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RESOURCE USE EFFICIENCY IN MILK PRODUCTION IN PUNE DISTRICT OF MAHARASHTRA

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Abstract: *The study was undertaken in Pune District of Maharashtra during 2012-13 with the objectives to examine the input-output relationships and to assess the resource use efficiency in milk production. The study covered 45 cooperative member milk producers and 45 non-cooperative member milk producers. The results of Cobb-Douglas production function revealed that concentrate had positive and significant influence on returns from buffalo milk among all the size groups of household for both the member and non-member groups. Green fodder and dry fodder were also influenced the returns from milk significantly among all the household categories for both the member and non-member groups with the exception of large category of non-member group. D_1 (Winter) and D_2 (Rainy) dummy variables were found to be positive and statistically significant. The results of Chow's test clearly revealed that the production functions between member and non-member groups differed significantly. The results of the resource use efficiency revealed that green fodder was over-utilized in small and medium categories for both the member and non-member groups, dry fodder was over-utilized by medium and large category of member group, concentrate was over-utilized by only medium category of member group and by small & medium categories of non-member group while it was under-utilized by large category of non-member group and labour was over-utilized by only small category of member group.*

Keywords: *Green Fodder, Dry Fodder, Concentrate, Labour, Milk and Resource Use Efficiency.*

Introduction

Pune District Milk Producers' Cooperative Union functioning has provided impetus to the enhancement of production and marketed surplus of milk in the Pune district. Therefore, milk production and disposal are expected to have undergone a discernible change. The milk production is influenced by various genetic and non-genetic factors. The non-genetic factors influencing the milk production are quantity and quality of feeds and fodders fed, order of lactation, stage of lactation, labour use, seasons etc. Hence the selection of suitable variables to study the milk production is very essential. To ensure the optimal use of various resources used by the milk producers is have great importance. It is essential to know whether the inputs owned by milk producers are used efficiently or not. An empirical assessment of determinants of milk production and resource use efficiency are important for planning, projecting and formulating dairy development policies. The input-output relationship in milk production and resource use efficiency have been studied by several researchers in the various parts of the country and found different for different areas depending upon the type of milch animals and the milk production technology. No study has been carried out to investigate the milk production function and resource use efficiency in respect of member and non-member households in Pune district of Maharashtra.

In view of this the present study was undertaken to fill this vital gap with the specific objectives (i) to examine the input-output relationships in buffalo milk production across different categories of households and (ii) to study the resource use efficiency in buffalo milk production across different categories of households.

Material & Methods

Pune District Milk Producers' Cooperative Society was purposively selected from Maharashtra state for the present study. All the societies were stratified into three strata, viz., low, medium and high

milk procurement societies on the basis of milk procurement per day using cumulative frequency square root technique. Amongst these societies, six milk procurement societies were randomly selected based on probability proportional to number of societies in each stratum for the present study. In order to have comparative analysis across herd size categories of both the member and non member milk producers, classification of households was done with cumulative frequency square root technique with milch animals as the basis of classification into small, medium and large herd size categories. From six selected societies, 45 member farmers were randomly selected based on probability proportional to number of farmers in each category. Then, an equal number of non-member farmers were selected from each category of farmers from the same society villages. Thus, a total of sample comprising of 90 farmers were selected for study during the year 2012-13. The primary data were collected from were randomly selected households with help of pre-tested schedule by personal interview. The data were collected on milk production, quantity of green fodder, dry fodder, concentrate and miscellaneous expenditure along with their monetary returns.

Analytical Framework

Milk Production Function: The multiple regression analysis was used to study the relationship between returns from milk and different factors influencing it. The specification of milk production function used in the present study was as follows:

$Y = f(X_1, X_2, X_3, X_4, X_{5,} D_{1,} D_2)$

Where,

Y = Value of milk produced per animal per day (Rs.)

X_1 = Value of green fodder fed per animal per day (Rs.)

X_2 = Value of dry fodder fed per animal per day (Rs.)

X_3 = Value of concentrate fed per animal per day (Rs.)

X_4 = Value of labour used per animal per day (Rs.)

X_5 = Value of veterinary aids per animal per day (Rs.)

Pooled milk production functions were also fitted using seasonal dummies. Two seasonal dummy variables were introduced as under:

D_1 = 1, if winter season, D_1 = 0, otherwise D_2 = 1, if rainy season, D_2 = 0, otherwise

Linear and Cobb-Douglas forms of production function were tried.

Linear $Y = Y = a + b_1 x_1 + b2\ x2 + b3\ x3 + b4\ x4 + b5\ x5 + u$

Cobb-Douglas $Y = a\ x_i^{bi}\ x2_i^{bi}\ x_i^{bi}\ x_i^{bi}\ x_i^{bi}\ x_i^{bi}\ x_i^{bi}\ e^{u}$ or

Where, Y = Output, X_i's = Input variables used, i=1,2,3,4 and 5, a = Constant term, b_i's = Parameters to be estimated and u = Random error term.

The choice for a specific functional form was made both on the basis of economic and statistical criteria. Finally, Cobb- Douglas function was found to be the best fit on the basis of coefficient of multiple determination. Hence, results of the same have been used for analysis and interpretation in the study.

Marginal Value Productivity and Resource Use Efficiency: Marginal value productivity of inputs for Cobb- Douglas production function was worked out using the relation,

$$MVPi = bi \frac{Y'}{X'}$$

Where, Y' and X' are the geometric means of output Y and respective i^{th} input and bi is the estimated regression coefficient associated with i^{th} inputs.

Resource use efficiency of inputs measures whether or not the inputs are used optimally. A necessary condition for this is that its MVP should be equal to its price. Mathematically, there exists resource efficiency in respect of the use of i^{th} input.

Since the mathematical form selected was Cobb Douglas and *SE* ( ) is the standard error of estimated partial regression coefficients associated with i^{th} inputs, if $MVP_i = P_{i,}$ where, P_i is the unit price

of i^{th} inputs. In order to examine the resource use efficiency, the MVP of those inputs was worked out whose regression coefficients were statistically significant in the estimated production function. Any deviation of MVP of i^{th} inputs from its unit price, are 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-test was used to test the statistical significance of the difference between the MVP of i^{th} inputs and its unit price.

Results and Discussion

Milk production function describes input-output relationship in milk production. Cobb-Douglas production function for buffalo milk in the case of member and non-member groups was fitted and the results regression analysis is presented in Table 1.

Table 1: Coefficients of parameters of Cobb-Douglas production function for buffalo milk

Category	constant	Regression Coefficients							R^2
		Value of Green Fodder (X1)	Value of Dry Fodder (X2)	Value of Concentrate (X3)	Value of Labour (X4)	Veterinary Expenditure (X5)	D1 (Winter)	D2 (Rainy)	
Member									
Small	1.6825	0.0845** (0.052)	0.6762* (0.1250)	0.6181** (0.1137)	0.1699* (0.0912)	0.0324 (0.0356)	0.0511* (0.0140)	0.0893** (0.0241	0.67
Medium	2.0017	0.0654** (0.0212)	0.3121** (0.0682)	0.3322** (0.0355)	0.5554** (0.0980)	0.0218 (0.0366)	0.0965** (0.0095)	0.0474** (0.0161)	0.61
Large	1.4811	0.4106** (0.1015)	0.3596** (0.1037)	0.7005** (0.1355)	-0.0243 (0.0929)	-0.0444 (0.0368)	0.0683** (0.0096)	0.0589* (0.0232	0.75
Non-member									
Small	1.8924	0.0498** (0.0660)	0.7084** (0.1115)	0.3468** (0.0433)	0.1342 (0.0935)	0.0148 (0.0105)	0.0815** (0.0137)	0.1384** (0.0190	0.55
Medium	1.7909	0.0564** (0.0209)	0.5321** (0.1198)	0.2197** (0.0255)	0.4354** (0.1561)	-0.0015 (0.0150)	0.0873** (0.0144)	0.1148** (0.0262)	0.63
Large	1.9262	0.2773 (0.1961)	0.1247 (0.1963)	0.8869** (0.1476)	0.0521 (0.1798)	-0.0954 (0.0826)	0.1540** (0.0202)	0.1223** (0.0414)	0.72

Figures in parentheses indicate standard error, * Significant at 5 per cent & ** Significant at 1 per cent

A close examination of the Table 1 revealed that the coefficients of multiple determination (R^2) were ranged from 0.61 (medium category) to 0.75 (large category) for the member group and from 0.55 (small category) to 0.72 (large category) for the non-member group. This indicated that total variations in returns from milk were explained by the variables included in the selected regression model ranged from 61 per cent (medium category) to 75 per cent (large category) for the member group and from 55 per cent (small category) to 72 per cent (large category) for the non-member group. It is revealed from Table 1 that concentrate showed to be most important variable influencing return from milk. Its regression coefficient was positive and statistically significant among all the household categories for both the member and non-member groups indicated greater influence of concentrate on returns from buffalo milk production. On an average, one per cent increase in the expenditure on concentrate resulted in an increase of 0.6181, 0.3322 and 0.7005 per cent in returns from milk in small, medium and large category of member, respectively and 0.3468, 0.2197 and 0.8869 per cent in returns from milk in small, medium and large category of member, respectively. Green fodder was observed to be next important variable to influence the returns from milk significantly across all the household categories for both the member and non-member groups with the sole exception of large category of non-member group. Regression coefficients of dry fodder like green fodder were also influenced the returns from

milk significantly among all the household categories for both the member and non-member groups with the sole exception of large category of non-member group. The regression coefficients of labour input was found to have positive and significant impact on returns from milk on small and medium category in the case of member group and only medium category in the case of non-member groups. The regression coefficients of veterinary expenditure were not found to be statistically significant among all the household categories for both the member and non-member groups. The seasonal dummy variables (D_1 and D_2) were used to examine the effect of a particular season on returns from milk. It was observed that both D_1 and D_2 dummy variables were found to be positive and statistically significant. This indicated that returns from buffalo milk were significantly differed in winter and rainy seasons as compared to summer season. The results of Chow test clearly indicated that two functions for member and non-member groups deviate significantly.

Resource Use Efficiency

The marginal value productivities (MVPs) of inputs used in buffalo milk production in comparison to their respective prices are presented in Table 2. The marginal value productivity of green fodder was positive and significantly lower than their price of this input in the case of small and medium categories for member and non-member groups. It indicated that green fodder was over-utilized in the case of small and medium categories for both the member and non-member groups. Therefore, use of this input should be decreased further by farmers of these categories for getting

Table 2: Comparison of MVPs of inputs with their prices for buffalo milk production across household categories

Category /Inputs	Member			Non-member		
	Small	Medium	Large	Small	Medium	Large
Green Fodder						
MVP	0.2411	0.1240	0.7818	0.0922	0.1213	--
Price	1.00	1.00	1.00	1.00	1.00	--
Diff. in MVP & Price	-0.7589** (0.0421)	-0.8760** (0.0456)	-0.2182 (0.2012)	-0.9078** (0.0262)	-0.8787** (0.0358)	--
Dry Fodder						
MVP	1.2108	0.6822	0.7155	1.3411	1.0340	--
Price	1.00	1.00	1.00	1.00	1.00	--
Diff. in MVP & Price	0.2108 (0.2359)	-0.3178** (0.1405)	-0.2845** (0.1849)	0.3411 (0.1902)	0.0340 (0.2090)	--
Concentrate						
MVP	1.1558	0.6711	1.4806	0.6363	0.4845	2.1661
Price	1.00	1.00	1.00	1.00	1.00	1.00
Diff. in MVP & Price	0.1558 (0.2357)	-0.3289** (0.0790)	0.4806 (0.2814)	-0.3637** (0.0842)	-0.5155** (0.0720)	0.1661* * (0.3719)
Labour						
MVP	0.3421	1.0903	--	--	0.7844	-
Price	1.00	1.00	--	--	1.00	-
	0.5679** (0.1894)	0.0903 (0.1976)	--	--	-0.2156 (0.3029)	

Figures in parentheses indicate standard errors of difference. ** Significant at 1 per cent

higher returns from milk production. The marginal value productivity of dry fodder was positive and significantly lower than its price only in the case of medium and large size group. It indicated that dry fodder was also over-utilized in the case of medium and large size group. This calls for decrease in the feeding of dry fodder in order to increase the return from milk by farmers of this category. The marginal value productivity of concentrate was positive and significantly lower than their price only in case of

medium category of member group and in the case of small and medium categories of non-member group while it was positive and higher than its price in the case of large category of non-member group. This indicated that concentrate was over-utilized by medium category of member group and small & medium categories of non-member group while it was under-utilized by large category of non-member group. This indicates that in order to get more return from milk production, buffaloes should be fed less concentrate by medium category of member group and small & medium categories of non-member group while buffaloes should be fed more concentrate by large category of non-member group. The marginal value productivity of labour was also positive and significantly lower than their price only in the case of small category of member group which indicated over utilization of labour on this category. This calls for decrease in the use of labour in order to increase the return from milk.

Conclusions

The results of the study inferred that concentrate, green fodder and dry fodder were the important influencing factors in buffalo milk production. Therefore, these factors should be considered by policy makers and dairy cooperatives in order to increase the returns from buffalo milk. The returns from buffalo milk were significantly higher in winter and rainy seasons as compared to summer season. In order to get higher returns from buffalo milk production, use of green fodder should be decreased by small and medium categories of both the member and non-member groups, dry fodder should be reduced by medium and large category of member group, concentrate should be reduced by medium category of member group as well as by small & medium categories of non-member group while it should be increased by large category of non-member group and use of labour should be reduced by small category of member group.

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