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Resource Use Efficiency in Milk Production and Milk Utilization Pattern of Milk Producers in Hilly Areas of Kumaon Region of Uttarakhand

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ABSTRACT

The present study was conducted in hilly areas of two districts, viz. Nainital and Almora of Kumaon region of Uttarakhand to estimate the resource use efficiency in milk production and to study the milk utilization pattern of milk producers. A sample of 120 farmers was drawn. Cobb-Douglas production function was employed to estimate the resource use efficiency, simple statistical tools to examine utilization pattern of milk producer. The magnitude of coefficients of multiple determination (R^2) indicate that the explanatory variables included in the model was responsible for 85 per cent, 91 per cent and 88 per cent variation in milk production in case of cows, buffaloes and at aggregate level, respectively. The regression coefficients of green fodder, dry fodder and veterinary expenses were found to be positive and significant in all cases, while the same of human labour was found to be positive and significant in case of buffaloes. More than two-third (66.78 per cent) quantity of milk produced by the milk producers was marketedand only about one-third portion (33.22) was utilized at farm level.

Key words: *Cobb-Douglas, Resource use efficiency, Regression coefficients, Utilization pattern*

INTRODUCTION

India is predominantly an agricultural country and livestock has been an integral component of India's agriculture and rural economy. India with only 2.4 per cent of world's total land area supports about 18 per cent of human and 15 per cent of livestock population in the world. Dairying brings socio-economic transformation to the rural poor in India. Dairying provides cash income and creates employment opportunity for rural people particularly for the small farmers and landless labourers. Dairying is considered to have high prospects to enhance the level of living of the poorest of the poor. Nearly 70% of population of the state is associated with animal husbandry, which alone generates around 97.24 million man-days of employment per annum (Annual report, ULDB, 2007-08).

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Milk production in the hilly region of Uttarakhand, represents an underdeveloped production environment due to the improper utilization of resources. The resource use efficiency varies from region to region and farmer to farmer due to the variation in the input use and socio-economic condition of farmers. If milk production has to be a remunerative enterprise the milk producers should be able to get a considerable net profit over- all cost of various inputs and selling cost of the product. The utilization pattern of milk producers varies from village to village and family to family on account of variation in factor like family size, size of livestock herd, milk production, etc. Usually in a large family the milk that is produced, is almost consumed in the family itself, a very little is left for sale. This problem is more common in rural and hilly areas. In view of the above problematic situation, present study was undertaken with following specific objectives to 1) estimate the resource use efficiency in milk production and 2) to study the milk utilization pattern of milk producers.

The study was conducted in hilly areas of Kumaon region of Uttarakhand in two districts viz. Nainital and Almora having highest livestock population. From each district, two blocks Bhimtal and Okhalkanda from Nainital district and Chaukhutiya and Hawalbagh from Almora district, were selected purposively. From each selected block, three villages each were selected randomly. From the selected villages ten milk producing households each were selected randomly. Thus the study was based on the information collected from 120 households. Total selected milk producing household were classified into three categories on the basis of type of animals they rear for milk production i.e. cow rearers, buffalo rearers and overall basis, to estimate resource use efficiency as well as milk utilization pattern of milk producers. Primary data on different aspects of livestock enterprise were collected by personal interview through a well structured pre-tested survey schedule. Secondary data collection was done through extensive literature review on the concerned subject matter.

Resource use efficiency in milk production

Cobb -Douglas type production function was employed to estimate the input- output relationship between milk production per household per day as dependent variable and green fodder, dry fodder, concentrate, human labour and veterinary expenses as explanatory variables for milk production. The production functions were estimated for per day per household milk production by cows and buffalo, separately. The function was also estimated for aggregate level. The functional relationship of the Cobb-Douglas function was fitted because it has been widely used in estimating input use efficiency by many researchers. This type of production function is linear in its logarithmic form, and therefore easy to estimate by using ordinary least squares (OLS) technique.

The form of the function fitted was specified as follows:

$$Y = aX_1^{b_1}X_2^{b_2}X_3^{b_3}X_4^{b_4}X_5^{b_5}e^u$$

where,

Y = Milk production (litres per household per day)
X_1 = Green fodder (kg per household per day)
X_2 = Dry fodder (kg per household per day)
X_3 = Concentrates (kg per household per day)
X_4 = Human labour (man days per household per day)
X_5 = Veterinary expenses (rupees per household per day)
a = Constant
e = Napier base

Elasticities b_1, b_2, $b_3 \ldots b_5$ indicate the percentage change in the output due to one per cent change in the particular input, while all other inputs are kept constant.

Before fitting the production function to the data, the data was put to test problem of multicollinearity. The equation was estimated using ordinary least square (OLS) method. The Cobb- Douglas form of production function was converted into log linear form prior to apply OLS technique as under;

$$\ln Y = \ln a + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + U$$

For testing the significance of regression coefficients (b_i's),'t' test was employed using the following formula;

$$t = \frac{b_i}{SE\ of\ b_i}$$

where,

b_i = Regression coefficient of i^{th} input.
S.E(b_i) = Standard error of i^{th} input.

In order to ascertain the goodness of fit, coefficient of multiple determination was calculated using the formula as given below:

$$R^2 = \frac{RSS}{TSS}$$

where

RSS = Regression sum of squares

TSS = Total sum of squares

Estimation of marginal value productivity

The marginal value productivity of different resources was calculated by multiplying the marginal physical product of the i^{th} input by the unit price of the milk. Mathematically it can be expressed as:

$$MVP_{Xi} = MPP_{Xi}(P_Y)$$

$$MVP_{Xi} = b_i \frac{\overline{Y}}{\overline{X_i}}(P_Y)$$

Where

MPP_{Xi}	=	Marginal physical product of i^{th} input
P_Y	=	Price of output per unit (Rs.)
$\overline{Y}$	=	Geometric mean of output
$\overline{X_i}$	=	Geometric mean of i^{th} input
b_i	=	Regression coefficients (i = 1,2,……,5)

Estimation of marginal input cost

The input cost of different resources was worked out by taking per unit charges of the respective resource.

$MIC_{Xi} = P_{Xi}$

where,

MIC_{Xi} = Marginal input cost of i^{th} input

P_{Xi} = Unit price of i^{th} input

Marginal value product (**MVP)** and marginal input cost **(MIC)** for each input was calculated. The significance of the differences of these two was tested by computing the value of 't' statistics, using the following formula;

$$t = \frac{MVPxi - MICxi}{S.E\ OF\ MVPxi}$$

where,

$$S.E\ of\ MVPxi = \sqrt{AVP.V(b_i)}$$

V(bi)= Variance of i^{th} coefficient.

Several authors (Onuk et al., 2010), Okon and Enete (2009) have used the following criterion for determining optimality of resource use:

MVP/MIC > 1 under utilization of resources

MVP/MIC = 1 optimal use of resources

MVP/MIC < 1 excess use of resources

Milk utilization pattern of milk producers

In order to study the milk utilization pattern of milk producers simple descriptive statistical tools like averages, percentage were used. Of the total milk produced, amount of milk was used for household consumption in the form of ghee, curd, whey etc., and quantity of milk was marketed, analyzed under this objective.

RESULT AND DISSCUSSION

Resource use efficiency in milk production

To examine the resource use efficiency in the milk production Cobb-Douglas production function was fitted separately for different categories of animals viz. cow, buffalo and cow plus buffalo as a whole. As revealed from the table 1.1 that the regression coefficient of green fodder, dry fodder and veterinary expenses were found to be positively significant in case of cow, buffalo and at aggregate level. The regression coefficient of human labour was found to be positively significant in case of buffalo. It may be inferred in case of cow, the coefficient of multiple determination (R^2) was 0.85 which indicated that the five variables selected for the analysis have explained 85 per cent variation in total milk production. Among the five variables, green fodder, dry fodder and veterinary expenses were significant at one percent level. The perusal of table 1.1 further depicts that in case of buffalo, the coefficient of multiple determination (R^2) was quite high on household basis. The coefficient of multiple determination was 0.91 for buffalo which indicated that the five explanatory variables included in the model had explained 91 per cent variation in total milk production. Among the five variables, green fodder, dry fodder, human labour and veterinary expenses were significant at one percent level. The table also revealed that in case of aggregate, the coefficient of multiple determination (R^2) was 0.88 which implies that all five variables viz. green fodder, dry fodder, concentrate, human labour and veterinary expenses included in regression model selected were responsible for 88 per cent variation in total milk production and rest by error terms. Among the five variables, green fodder, dry fodder and veterinary expenses were significant at one percent level.

Table 1.1: Estimated production function for milk production by cows and buffalo

Category of animals	Item	Constant	Green fodder (Kg)	Dry fodder (Kg)	Concentrate (Kg)	Human labour (Mandays)	Veterinary expenses (Rs.)
Cows	b_i	-0.4013	0.3887*	0.5997*	0.0811	0.0262	0.1343*
	Standard error	0.1127	0.0968	0.1098	0.0552	0.0326	0.0418
	t value	-3.5609	4.0136	5.4620	1.4678	0.8028	3.2106
R^2=0.85							n=78
Buffalo	b_i	-0.2830	0.4615*	0.4742*	-0.0042	0.1292*	0.0861*
	Standard error	0.1139	0.1036	0.0646	0.0238	0.0414	0.0270
	t value	-2.4853	4.4547	7.3440	-0.1753	3.1179	3.1949
R^2= 0.91							n=59
Aggregate	b_i	-0.2292	0.3339*	0.5392*	0.0337	0.0314	0.1919*
	Standard error	0.0719	0.0560	0.0532	0.0325	0.0249	0.0275
	t value	-3.1897	5.9613	10.1320	1.0350	1.2602	6.9706
R^2=0.88							n=120

*Significant at 1% level; **Significant at 5%

Marginal value productivity and resource use efficiency in milk production by cows and buffalo

The marginal value product of various input at their geometric mean levels holding other variables constant, for all categories of animal were presented in table 1.2. A significant higher MVP of an input than its price shows that more of the input can be used to increase productivity, while a significant lower MVP of an input than its unit price indicates that the input is used in excess and needs reduction. A perusal of the table 1.2 and 1.3 reveals that marginal productivity of green fodder which exercised positive impact on yield on cow, buffalo and cow plus buffalo as a whole at Rs. 2.08, Rs. 3.57 and Rs. 2.05 respectively. However, a comparison of the price of green fodder with its marginal value product shows that the marginal value of product was significantly higher than its acquisition cost in all cases, which implies that there was a scope to increase the yield of milk through increasing the use of green fodder. The marginal value productivity of dry fodder was found to be Rs. 12.11, Rs.9.82 and Rs. 10.91 in case of cow, buffalo and at aggregate level. A comparison of marginal value product of dry fodder with its acquisition cost indicates that the marginal value product of same was significantly higher than its acquisition cost in all cases which suggests that there was an urgent need to increase the use of all the inputs in the production of milk to the optimal level, so that dairy farmers of the study area can gain much more than the previous one. The marginal value productivity of human labour was significantly higher than its marginal input cost in case of buffalo. This reveals that human labour on buffalo is applied at suboptimal level which implying thereby that there was scope to raise the milk production through increasing human labour on buffalo. It was also revealed from the table that the marginal value productivity of veterinary expenses was significantly higher than its acquisition cost on cow, buffalo and at aggregate level, which shows that there was suboptimal use of this resource and per household milk production can be raised through augmenting the veterinary expenses in this cases, so that dairy farmers of the study area can gain much more than what they are presently receiving.

Table 1.2: Marginal value productivities (MVPs) of the resources

S.No	Variables	Category of animals		
		Cow	Buffalo	Aggregate
1.	Green fodder (kg)	2.08* (1.52)	3.57* (1.40)	2.05* (1.46)
2.	Dry fodder (kg)	12.11* (3.87)	9.82* (2.80)	10.91* (3.33)
3.	Concentrate (kg)	8.40 (6.31)	-0.52 (3.57)	3.68 (4.94)
4.	Human labour (man days)	17.48 (65.11)	80.34* (68.85)	20.19 (66.77)
5.	Veterinary expenses (Rs.)	37.87* (1)	25.13* (1)	55.07* (1)

Note: Figures in parantheses indicate the respective marginal input cost
*Significant at 1 per cent probability level
**Significant at 5 per cent probability level

Table 1.3: Resource use efficiency (MVP/MIC) in milk production

S.No	Variables	Category of animals		
		Cow (MVP/MIC)	Buffalo (MVP/MIC)	Aggregate (MVP/MIC)
1.	Green fodder (kg)	1.37	2.55	1.40
2.	Dry fodder (kg)	3.13	3.51	3.27
3.	Concentrate (kg)	1.33	-0.15	0.75
4.	Human labour (man days)	0.27	1.17	0.30
5.	Veterinary expenses (Rs.)	35.87	25.13	55.07

2. Milk utilization pattern of milk producers

Agriculture commodities produced at farm have multiple uses; it is consumed or utilized in different ways. Therefore, it is imperative to study utilization pattern of milk at producers' level. The utilization pattern helps the milk producers to direct their own development, placing control on resources, they create. Total milk which produced is utilized for calf feeding, for human consumption in the form of fresh milk, ghee, curd and residual if any of milk is marketed. A perusal of the table 2.1 reveals that the total milk produced per household per annum at aggregate level was 2088.89 litres per annum. The analysis of the table indicates that 384.93 litres (18.88 per cent) and 404.46 litres (18.69 per cent) per household per annum was consumed at household in the form of fresh milk by cow and buffalo rearers, respectively. It was estimated that 169.25 litres and 180.66 litres was utilized for curd making at household level, respectively with an average of 174.07 litres at aggregate level. Approximately 75 litres per household per annum was fed to calf in case of milk produced by cow while 105 litres per household per annum was fed to calf in case of milk produced by buffalo. The table further reveals that at aggregate level 1392.59 litres (66.78 per cent) of milk produced per household per annum was marketed, which varied from 1353.07 litres (66.73 per cent) in case of cow to 1445.29 litres (66.67 per cent) in case of buffalo. The utilization pattern of milk shows that major portion of milk was marketed by milk producers and only about one-third portion was utilized at farm level in the form of curd, ghee, etc.

Table 2.1: Milk utilization pattern of milk producers on annual basis

(litre/annum/household)

S.No	Particulars	Cow	Buffalo	Aggregate
1.	Total milk produced (litres)	2029.60 (100)	2167.93 (100)	2088.89 (100)
2.	**On Farm Utilization**			
a.	Fresh milk consumption (litres)	384.93 (18.88)	404.46 (18.69)	392.96 (18.88)
b.	For ghee making (litres)	47.36 (2.34)	32.52 (1.52)	45.26 (2.10)
c.	For curd making (litres)	169.25 (8.27)	180.66 (8.25)	174.07 (8.39)
d.	Milk fed to calves (litres)	75.00 (3.78)	105.00 (4.88)	84.00 (4.02)
	Sub Total (a – d)	676.53 (33.27)	722.64 (33.33)	693.92 (33.22)
3.	**Total milk marketed in litres**	1353.07 (66.73)	1445.29 (66.67)	1392.59 (66.78)

Figures in parenthesis indicate per cent of total production

Table 2.2 Milk utilization pattern of milk producers on per day basis

(litre/day/household)

S.No	Particulars	Cow	Buffalo	Aggregate
1.	Total milk produced (litres)	5.56 (100)	5.94 (100)	5.72 (100)
2.	**On Farm Utilization**			
a.	Fresh milk consumption (litres)	1.05 (18.88)	1.11 (18.69)	1.08 (18.88)
b.	For ghee making (litres)	0.13 (2.34)	0.09 (1.52)	0.12 (2.10)
c.	For curd making (litres)	0.46 (8.27)	0.49 (8.25)	0.48 (8.39)
d.	Milk fed to calves (litres)	0.21 (3.78)	0.29 (4.88)	0.23 (4.02)
	Sub Total (a – d)	1.85 (33.27)	1.98 (33.33)	1.90 (33.22)
3.	**Total milk marketed in litres**	3.71 (66.73)	3.96 (66.67)	3.82 (66.78)

Figures in parenthesis indicate per cent of total production

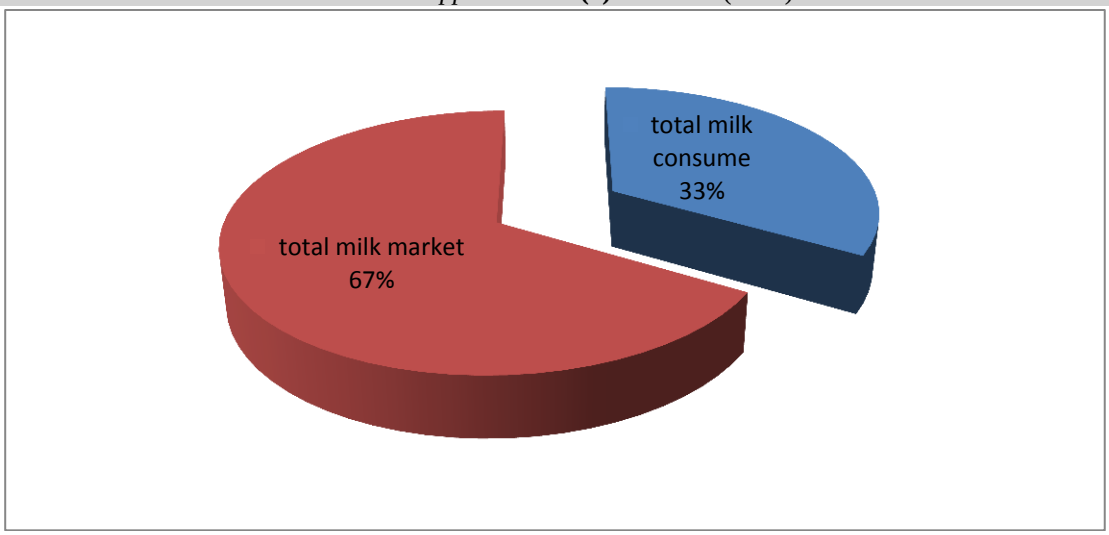

Fig 2.1: Share of total milk production at aggregate level

As far as per day milk utilization is concerned, it is clear from the table that total milk produced per household per day at aggregate level was estimated to be 5.72 litres per day. Further, it was estimated that 1.05 litres, 1.11 litres and 1.08 litres per household per day of milk was utilized at household in the form of fresh milk in case of cow, buffalo and at aggregate level (cow plus buffalo), respectively. About 0.46 litres (8.27 per cent) and 0.49 litres (8.25 per cent) was utilized for curd making in case of cow and buffalo, respectively. Approximately 0.21 litres per household per day was fed to calf in case of milk produced by cow while 0.29 litres per household per day was fed to calf in case of milk produced by buffalo. Remaininig 3.82 litres of milk produced per household per day was marketed at aggregate level which varied from 3.71 litres (66.73 per cent of total milk produced) in case of cow to 3.96 litres (66.67 per cent of total milk produced) in case of buffalo.

CONCLUSION

Inputs, particularly green fodder and dry fodder were under-utilized by milk producers in the study area; hence the cost for maintaining milch animals and for milk production was high enough. The cost for maintaining milch animals and for milk production can be rationalized by appropriately feeding the animals. Interventions on the part of government, state or local are needed by according permission to the farmers to collect green and dry fodder from forest area or promoting the cultivation of all season green fodder crops through a campaign, as the scarcity of green fodder in hilly areas is well known problem. There is a need to aware and motivate the livestock rearers about scientific feeding of feed concentrate through extension programmes on animal husbandry such as demonstrations, field trips, etc. and also to undertake livestock breeding programme at large scale to improve the breeds of dairy animals at the reasonable cost. In order to augment the milk production in hilly areas initiatives are needed to ensure accessible milk market to enable the milk producers to realized reasonable price for their produce.

REFERENCES

1. Bardhan, D. and Sharma, M.L., Resource productivity in milk production at farm household level in kumaon region of Uttarakhand. *Asian Journal Dairy and Food Research*, **32 (4):** 275-282 (2013).
2. Bereda, A.; Yilma, Z. and Nurfeta, A., Handling, processing and utilization of milk and milk products in Ezha district of the Gurage zone, Southern Ethiopia. *Journal of Agricultural Biotechnology and Sustainable Development*, **5 (6):** 91-98 (2013).
3. Gupta, J.N. and Kumar, P., Resource use efficiency in milk production in

Muzaffarnagar district of Uttar Pradesh. *Asian Journal of Dairy Research*, **7 (4):** 203-212 (1988).

4. Kumar, G.B. and Singh, R.V., Resource use efficiency of cow milk production in Tamil Nadu. *Indian Journal of Dairy Science*, **57 (2):** 137-140 (2004).
5. Kumar, S. and Agarwal, S.P., Resource use efficiency of milk production in Mathura district of Uttar Pradesh. *Indian Journal of Dairy Science*, **47 (11):** 915-920 (1994.).
6. O' Connor, C.B., Rural smallholder milk production and utilization and the future of dairy development in Ethopia. *Dairy Marketing in Sub-Saharan Africa*, 120-130 (1992).
7. Quddus, M.A.; Rahman, K.M.M. and Islam, M.A., Productivity and resource use efficiency of milk production of the small scale dairy farmers. *Bangladesh J.Agric. Econs.*, **33 (1-2):** 71-81 (2010).
8. Singh, K.R.; Agawal, S.B. and Malhotra, R., Resource use efficiency in milk production and disposal of milk in Imphal-West district of Manipur. *Indian Journal of Dairy Science*, **60 (3):** 213-217 (2007).
9. Singh, R.S., Resource productivity and return to scale in dairy on marginal and small farms in intermediate zone of Jammu and Kashmir. *Indian J. of Agric. Econ*, **47(3):** 537-538 (1992).
10. Sharma, K.S.; Malhotra, R and Mahajan, S., Resource-use efficiency in milk production in Malwa region of Madhya Pradesh. *Indian Journal of Dairy Science*, **67 (6):** 531-534 (2014).