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RESEARCH ARTICLE

Milk production function and resource use efficiency in rural and urban area of district Bulandshahr of Western U.P.

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Abstract : Study was conducted to find out the input-output relationship and assess the resource use efficiency in milk production in different categories of rural and urban milk producers in Bulandshahr district of western U.P. The data pertaining to milk yield and value of milk, quantity of dry fodder, green fodder and concentrate fed to each milch animal along with price were collected from a total 140 household (70 rural and 70 urban families) selected on the basis of probability proportionate random sampling technique by personal interview method with the help of pre-tested schedule. Linear and Cobb-Douglas production functions were applied. The functional analysis indicates that the functional analysis indicates that the significant co-efficient of concentrates showed a significant impact on milk yield in all categories of rural and urban milk producers. Further, the regression co-efficient of green fodder was found significant in rural and urban milk producer which shows further scope to increase milk production through green fodder in both categories. The regression co-efficient of dry fodder was not found significant in any category of rural and urban milk producers. The marginal value productivity of concentrate was significantly higher than its price in milk production in case of rural and urban milk producers. It indicates that the concentrates was not used at optimal level by milk producers and there is much scope for increasing net returns from milk production by increasing the more use of concentrates.

Key words : Concentrate, Dry fodder, Green fodder, Resource use efficiency, Rural, Marginal value of productivity (MVP), Urban

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INTRODUCTION

Dairy sector in India has acquired substantial growth momentum from 9th plan onwards as a result of which we now rank first among the world's milk producing nations, achieving an annual output of about 146.3 million tonnes of milk during 2014-15. This represents sustained growth in the availability of milk and milk products for our growing

population. Dairying has become an important secondary source of income for millions of rural families and had assumed the most important role in providing employment and income generating opportunities particularly for marginal and women farmers. Most of the milk is produced by small, marginal farmers and landless labourers. Government of India is making efforts for strengthening the dairy sector through various development schemes. (Satyakam, 2016) Dairying has got its own identity as major subsidiary income generating activity in mixed crop livestock systems in India. A majority of Indian dairies are characterized by indigenous, crossbred cows and buffaloes profusely fed on crop residues which are available at the agricultural farm yard. Milk is a 'cash crop' for them, converting low value agricultural byproducts, crop residues and cheap family labour into a value added market commodity (Taneja and Birthal, 2005). Increase in milk production with limited resources like quality and quantity of feed, labour, genetic potential of the animal and to ensure the optimal use of various inputs used by the milk producers is matter of primary concern. It is important to know whether the inputs owned by milk producers are used efficiently or not. Resource use efficiency comprised the distribution of a given amount of scare factor among the set of alternatives in the production so as to maximize the profit (Ganesh Kumar *et al.*, 2000). An empirical assessment of determinants of milk production and resource use efficiency are important for planning, projecting and formulating dairy development policies in a particular region (Meena *et al.*, 2012). No study has been carried out to investigate the milk production function and resource use efficiency in respect of rural and urban area of Bulandshahr district of western U.P. To achieve optimum production of milk, it is imperative to know the resource use efficiency in milk production. Therefore, an attempt has been made in the present study to examine the resource use efficiency in milk production. Keeping in view the present study was conducted with the following specific objectives:

– To examine the production of milk
– To know the returns from milk
– To find out resource use efficiency in milk production

RESEARCH METHODOLOGY

The study was confined to Bulandshahr district in western Uttar Pradesh. The Bulandshahr district was purposively selected for the study because the dairy development facilities are well developed for increasing the milk production in the district. The Bulandshahr district consists of sixteen development blocks, one blocks namely Bulandshahr was selected for the present study purposively. Since, this block is near the district headquarter. After selection of block the list of villages falling in Bulandshahr block was taken from the block headquarter. Then the whole villages were divided into two categories *i.e.* villages located in the urban vicinity *i.e*. city boundary (Nagar Maha Palika) and secondly the villages located out of the city boundary (rural area) at different distances in rural area. After doing so, 5 villages from rural and 5 villages from urban areas were selected, randomly. After selection of villages, two separate lists of animal keeper of weaker section community (small, marginal and landless) were prepared for rural and urban areas. Then 70 cases from rural milk producers (14 small, 21 marginal and 35 landless) and 70 cases from urban milk producers (12 small,16 marginal and 42 landless) were selected for the present study for the comparison of the economy of rural and urban milk producers. The final selection of cases of rural and urban milk producers families was made purely on random basis from different categories based on proportion to its size. The study was based upon primary data. The primary data were collected with the help of pre-prepared schedules and questionnaires by personal interview method within four five meetings with the respondents. Thus, the survey method was used for the collection of data. The primary data related to the year 2008-09. The data obtained from different categories of rural and urban milk producers were analyzed with the help of tabular analysis for drawing the result.

Regression analysis was employed to develop the functional relationship in milk production. The equations were fitted using per animal data, taking production per day as dependent variable and value of feed and fodder as explanatory variable. Two forms of production function, linear and Cobb-Douglas were tried to feed and fodder to establish the relationship with production of milk. The Cobb- Douglas Model was found to be the best fit for milk production function. To ascertain the functional relationship in milk production regression analysis was employed separately for rural and urban milk producers. So ascertaining input-output relationship of milk production value of concentrates, dry

fodder and green fodder were considered together with over variables in regression analysis. To find out input-output relationship between milk production and various explanatory variables *viz.*, dry fodder, green fodder and concentrate. The regression analysis was employed separately for rural and urban milk producers. The specification of milk production function used in the present study was as follows:

$$Y = f(X_1, X_2, X_3)$$

where,

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

X_1 = Cost of concentrate fed per animal per day (Rs.)

X_2 = Cost of green fodder fed per animal per day (Rs.)

X_3 = Cost of dry fodder fed per animal per day (Rs.).

Two type of function form namely multiple linear and Cobb- Douglas were tried.

Linear $Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + U$

Cobb-Douglas $Y = aX_1^{b1} X_2^{b2} X_3^{b3} U$

where,

U = The error term.

In addition to the 'a' is constant term and b_1, b_2 and b_3 are the regression co-efficient of Y with respective explanatory variables X_1, X_2 and X_3, respectively.

Y is the dependent variable.

Marginal value productivity:

The marginal value productivity (MVP) in different categories of rural and urban families for major input like dry fodder, green fodder and concentrate were estimated at their geometrical mean level to judge the degree of disequilibrium in the resource use and suggested the direction of resource use (Sharma and Singh, 1993). The formula for ascertaining the MVP for major input was used as under:

$$MVP(X_n) = b_n \frac{G.M.\ OF\ Y}{G.M.\ OF\ X_n}$$

where,

b_n = Regression co-efficient associated with X_n input

G.M = Geometric mean.

n= Inputs (1, 2, 3)

X_n = Geometric mean of n input

Y= Geometric mean of output.

RESULTS AND DISCUSSION

The production of milk per family and per animal in different categories of rural and urban milk producers was studied as presented in Table 1.

The Table 1 indicates that overall average milk production per family was 4414.33 litres and 3906.63 litres in case of rural and urban milk producers, respectively. The milk production per family was higher in all categories of rural milk producers as compared to urban milk producers. It was due to higher milk production and better care of mulch animals in case of rural on the one hand and better quality of animals on the other hand. The table further shows that production of milk per animal was 1806.55 litres and 1730.13 litres in the case of rural and urban milk producers, respectively. The milk production per animal was maximum in all categories of rural milk producers in comparison to urban milk producers. It was due to keeping of better animals and better feeding by the rural milk producers.

The net returns from milk per family and per animal in different categories of rural and urban milk producers was worked out as shown by the Table 2.

Table 2 reveals that overall net returns per family was Rs. 43596.48 in the case of rural milk producers and Rs. 45339.49 in the case of urban milk producers. The net returns from milk per family in all categories of rural milk producers was higher as compared to urban milk producers. It was due to more milk production found in the case of rural milk producers. The table further shows that overall average net returns per animal was Rs. 17774.26 and Rs. 20053.19 in the case of rural and urban milk producers, respectively. The net returns from milk per animal was higher in all categories of rural in comparison to urban milk producers. It was due to more milk sold at remunerative price by the urban milk producers. Milk production functions under different categories of rural and urban milk producers families was studied and shown in Table 3.

The Table 3 reveals that in case of rural milk producers families the overall average of variation in per day milk production came to 73 per cent. In different categories it came to about 62 per cent on small farms, about 84 per cent on marginal farms and 86 per cent in case of landless families. In case of urban milk producers families the overall average of variation in per day milk production came to about 77 per cent. The category wise analysis indicates that it came 74 per cent on small farms, about 87 per cent on marginal farms and about 83 per cent in landless families of urban milk producers. It was explained on the basis of variables involved in the regression equation. The elasticity of milk production were found significant for green fodder and concentrates in case of rural and urban milk producers. The elasticity for green fodder was found to be positive and significant for small and landless categories in rural and urban both milk producers, but statistically non significant for marginal families in case of rural and urban milk producers. In case of rural and urban both milk producers the elasticity for dry fodder was found to be non- significant in all categories of respondents. The elasticity for concentrate was found to be significant in small, marginal and

Table 1: Production of milk per family and per animal in different categories of rural and urban milk producers

(in litres)

Category	Milk production per family	Milk production per animal
Rural		
Small	3914.01	1767.61
Marginal	4485.21	1846.85
Landless	4571.92	1797.95
Overall	4414.33	1806.55
Urban		
Small	3892.80	1796.68
Marginal	4282.34	1803.10
Landless	3767.46	1683.33
Overall	3906.63	1730.13

Table 2 : Net returns from milk production per family and per animal in different categories of rural and urban milk producers

(in Rs.)

Category	Net return per family	Net return per animal
Rural		
Small	32744.73	14787.80
Marginal	44562.53	18349.26
Landless	47357.55	18623.85
Overall	43596.48	17774.26
Urban		
Small	39268.18	18123.83
Marginal	51649.23	21747.27
Landless	44670.43	19959.06
Overall	45339.49	20053.19

landless categories of rural milk producers and in case of urban milk producers the elasticity was not significant in case of small and landless categories but it was significant in case of marginal respondents. The overall elasticity of milk production were found to be significant for green fodder and concentrates in case of rural and urban milk producer respondents. The milk production in case of rural and urban both milk producers is likely to increase further by increasing green fodder and concentrates. The functional analysis indicates that the significant co-efficient of concentrates showed a significant impact on milk yield in all categories of rural and urban milk producers. Further, the regression co-efficient of green fodder was found significant in rural and urban milk producer, which shows further scope to increase milk production through green fodder in both categories. The regression co-efficient of dry fodder was not found significant in any category of rural and urban milk producers. The other researchers found in their studies that (Mahajan, 2010) concluded that Cobb Douglass function was best fit. In production function of peri urban dairy farm, the partial regression co-efficient of expenditure on concentrate for crossbred cattle were found positive and significant with total explained variation, that is, R-2 as 84.3 per cent Singh (2008) concluded that green fodder; dry fodder and concentrate were underutilized indicating that feeding of more quantity of green fodder and concentrate will further increase the productivity of milch buffaloes in the study area. (Vishnoi *et al*., 2015) the green fodder, dry fodder, labour and miscellaneous expenditure were found to be statistically significant in case of small category of commercial dairy farm, green fodder, dry fodder and miscellaneous expenditure in case of medium, green fodder, concentrate, labour and miscellaneous in case of large and concentrate and labour in case of overall herd size category. The results of resource use efficiency. (Venkatesh and Sangeetha, 2011) found in their study that all the selected input variables such as green fodder, dry fodder, concentrates and health care were positive and significant

Table 3 : Milk production functions under different categories of rural and urban milk producers families

Category	No. of observations	Constant	Regression co-efficient			R-2
			Green fodder	Dry fodder	Concentrate	
Rural						
Small	28	8.103	0.0189** (0.016)	-0.0532 (0.063)	0.697* (0.100)	0.623
Marginal	45	7.362	0.0697 0.058)	-0.072 (0.045)	0.579* (0.097)	0.847
Landless	79	8.403	0.1310* (0.089)	-0.037 (0.076)	0.547* (0.117)	0.862
Overall	152	6.456	0.156* (0.030)	-0.110 (0.040)	0.129* (0.035)	0.728
Urban						
Small	22	1.180	0.036* (0.013)	-0.022 (0.019)	0.172* (0.052)	0.739
Marginal	31	2.336	0.0986 (0.0134)	-0.048 (0.041)	0.169* (0.087)	0.872
Landless	83	3.583	0.095* (0.055)	-0.035 (0.021)	0.121 (0.070)	0.832
Overall	136	5.633	0.119* (0.028)	-0.0143 (0.048)	0.110* (0.014)	0.766

* and ** indicate significance of values at P=0.01 and 0.05, respectively
(Figures in parenthesis indicate standard error) Note- only wet animals have been considered for functional analysis

Table 4 : Marginal value productivities under different categories of rural and urban milk producers families (in Ra.)

Category	Green fodder	Dry fodder	Concentrate
Rural			
Small	10.180	1.214	6.436
Marginal	6.246	1.002	2.254
Landless	-0.012	2.808	6.925
Overall	5.827	-1.734	6.432
Urban			
Small	11.500	-0.128	5.289
Marginal	1.529	-0.513	2.042
Landless	3.827	-0.286	3.224
Overall	6.937	-1.231	5.183

impact on the production of milk indicating the potentiality of their further use. (Kashish *et al.*, 2016) found that co-efficients of dry fodder and concentrates were positive and significant indicating increase in feed and fodder inputs will increase the milk productivity. Most of the other past studies conducted on resource use efficiency using milk production function analysis (Murthy and Naidu, 1992; Shah and Singh, 1995; Kairon *et al*., 1995; Kumar and Singh, 2004; Dwaipayan *et al.*, 2006 and Kumar *et al*., 2012) concluded that green fodder and concentrate affect milk production significantly. (Tanwar *et al.*, 2015) concluded that concentrate and green fodder are the major explanatory variables affect the milk production as well as returns from dairy farming in most of the categories in members and non-members of dairy co-operatives.

The marginal values of productivities (M.V.P.) were also estimate separately in different categories of rural and urban milk producers family are shown in Table 4.

Data in Table 4 reveals that overall basis the dry fodder has no scope for further increase because of negative marginal value productivities in case of rural and urban families both. The MVP of green fodder and concentrate was 10.180 and 6.436, respectively in case of small in rural category. It shows that there is greater scope to increase these inputs for enhancing milk production due to positive and higher MVP. Category wise analysis in case of rural category shows that there is further scope for increase in green fodder and concentrates for enhancing milk production. The table further shows that in case of urban respondents on overall basis the MVP of dry fodder was -1.231and 6.937 for green fodder and 5.183 for concentrate. It shows that there is no scope for increasing the dry fodder but green fodder and concentrates can be increase for enhancing milk production. It was also found that MVP of concentrates in small, marginal and land less milk producers were 5.289, 2.042 and 3.224, respectively. It can be concluded that MVP of concentrate was positive which implies that this input was underutilized and further increase in concentrates will increase the milk production. The marginal value productivity of concentrate was significantly higher than its price in milk production in case of rural and urban milk producers. It indicates that the concentrates was not used at optimal level by milk producers and there is much scope for increasing net returns from milk production by increasing the more use of concentrates. The other researcher found in their study that (Wani *et al*., 1992) estimated the marginal value product of relevant input variables separately for non-descript and crossbred cows in the Kashmir valley. (Vishnoi *et al.*, 2015) indicated that none of the marginal value productivity of all inputs was statistically significant across and overall herd size category except labour in large category and overall herd size category in the study area. (Rangnath *et al*., 2015) revealed that concentrates had positive and significant influence on milk production from both milking buffaloes and crossbred cows in the study area. It was found that for both milking buffaloes and crossbred cows concentrates was under utilized in the study area (Meena *et al.*, 2012). 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 category of member group, concentrate was over-utilized by only medium category of member group and by small and 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.

Conclusion:

The functional analysis shows that the significant co-efficient of concentrates showed a significant impact on milk yield in all categories of rural and urban milk producers. Further, the regression co-efficient of green fodder was found significant in rural and urban milk producers which shows further scope to increase milk production through green fodder in both categories. The regression co-efficient of dry fodder was not found significant in any category of rural and urban milk producers. The marginal value productivity of concentrate was significantly higher than its price in milk production in case of rural and urban milk producers, which shows that the concentrates was not used at optimal level by milk producers and there is much scope for increasing net returns from milk production by increasing the more use of concentrates in the area under study.

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