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Resource Use Efficiency in Milk Production in Mizoram State of North-East India

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ABSTRACT

The present study was undertaken in Mizoram state to study resource use efficiency in milk production on sample households. Out of the eight districts in Mizoram, three districts were selected purposively based on milk production and cattle population. From each of the three districts, two blocks were selected randomly and from each of the selected block cluster of two to three villages were selected. A sample of 180 milk producing households were selected randomly from the selected villages during the year 2014-15. Linear, Cobb-Douglas and Semi-logs milk production functions were tried to study resource use efficiency. The Cobb-Douglas was found best fit keeping in view sign, significance of regression co-efficient and value of R^2 for both crossbred and local cows. The regression coefficients of dry fodder and miscellaneous expenses were found significant for both the animal groups. It was observed that dry fodder and miscellaneous expenses were underutilised for crossbred cows and green fodder was underutilised in case of local cows indicating that use of more quantities of these inputs will further increase the productivity of milch cattle in the study area.

Keywords: Crossbred cow, local cow, resource utilisation, Mizoram

Over the last three decades or so, the Indian dairy sector has progressed from a situation of scarcity to that of plenty. With the growing importance of the dairy sector in Indian economy, the Government of India has taken several initiatives from time to time to enhance the potential of this sector. Irrespective of the spectacular developments accomplished in dairying at national perspective, the fruits of success did not percolate down across regions and states. In general, the situation in North-Eastern (N.E) states of India is still not at par with the other states of the country in terms of various dairy development indices. However, despite the poor performance of dairy sector in the N.E region, the demand for milk and milk products has been increasing due to increase in per capita income and changes in lifestyle (Feroze *et al.* 2010). Although livestock is an important component of mixed farming system and plays an important role in the economy of Mizoram, the production of milk and milk products in the state is least comparing to other states of the N.E region. The state shared only 0.91 per cent of the N.E Region's milk production in the year 2012-12. During the same period, the milk production in the state was only 13639 tonnes and the per capita availability of milk per day was 33 grams (GoM, 2014) which was very low comparing to the national average of 132.4 million tonnes and 299 grams, respectively (GoI, 2014).

A number of studies on resource use efficiency in milk production have been carried out in different agro-climatic regions of India (Venkatesh and Sangeetha, 2011; Meena *et al*. 2012; Singh *et al*. 2012; Sharma *et al*. 2014; Rangnath *et al*. 2015; Vishnoi *et al*. 2015). However, no such study has been carried out in Mizoram state. Therefore, present study was conducted with the aim of estimating the input-output relationship and resource use efficiency in milk production in Mizoram. The objective was to understand whether the inputs are under-utilised or over-utilised for milk production.

MATERIALS AND METHODS

Study area

The study was conducted in Mizoram State. Out of the eight districts in Mizoram the three districts namely, Aizawl, Kolasib and Champhai districts were purposively selected as the bovine population as well as milk production is relatively higher in these districts as compared to the other districts of the state. From each of the three districts, two blocks were selected randomly and from each of the selected block cluster of two to three villages were selected. A sample of 30 dairy farmers was randomly selected in equal-probability proportion from each of the selected blocks thus making a total of 180 sample dairy farmers.

Data Collection

The primary data was collected by conventional survey method on a well-structured schedule through personal interview on various aspects of dairy enterprises from selected households for the year 2014-15. The data collected covered socioeconomic characteristics, quantity and value of feeds and fodder, dairy equipment and cattle shed along with value and expected life, family and hired labour employed along with prevailing wage rate, veterinary and miscellaneous expenses and milk production along with the prevailing market prices of milk.

Milk Production Function

Milk production is a complex process influenced by several explanatory variables. In the present study, production function analysis was employed to estimate the resource use efficiency in milk production. The production function used was as under:

$$Y = f\left(X_1, X_2, X_3, X_4, X_5\right)$$

Where,

Y = Value of milk produced/animal/day (₹)

X_1 = Value of green fodder fed/animal/day (₹)

X_2 = Value of dry fodder fed/animal/day (₹)

X_3 = Value of concentrate fed/animal/day (₹)

X_4 = Value of labour employed/animal/day (₹)

X_5 = Value of miscellaneous expenses[1]/animal/day (₹)

The choice of a specific functional form was based on economic and statistical criteria and coefficient of multiple determinations (R^2). Four types of functions were tried which are as follows:

Linear:

$$Y = a + \sum_{i=1}^{n} b_i X_i + u$$

Cobb Douglas:

$$Y = a * \sum_{i=1}^{n} X_i^{bi} e^{u}$$

Semi-log (Lin-Log):

$$Y = \ln a + \sum_{i=1}^{n} b_i \ln X_i + u$$

Semi-log (Log-Lin):

$$\ln Y = a + \sum_{i=1}^{n} b_i X_i + u$$

Where,

Y = Output

X_i = i^{th} input used

a = Constant term

b_i = Partial regression coefficient of the i^{th} input to be estimated

u = Random error distributed normally with zero mean and constant variance

e = Base of natural log

Ideally, the output (Y) and inputs (X_i) in the above production functions were measured in monetary values rather than their physical quantities; this was done because the quality of feeds and fodders differs from one respondent to the other and can be more appreciably reflected value terms.

Marginal Value Productivity (MVP)

Marginal value productivity of inputs from the most appropriate milk production function (Cobb Douglas in the present case) was worked out.

$$MVP_i = b_i \frac{\overline{Y}_1}{\overline{X}_1}$$

Where, $\overline{Y}_1$ and $\overline{X}_1$ are the geometric means of Y and i^{th}

input, respectively and b_i is the regression coefficient associated with i^{th} input.

Resource Use Efficiency

Resource use efficiency of inputs measures whether or not the inputs are used efficiently. They are used efficiently if the MVP of the input is equal to its unit price i.e.

$$MVP_i = P_i$$

Where P_i is the unit price of the i^{th} input.

In order to examine the resource use efficiency, the marginal value productivity of various inputs was worked out for significant regression coefficients in the estimated milk production function. Any deviation of MVP of input from its unit price may be termed as resource use inefficiency. The higher the difference between MVP of an input and its price, the higher is the resource use inefficiency and vice versa.

Further, t-statistic given below was used to test the statistical significance of the difference between the MVP of an input and its unit price.

$$t = \frac{\left|MVP_i - P_i\right|}{S.E\left(MVP_i\right)}$$

where, S.E. (MVPi) = Standard error of MVP and S.E. (bi) is the standard error of regression co-efficient associated with ith input. In case of the present selected Cobb Douglas milk production function, it was calculated as:

$$SE\left(MVP_i\right) = SE\left(b_i\right)\frac{\bar{Y}_1}{\bar{X}_1}.$$

RESULTS AND DISCUSSION

Input-output relationship

Choice and specification of variables have considerable importance on the regression analysis. Even if a single relevant variable is omitted or an unwanted variable is included, the fitted model becomes biased in the economic sense (Heady and Dhillon, 1961). Amongst all production function tried, Cobb Douglas function was found best fit for both crossbred cows and local cows keeping in view the significance, sign of explanatory variable sand value of R^2, hence was preferred for further economic analysis. The Cobb Douglas milk production functions for milking crossbred and local cows are given below.

Table 1 revealed that, the regression coefficients of expenditure on dry fodder, concentrates and miscellaneous expenses for crossbred cows were found

Table 1: Estimated parameters of Cobb Douglas milk production function for crossbred cows

Constant	Estimated parameters						
	Green fodder	Dry fodder	Concentrate	Labour	Miscellaneous expenses	R^2 (%)	N
5.206	0.008	0.064*	0.106**	-0.024	0.149**	68	128
(0.738)	(0.169)	(0.031)	(0.039)	(0.080)	(0.042)		

Note: ** Significant ($p < 0.01$) and * Significant ($p < 0.05$).

Figures in parentheses indicate the standard error of estimate.

Table 2: Estimated parameters of Cobb Douglas milk production function for local cows

Constant	Estimated parameters						
	Green fodder	Dry fodder	Concentrate	Labour	Miscellaneous expenses	R^2 (%)	N
3.871	0.674**	-0.040	0.133**	0.205*	0.087**	76	52
(0.775)	(0.022)	(0.092)	(0.052)	(0.101)	(0.016)		

Note: ** Significant ($p < 0.01$) and * Significant ($p < 0.05$).

Figures in parentheses indicate the standard error of estimate.

Table 3: Marginal Value Product for crossbred and local cows

Category	MVP	Input Price	Difference	SE of MVP	t-value
Crossbred cow					
Dry fodder	7.36	1	6.36*	3.56	1.79
Concentrate	1.63	1	0.63	0.59	1.05
Miscellaneous expenses	7.65	1	6.65*	2.16	3.08
Local cow					
Green fodder	11.61	1	10.61*	2.10	5.06
Concentrate	22.53	1	21.53	25.79	0.84
Labour	0.60	1	0.40	0.62	0.64
Miscellaneous expenses	17.58	1	16.58	32.30	0.51

Note: ** Significant ($p < 0.01$) and * Significant ($p < 0.05$).

positive and significant explaining total variation (R^2) as 68%. The production function analysis indicated that milk productivity could be increased through effective feeding of dry fodder and concentrates and also higher miscellaneous expenses. The table further revealed that the regression coefficient for green fodder was positive and not significant while labour was found negative but not significant. This result corroborates with the findings of Sharma *et al.* (2014) and Rangnath *et al.* (2015) who reported the positive significant impact of concentrates in milk production of crossbred cows in Malwa region of Madhya Pradesh and Western Maharashtra, respectively.

The milk production function for milking local cows revealed that 76 per cent of the variation in returns from milk was explained by expenditures on green fodder, dry fodder, concentrates, labour and miscellaneous expenses (Table 2). Among the five explanatory variables included, regression coefficient of green fodder, concentrates, labour and miscellaneous expenses were found to be positive and significant implying that milk production of local cows could be significantly increased through the efficient use of these inputs. However, the regression coefficient of dry fodder was found to be negative and non-significant in the study area. The findings were in conformity with the findings of Sharma *et al.* (2014) who reported that milk production of local cows could be significantly increased through the efficient feeding of green fodder concentrates in the Malwa region of Madhya Pradesh.

Resource use efficiency in milk production

The marginal value products (MVPs) of inputs whose regression coefficients were found statistically significant in milk production function were compared with their respective unit price to examine the resource use efficiency. A significant higher MVP of an input from its unit price shows that more of that input can be used to increase productivity, while a significant lower MVP of an input than its unit price indicates that the input used is in excess and needs rationalisation. The marginal value products (MVP) of significant inputs for both crossbred and local cows are given in Table 3.

Table 3 revealed that in case of crossbred cows, the difference between marginal value product and marginal factor cost for dry fodder and miscellaneous expenses were positive and significant, indicating that dry fodder and miscellaneous expenses were under-utilised in the study area. Thus, there is a potential to increase the milk production by judicious feeding of dry fodder. Also, increasing miscellaneous expenses would help to boost milk production of crossbred cows in the study area.

The table also revealed that the difference between MVP of green fodder and its unit was found to positive and significant for milking local cows (Table 3) which indicated that green fodder was underutilised for local cows in the study area. The findings of Singh *et al.* (2007) in Imphal West district of Manipur and Mahajan and Chauhan (2011) in Ludhiana district of Punjab reported that concentrates were being efficiently utilised for crossbred cows whereas

green fodder and concentrates were underutilised for local cows in Malwa region of Madhya Pradesh (Sharma *et al.* 2014).

CONCLUSION

The study revealed that concentrates and miscellaneous expenses had positive and significant influence on milk production from both milking local and crossbred cows. It was found that for crossbred cows dry fodder and veterinary expenses were underutilised whereas for local cows green fodder was underutilised in the study area. Therefore, it is suggested that dairy farmers in Mizoram should put more efforts for efficient utilisation of these inputs to increase the milk production. The extension agencies should also take more initiative for giving technical guidance to the farmers about scientific dairy farming in general and better feeding management of milch animals with quality feeds and fodder in particular, in the area.

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Footnotes

1 Miscellaneous expenses mainly include expenses on veterinary charge, electricity, drinking water and packaging material.