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Influence Of Various Input Variables And Cost Analysis Of Milk Production In The Automated Dairy Sector

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Abstract
The success of dairying as a form of business depends on profitable milk production which is influenced by various input variables and their judicious use. The research was undertaken at ten commercial dairy units with a minimum number of hundred dairy animals each located in and around Hyderabad city of Telangana state by using a structured interview scheduleIn the fully automated dairy units the mean herd size (1074), fixed costs (Rs.136497785) and variable costs (Rs.9677180) are higher than in the semi-automated dairy units (331, Rs.60980118 and Rs.55987.3 respectively). For every 100 units of herd, fully automated units are using 3 units of labor and in semi-automated dairy units it was 8.2 units which was 2.7 times higher and costs incurred per unit herd in semi-automated on labor are also 2.7 times higher. Cobb-Douglas production function indicated that the independent variables such as capital cost (3.406**) and medicine cost (2.704**) have positively and significantly contributed to value of milk output in the automated dairy units. When there is 1% increase in the capital cost and medicine and veterinary costs there is 3.4% and 2.7% increase in the value of the milk output whereas feed cost (-1.196*) and operational cost (-1.984*) have negatively and significantly contributed to the value of milk output.
Key words: automation, fixed costs, variable costs, income, labor, Cobb-Douglas production function.

INTRODUCTION

The success of dairying as a form of business depends on profitable milk production which is influenced by various input variables and their judicious use. In the long term, productivity and especially productivity growth are necessary conditions for the survival of a farm. To improve productivity at the farm level, investments in new technology are needed and across the globe, the trend towards fewer, larger dairy operations continues. Though dairying is being effectively practiced, the information on cost and incomes from milk production and productivity of different factors is scanty, which is most important from producer point of view who under takes dairying as a new enterprise.

Studies on the prevailinginput variables, cost analysis of milk production is important for planning, projecting and formulating dairy development policies and helps the entrepreneur in making decisions to establish dairy farms that are economically viable, technically feasible and sustainable. Considering the importance of study in this arena it is proposed to carry out research work.

MATERIALS AND METHODS

The proposed research was undertaken at ten commercial dairy units with a minimum number of hundred dairy animals each located in and around Hyderabad city of Telangana state.A structured interview schedule was prepared for the purpose of data collection that includes a questionnaire regarding study of various input variables such as fixed cost, variable costs which influence the cost of milk production and income from milk are included. Fixed costs include cost of automation, infrastructure, cost of animals and cost of sheds. Variable costs include cost of labor, cost of feed, operating and miscellaneous costs and insurance costs. To quantify the returns average price through sale of milk is taken.

The Cobb-Douglas production function model was used to determine the effect of key variables on cost of milk production.

Calculations

Gross income= Quantity of milk × prevailing rate of milk

Cobb-Douglas production function

$Y = aX_1{}^{b1}X_2{}^{b2}X_3{}^{b3}X_4{}^{b4}X_5{}^{b5}X_6{}^{b6}X_e{}^{Ui}$

The Cobb-Douglas production function was transformed into the following logarithmic form so that it could be estimated by the ordinary least squares (OLS) method:

In Y = In a $+b_1$ In $X_1+ b_2$ In $X_2+ b_3$ In $X_3+ b_4$ In $X_4+ b_5$ In X5+ b6 In X6+U_i Where,

Y = value of the milk yield per animal per animal per day

X1 = value of feed used per animal per day

X2= value of medicines and veterinary costs used per animal per day

X3 = value of operational and miscellaneous costs used per animal per day

X4 = value of insurance cost per animal

X5 = value of capital cost used per animal

X6 = value of labor used per animal per day

In = natural logarithm

a = constant

$b_1 – b_6$ = production coefficients

e = base of natural logarithm

ui = error term

Results and Discussion

1. **Expenditure of the fully automated and semi-automated dairy units on the capital and variable costs :**

   In fully automated dairy units the mean herd size (1073.75), fixed costs (Rs.136497785) and variable costs (Rs.9677180) were higher than in the semi-automated dairy units (mean herd size 331, fixed costs Rs.60980118 and variable cost Rs.55987.3). As per unit herd size, expenditure of fully automated units on capital (Rs.127123) and variable costs (Rs.9013) was less when compared to semi-automated units expenditure on capital (Rs.184230) and variable costs (Rs.9535).

2. **Utilization of labor in the fully automated and semi-automated dairy units** Fully automated farms with a mean herd size of 1074 have incurred Rs.329333 per month on labor whereas in the semi-automated farms it was Rs.285875. In fully automated dairies for every 100 units of herd 3 units of labor and in semi-automated dairies 8.2 units of labor are used which is 2.7 times higher than fully automated.

3. **Variable cost per animal per day in the dairy units**

   Variable costs like labor, feed, medicine, operational and miscellaneous and insurance costs were tabulated in Table 6. It reveals that highest cost incurred per animal per day is on the feed and 50 percent of the dairy units were not insuring their animals. Among the production costs, feed cost has got the highest share (87.82 %) followed by labor cost (5.47 %), medicine cost (3.21%), operational and miscellaneous costs (1.90%) and insurance cost (1.6%).

4. **Cobb-Douglas production function**

   The independent variables such as capital cost (3.406**) and medicine cost (2.704**) have positively and significantly ($p < 0.01$) contributed to value of milk output in the automated dairy units. When there is 1 percent increase in the capital cost and medicine and veterinary costs there is 3.4 percent and 2.7 percent increase in the value of the milk output respectively. Feed cost (-1.196*) and operational cost (-1.984*) have negatively but significantly ($p < 0.05$) contributed to the value of milk output which means that as the feed cost is increased by 1 percent value of milk output decreased by 0.32 percent and as the insurance costs increases by 1percent the value of output decreases by 1.2 percent. R square is worked out to 31.9 percent and the function was found significant.

5. **Income in relation to the yield and fat percent in dairy units**

   Fully automated dairy units were producing an average 16.0 litres of milk with 5.32% of fat and gross income @ Rs. 676.5/day/animal when compared to semi-automated units i.e 12.26 litres with

4.41% fat and gross income @ Rs.661.8/day/animal. At each farm the average sale of milk per litre/day was different attributing to its location and market issues.

Summary
In the fully automated dairy units the mean herd size (1074), fixed costs (Rs.136497785) and variable costs (Rs.9677180) are higher than in the semi-automated dairy units (331, Rs.60980118 and Rs.55987.3 respectively). Labor requirement was 2.7 times higher in semi- automated units than in the fully automated units per every 100 herd size. Cobb-Douglas production function indicated that the independent variables such as capital cost (3.406**) and medicine cost (2.704**) had highest positive influence on the value of milk output in the automated dairy units whereas feed cost (-1.196*) and operational cost (-1.984*) have negatively and significantly contributed to the value of milk output.

Table 1 List of the dairy units with herd size fixed costs and variable costs

S. No	Category of dairy unit	Mean Herd size	Mean Fixed costs	Mean Variable cost per month
1	Automated	1073.75	136,497,785	9677180
	Per unit herd size	1	127123	9013
2	Semi- automated	331	60980118	3155987.3
	Per unit herd size	1	184230	9535

Table 2 Labor in the dairy units

S. No	Category of dairy unit	Mean Herd size	Mean No. of laborers	Mean Labor cost per month
1	Automated	1073.75	32	329333
	Every 100 units of herd	100	3	
2	Semi- automated	331	26.5	285875
	Every 100 units of herd	100	8.2	

Table 3 Variable cost per animal per day for the dairy units

Dairy unit	Labor cost per animal per day in Rs.	Feed cost per animal per day in Rs.	Medicines cost per animal per day in Rs.	Operational and miscellaneous costs per animal per day in Rs.	Insurance cost per animal per day in Rs.	Total production cost in Rs.
1	10.12	227	3.31	7.36	7.86	255.65
2	5.52	211	1.74	5.81	9.93	234
3	7.97	250	2.68	9.75	8.25	278.65
4	11.67	233.5	10.01	9.28	0.00	264.46
5	29.22	203	17.53	12.86	0.00	262.61
6	24.05	484	7.22	3.61	0.00	518.88
7	5.48	220	3.05	8.12	7.12	243.77
8	12.01	260	2.09	19.14	0.00	293.24
9	35.51	200	0.36	7.36	0.00	243.23
10.	15.03	225	6.26	8.52	12.6	267.41
Average	15.658	251.35	5.425	9.181	4.576	286.19

Table 4 Regression Coefficients in Cobb-Douglas production function

	Coefficients	T	Sig.
Value of milk output	2.412		2.779
Feed cost	-0.323	-0.210	-1.196*
Medicine and veterinary cost	0.171	0.471	2.704**
Operational and miscellaneous cost	-0.300	-0.339	-1.984*
Insurance cost	-0.012	-0.109	-0.509
Capital cost	0.526	0.596	3.406**
Labour cost	0.020	0.034	0.174

Table 5 Income in relation to the milk yield and fat percent in dairy units

S. No	Category of dairy unit	Herd size	Average M.Y per animal in litres	Average fat percent per animal	Value of milk output per animal in Rs.
1	Automated	1073.75	16	5.32	676.5
2	Semi- automated	331	12.26	4.41	661.8

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