiois a procedure for estimating investment by contrasting the economic benefits with the economic costs of the activity. The output-inputratio can be utilized to assess the economic merit of an investment. Here, the output-input ratio is the ratio between the gross return from eggs, culled birds, sale of manure and sale of empty bags to the total cost of input utilized.

$$\text{Output input ratio (layer farming)} = \frac{\text{Gross income from sale of eggs, culled birds, manure and empty bags}}{\text{Total cost of input used in the enterprise}}$$

Break-even point

The break-even point (BEP) is the point at which cost or expenses and revenue are equivalent which indicates the level of production at which the poultry producer neither loses money nor makes a profit. In other words, the quantity at which all inputs cost allocated to a product are equal to all revenues from its sale is known break-even point (Reddy & Ram, 2017). BEP can be mathematically calculated by the cost-volume-profit (CVP) formula as given hereunder.

$$\text{Break - even point (Y*)} = \frac{\text{TFC}}{P_y - \text{AVC}}$$

where, for layer unit,

Y* = Break-even number of layer units

TFC = Total fixed cost

P_y= Per unit price of output (sale of only eggs)

AVC= Average variable costs

Results and discussion

Socio-economic profile of sample layer farmers

The socio-economics characteristic of sample layer poultry farmers has been depicted in Table 1. The results revealed that the overall layer farmers age group 41-60 years were 49 per cent followed by the age group up to 40 and above 60 year age group. The educational level of a person plays an important role in the adoption of the latest farm technology. Therefore, the educational status of the head of the family was enquired from the sample layer farmers, who acted as decision-makers in the family was found that 41 per cent of layer farmers got the above matric standard at the overall level which was reported in the earlier study (Memon et al., 2015). There was 91 per cent overall layer farmers engaged in poultry farming along with agriculture was the main occupation. Lastly, the joint family system prevailed in the study area. It was noticed that at the overall level, 38.00 per cent of the sample respondents live in a joint family. These findings were consistent with studies carried out by Afolami et al.(2013); Noonari et al. (2015); Zalkuwi et al. (2015); Owhonda et al.(2021).

Table 1: Socio-economic profile of sample layer farmers

Sr. No.	Particulars	Farm Size Category			Overall Average (N = 100)
		Small (n_1 = 42)	Medium (n_2 = 33)	Large (n_3 = 25)	
A	**Age of Respondents (years)**				

1	Up to 40	35.72	21.21	36.00	31.00
2	41-60	52.38	54.55	36.00	49.00
3	Above 60	11.90	24.24	28.00	20.00
B	**Educational Level**				
1	Up to matric	69.05	66.67	32.00	59.00
2	Above matric	30.95	33.33	68.00	41.00
C	**Occupation**				
	Poultry farming plus agriculture	88.10	93.94	92.00	91.00
	Poultry farming plus services	11.90	6.06	8.00	9.00
D	**Type of Family**				
	Joint	47.62	36.36	24.00	38.00
	Nuclear	52.38	63.64	76.00	62.00

Costs of layer eggs farming

The variable and fixed costs of egg production for different categories of layer units shown in Table 2. It is observed that poultry feed followed by pullet feed was the most important item of variable cost which accounted for 65.42 per cent of the total maintenance cost of layer production. Besides, the absolute cost of these items was found to decline across the farms. In the case of pullet feed no specific trend was observed though it was the second-highest component of the maintaining layer for egg production. The cost incurred on day-old chicks being the base for egg production was noticed to be the third important component of variable cost for which the figures both in absolute and percentage terms were found to increase with the size of the holding. Such results were reported by Dhanda, (2004); Singh et al. (2010); Anang et al. (2013); Bhullar et al. (2012); Afolami et al. (2013); Nmadu et al. (2014); Pawariya and Jheeba, (2015); Owhonda et al. (2021).

Human labour was another important item which accounted for 3.72, 3.00 and 2.64 per cent of the total cost. At the overall level, the share of human labour was to the extent of 3.13 per cent. Across the farms, these costs were decreasing due to economies of scale. The layer birds were providing medicines and vaccination against various diseases so as to reduce mortality and increase the production of eggs. The cost incurred on medicines and vaccines was `8.75 highest

on small layer farms followed by medium layer farms (`8.70) and large layer farms (`8.46) per bird. The proportion of expenditure incurred on medicines and vaccines was to the extent of 0.82 and 0.89 for small to medium & large layer farms and it accounted for 0.86 at the overall level. This finding is consistent with studies of Dhanda, (2004); Anang et al. (2013).

The electricity and diesel charges accounted for 0.76 per cent of the total cost on the average sample layer farms. The overall electricity and diesel expenses were `7.57 per bird which comprised 0.76 per cent of the total cost Similar, problem was also highlighted in the study (Singh et al., 2010; Nmadu et *al*., 2014).

The fuel for the brooder included sawdust, wood block and gas which were required to maintain the temperature in the shed. The cost incurred on fuel for the brooder was `0.70 per bird on overall layer farms and comprised of just 0.07 per cent of the total cost. The miscellaneous items include lodging charges of permanent labour along with electricity and water facilities. The expenditure on such items was highest on medium layer farms (`4.89) followed by large (`4.47) and small layer farms (`1.47) per bird. On an overall basis, this cost was `3.61 per bird and comprised a 0.37 per cent share in the total cost. Similar findings were reported by Singh et al. (2010);Nmadu et al. (2014).

The interest on variable cost was charged for half of the production period and it was `31.92 which accounted for 3.18 per cent of the total cost Pawariya and Jheeba, 2015 also reported similar findings. The variable cost estimated in this study is comparable with Bhullar et al., (2012); Afolami et al. (2013); Owhonda et al. (2021).

The fixed cost of egg production presented in Table 2 also revealed that the interest on fixed capital was to the extent of `18.57, `19.20 and `19.36 on small, medium and large layer farms per bird, respectively. However, at the overall level, it was for `19.04 which accounted for 1.90 per cent of the total cost. Similarly, the depreciation on fixed assets was the next major component of fixed cost which was highest for large layer farms (`14.71) followed by medium layer farms (`14.53) and small layer farms (`14.13) per bird. Furthermore, the overall depreciation on fixed assets was found to be `14.46 which accounted for 1.44 per cent of the total. These results were confirmed by Anang et al. (2013); Nmadu et al. (2014); Pawariya and Jheeba, (2015).

Table 2: Costs of eggs production on different categories of sample layer farms

(`bird^{-1})

Sr. No.	Cost items	Farm Size Category			Overall Average
		Small	Medium	Large	
A	**Variable cost**				
1	Day old chicks	37.65 (3.53)	37.93 (3.83)	39.16 (4.09)	38.25 (3.82)
2	Pullets feed up to 22 weeks	199.30 (18.70)	188.56 (19.06)	186.27 (19.45)	191.38 (19.07)
3	Poultry feed after 22 weeks	703.61 (66.02)	646.16 (65.31)	621.81 (64.91)	657.19 (65.42)
4	Human labour	39.68 (3.72)	29.67 (3.00)	25.26 (2.64)	31.54 (3.13)
5	Medicines/vaccines	8.75 (0.82)	8.70 (0.88)	8.46 (0.88)	8.64 (0.86)
6	Electricity/diesel	7.77 (0.73)	7.44 (0.75)	7.51 (0.78)	7.57 (0.76)
7	Fuel for brooder (saw dust, wood block & gas)	0.78 (0.07)	0.81 (0.08)	0.52 (0.05)	0.70 (0.07)
8	Miscellaneous	1.47 (0.14)	4.89 (0.49)	4.47 (0.47)	3.61 (0.37)
9	Sub-total (1 to 8)	999.01 (93.74)	924.16 (93.41)	893.46 (93.27)	938.88 (93.48)
10	Interest on working capital @ 6.80% p. a. for 6 months	33.97 (3.19)	31.42 (3.18)	30.38 (3.17)	31.92 (3.18)
	Total variable cost (9 to 10)	1032.97 (96.93)	955.58 (96.59)	923.84 (96.44)	970.80 (96.66)
B	**Fixed cost**				
1	Interest on fixed capital @ 6.80% p.a.	18.57 (1.74)	19.20 (1.94)	19.36 (2.02)	19.04 (1.90)
2	Deprecation on fixed assets	14.13 (1.33)	14.53 (1.47)	14.71 (1.54)	14.46 (1.44)
	Total fixed cost (1 to 4)	32.70 (3.07)	33.73 (3.41)	34.08 (3.56)	33.50 (3.34)
C	Total cost (A+B)	1065.67 (100.00)	989.31 (100.00)	957.92 (100.00)	1004.30 (100.00)

Note: Figures in the parentheses indicate percentages to the total

Miscellaneous items include staying charge of permanent labour, electricity provides to labour and water facility for labour etc.

Gross returns on sample layer farms

The gross returns of egg production per bird by the different categories of sample layer farms have been explained in Table 3. It can be noticed from the table that the expected income

from the sale of eggs was highest on small layer farms (`1079.22) followed by medium layer farms (`1040.53) and large layer farms (`1038.67). The income from the sale of eggs per bird basis showed a decreasing trend with the size of the farm. It can be inferred from the results that the relative profitability of egg production is affected by the rate of laying and the price of eggs.

The layer poultry birds were also disposed of in culled form after 12 months when the egg production rate was found declining by 50 per cent of the peak level. Thus the layer farmers sold the culled birds for meat purposes. The gross returns from culled birds were arrived at by subtracting the value on account of mortality losses. The income from culled birds was highest at`44.10 per bird on large layer farms in comparison to medium (`42.62) and small (`42.42) which was supported by the study (Singh et al., 2010).

The poultry manure in the study area was also in great demand and is used for increasing the fertility of the land. The returns from manure were worked out to be `4.37, `2.69 and `2.97 per bird on small, medium and large layer farms, respectively. The income from poultry manure was lowest (`2.69) on medium farms as compared to other categories. The medium layer farmers utilized the maximum quantity of poultry manure in their own fields Similarly, the result described in the study by Singh et al. 2010. The income from the sale of empty bags came out to be highest (`5.66) on large as compared to medium with `5.43 and small layer farms with `5.23. The gross returns were `1093.55 per bird followed by the sale of culled birds for `43.05, the sale of empty bags for `5.44 and the sale of manure for `3.34 per bird. In the view of Dhanda, 2004 study gross returns revealed a declining trend with farm size and these were estimated at `1117.85, `1081.11 and `1081.70 on small, medium and large layer farms, respectively.

Table 3: Gross returns from layer farming on sample farms

(`bird^{-1})

Sr. No.	Particulars	Farm Size Category			Overall Total
		Small	Medium	Large	
1	Expected returns from eggs	1079.22	1040.53	1038.67	1052.81
2	Loss in value of eggs due to breakage	13.39	10.17	9.69	11.08
3	Actual returns from eggs (1-2)	1065.83	1030.36	1028.98	1041.72
4	Value of culled birds	46.32	47.74	48.00	47.35
5	Mortality losses of birds	3.90	5.12	3.90	4.31
6	Actual returns from culled	42.42	42.62	44.10	43.05

	birds (4-5)				
7	Sale of poultry manure	4.37	2.69	2.97	3.34
8	Sale of empty bags	5.23	5.43	5.66	5.44
9	**Gross returns (3+6+7+8)**	**1117.85**	**1081.11**	**1081.70**	**1093.55**

Costs and returns from layer farming

The results of returns over different costs, output-input ratio and break-even point components on various layer farms have been presented in Table 4. It can be noticed from the table that the total variable cost per bird was maximum on small layer farms with `1032.97 followed by medium layer farms with `955.58 and large layer farms with `923.84 and at overall level was `970.80. The scenario of the total fixed cost per bird was different from the total variable cost which was maximum for large layer farms at`34.08 followed by medium layer farms with `33.73, small layer farms with`32.70 and overall average farms was `33.50. The total cost per bird was highest on small layer farms (`1065.67) as compared to medium layer farms (`989.31) and large layer farms (`957.92) and an overall basis was `1004.30. The total cost indicated a declining trend with the size of the holding. As far as returns are concerned, the small layer farmers could derive higher gross returns of `1117.85 per bird followed by large layer farms (`1081.70) and medium layer farms (`1081.10). However, on an overall basis, it was `1093.55 per bird in the study area.

The net returns over variable and total cost per bird were the highest of `157.86 and `123.78 on large layer farms followed by medium (`125.52 and `91.79) and small layer farms (`84.87 and `52.17), respectively. The net returns over fixed cost were highest of `1085.15 per bird on small layer farms as compared to large layer farms (`1047.62) and medium layer farms (`1047.38). At the overall average, the net returns over the variable, fixed and total costs were `122.75, `1060.05 and `89.25 per bird.

A commonly used indicator of study profitability is the output-input ratio. The output-input ratios over variable and total cost were highest (1.17 and 1.13) on large layer farms followed by medium (1.13 and 1.09) and small layer farms (1.08 and 1.05) and at overall basis, these ratios were 1.13 and 1.09, respectively. Similarly,findings were reported by (Dhanda, 2004; Singh et al., 2010). Thus the net returns have shown a positive correlation with the size of layer farming. The output-input ratio over fixed cost was highest on small layer farms (34.19) in

comparison to medium layer farms (32.06) and large layer farms (31.74). It has shown a negative correlation with the increasing size of layer farming.

The Break-Even Quantities (BEQs) in the number of birds and number of eggs in lakh per year were estimated to be 7431 and 21.91 on small layer farms in comparison to medium layer farms (21769 and 63.81) and larger layer farms (50742 and 148.46). For the study area as a whole, the BEQs with respect to number of birds and eggs were 26647 and 78.06, respectively. The proportional gap from actual production was found to decrease with the size of holding, that is, from 28.61 per cent on small farms to 27.72 per cent on the large category and it was found 28.12 per cent on an overall basis.

Table 4: Cost and returns from layer farming on sample farms

(`bird^{-1})

Sr. No.	Particulars	Farm Size Category			Overall Average
		Small	Medium	Large	
1	Total variable cost	1032.97	955.58	923.84	970.80
2	Total fixed cost	32.70	33.73	34.08	33.50
3	Total cost (1+2)	**1065.67**	**989.31**	**957.92**	**1004.30**
4	Gross returns	**1117.85**	**1081.10**	**1081.70**	**1093.55**
5	Net returns over variable cost (4-1)	84.87	125.52	157.86	122.75
6	Net returns over fixed cost (4-2)	1085.15	1047.38	1047.62	1060.05
7	Net returns over total cost (4-3)	52.17	91.79	123.78	89.25
8	Output-input ratio over variable cost	1.08	1.13	1.17	1.13
9	Output-input ratio over fixed cost	34.19	32.06	31.74	32.66
10	Output-input ratio over total cost	1.05	1.09	1.13	1.09
11	BEP (No. of birds)	7431	21769	50742	26647
12	BEP (No. of eggs in lakh)	21.91	63.81	148.46	78.06
13	Gap from actual production (%)	28.61	28.02	27.72	28.12

Total number of layer birds, eggs production and gaps on sample layer farms

The number of layer bird gaps in egg production and the total number of eggs produced by different categories of layer farming have been presented in Table 5. It is observed from the table that the total birds and mortality of birds were highest on large layer farms with 70200 and 5709 followed by medium layer farms (30242 and 3240) and small layer farms (10410 and 961). However, at the overall level, these birds were 36952 and 3304, respectively. Similarly, the culled birds which were arrived at by subtracting the value on account of mortality of birds was also highest (64491) on larger layer farms in comparison to medium layer farms (27002) and small layer farms (9449) and overall basis it was 33647. The large layer category produced 205.39 lakh eggs during the whole cycle which was higher than the medium category (88.64 lakh eggs) and small layer (30.69 lakh eggs).

The breakage of eggs on the farms during harvesting was lowest (0.38 lakh eggs) on small layer farms as compared to medium layer farms (0.87 lakh eggs) and larger layer farms (1.92 lakh eggs). The realized eggs production worked out from actual production after subtracting breakage of eggs was highest on large layer farms with 203.48 lakh eggs as compared to medium layer farms (87.78 lakh eggs) and small layer farms (30.31 lakh eggs) and at the overall level, it was found 107.19 lakh eggs. Moreover, the gap in expected egg production on scientifically managed farms increased in number with the increase in the size of the category.

Table 5: Total number of layer birds, eggs production and gaps on sample layer farms

(Number farm^{-1})

Sr. No.	Particulars	Farm Size Category			Overall Average
		Small	Medium	Large	
1	Total birds	10410	30242	70200	36951
2	Mortality of birds	961	3240	5709	3304
3	Culled birds (1-2)	9449	27002	64491	33647
4	Actual eggs production (lakh)	30.69	88.64	205.39	108.24
5	Breakage of eggs (lakh)	0.38	0.87	1.92	1.05
6	Realized eggs production (lakh) (4-5)	30.31	87.78	203.48	107.19
7	Expected egg production during year per layer on scientifically managed farm (lakh)	31.61	91.84	213.18	112.21

8	Gap (lakh) (7-4)	0.92	3.20	7.79	3.97
9	Gap (%)	(-) 2.41	(-) 2.90	(-) 3.04	(-) 2.94
10	Poultry manure (tonnes)	143.06	253.27	626.94	341.09
11	Empty bags	8395	24455	56210	29687
12	Mortality of per 1000 birds	92	107	81	89

Note: (-) indicate the % deficit production

As per viewpoint the expected egg production should be 31.61, 91.84, 213.18 and 112.21 lakh egg production on small, medium, large and overall layer farms, respectively. The gap between expected eggs production and actual egg production was negative and highest at 3.04 per cent on larger layer farms followed by medium (2.90 per cent) and small (2.41 per cent) and on all farms, it was 2.94. The large layer farms produced 626.94 tonnes of poultry manure which was highest as compared to medium (253.17 tonnes) and small (143.06 tonnes) and it was 341.09 tonnes on all farms. Empty bags were also highest in number on large layer farms (56210) than 24455 on medium and 8395 on small.

The mortality per 1000 birds was lowest (81) on large layer farms in comparison to small (92) and medium (107). However, at the overall level, it was found 89. While comparing the mortality rate across categories large layer was found highly efficient due to efficient management and providing sufficient infrastructure for reducing the mortality rate.

CONCLUSION AND POLICY IMPLICATIONS

The research findings in the field of layer production indicated that the results confirmed that the net returns over total and variable cost per layer bird were rising with an increase in the size of farming. This increasing trend of net returns received by different farm sizes could also be attributed to the economies of scale on largerlayer farms. The output-input ratio over variable and total cost was also greater than unity, which means that the business is financially feasible. The range of output-input ratio was also found rising with their size, resultantly the large farms were economically more viable than medium and small. The large layer farms also attained a break-even quantity of average herd at a higher percentage due to the involvement of fixed cost on a large scale. The study suggests that the government should provide graded subsidies and reduce the GST on feed and poultry medicine and other micronutrients for poultry farming. Farmers also need to be guided to reduce the expenditure on the inputs to enhance the output-input ratio.

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