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Resource Efficiency in Milk Enterprise

by

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Introduction : India has the largest bovine population with nearly one-fourth of world cattle and 60 per cent of world's buffaloe population. Yet, the contribution from these animal resources to the national income is only about three and a half per cent on account of low productivity in this sector. Generally, productivity is not measured in relation to input factors as concentrates, green fodder *etc* since, whatever is available on the farm as a bye-product is fed to cattle without going into detail about the needs of the animal and the input factors that have to be supplied. The low productivity and high cost of maintenance of dairy animals have of late set the farmers to examine the possibilities of substitution in dairy ration with a view to bring down the cost and to increase the profits.

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A study was, therefore, undertaken (i) to estimate the milk production function and to derive the efficiency of resources involved in milk enterprise in the mixed farm holdings of Coimbatore *taluk* and (ii) to assess the possibilities of substitution between two classes of feeds, namely concentrates and fodder.

Material and methods: Data were collected from thirty holdings where mixed farming was followed adopting multi-stage stratified random sampling technique. Ten villages were fixed at random, distributed among the five *firkas* of Coimbatore *taluk* in proportion to the net area irrigated by wells in each of the *firkas*. In each selected village, a detailed list of owner operated and well irrigated cotton growing mixed farm holdings with less than ten acres was prepared, out of which three holdings were selected at random per village. This method of sampling induced an element of homogenity in the sample.

Variables considered: Concentrates (X_1) fodder (X_2) value of animal (X_3) and lactation period (X_4) were the factors studied. Even though a number of factors influence milk yield, it is assumed to depend mainly on these four variables. The breed of animal is highly correlated with milk yield. To get over the difficulty of ascertaining different breeds, the value of the animal was taken as one of the factors since breed character is included in evaluating the animal. Besides, in most of the farms there were no separate breeds exclusively for milch or draft purposes. For the purpose of fitting the function, factors one to three were expressed in monetary value, while factor X_4 was expressed in terms of lactation days. The dependent factor Y was expressed in terms of litres of milk and was valued at Re. 0.50 per litre of cow's milk and Re. 0.62 per litre of buffaloe's milk. The data were gathered during the year 1961–'62.

MODEL: A single Cobb-Douglas function was used to study the influence of the different factors on the production of milk. Regression coefficients were worked out to express the elasticity of each of the factors. The statistical significance of the regression coefficients was arrived at to provide a measure of the influence of individual factors on milk production and the sum of elasticity coefficients to indicate the nature of returns to scale in the sample area. The average value productivity for each factor was derived as the mean yield for that factor at geometric mean level. The marginal value productivity was obtained as a product of average value productivity and the corresponding elasticity coefficients.

Results and Discussion: The correlation matrix for the milk yield and the associated factors are presented in Table I.

TABLE I

Correlation Matrix

	Y Milk yield	X_1 Concentrates	X_2 Fodder	X_3 Value of animal	X_4 Lactation period
Y	1·00000	0·83360**	0·41872*	0·67613**	0·92703**
X_1		1·00000	0·53441**	0·72778**	0·77815**
X_2			1·00000	06·9933**	0·48422**
X_3				1·00000	0·68794**
X_4					1·00000

** Significant at 0·01 level * Significant at 0·05 level.

The matrix revealed significant correlation between milk yield and the selected factors.

In order to assess the extent of influence of each factor, a multiple regression was fitted as under :—

$$Y = 0{\cdot}6196 + \underset{0{\cdot}1991}{0{\cdot}3125}X_1 + \underset{0{\cdot}1271}{-0{\cdot}1259}X_2 + \underset{0{\cdot}0918}{0{\cdot}0463}X_3 + \underset{0{\cdot}1111}{0{\cdot}7138}X_4$$

$$t = \quad 1{\cdot}569 \qquad 0{\cdot}991 \qquad 0{\cdot}505 \qquad 6{\cdot}427$$

$$b = 0.9467$$

$$R^2 = 0.9008$$

where Y is the milk yield in litres, X_1 is the input of concentrates, X_2 is the value of fodder, X_3 is the value of animal and X_4 is the lactation days.

It showed that all the factors except fodder have positive coefficients indicating different degrees of influence on the output of milk. However, the factor X_4, namely the lactation days seems to significantly influence the milk yield. The other factors do not appear to be important in influencing milk yield under the existing conditions in the farms enquired. The negative coefficient for fodder renders any possible explanation difficult. However, it could be taken that the fodder input does not seem to have any significant influence on output of milk. Or in the farms enquired it is possible that green or dry fodder is fed to milch cattle more than they might actually need. This extreme interpretation is rather a possibility. However, it can be stated that one per cent increase in the lactation period of dairy animal in the mixed farm holdings of Coimbatore *taluk* increases the milk production by 0·71 per cent from its mean level, keeping all other factors constant.

The sum of elasticity coefficient indicates the nature of returns to scale of milk enterprise in mixed farm holdings of the sample. $\sum b_i$ amounts to 0.9467 which is less than one indicating diminishing returns to scale. To put it explicitly, a simultaneous increment of all the factors by one per cent will result in an increment of milk production by 0.95 per cent indicating that the milk enterprise in the holdings in the sample is in a stage of diminishing return positively due to over exploitation of available resources.

Productivity of the factors : The average value productivity and marginal value productivity were considered with a view to ascertain profitable avenues of ivestment. The average and marginal value productivities at the geometric mean level are furnished in table II.

TABLE II

Productivity of Factors

Factors		Average value productivity at geometric mean level (in Rs. per rupee)	Marginal value productivity at geometric mean level (in Rs. per rupee)
Concentrates	X_1	2·81	0·87
Fodder	X_2	7·11	0·89
Value of animal	X_3	1·75	0·08
Lactation days	X_4	1·73	1·24

It is seen from the above table that fodder has the highest average value productivity while its marginal value productivity is less than one, indicating that additional investments in that factor will yield less than the value invested. However, the marginal value productivity of lactation days (X_4), which is 1.24 per lactation day, indicates an additional income of Rs. 1.24 for every additional day in the lactation period. This leads to the conclusion that efforts should be taken to increase the lactation period of animals if the returns in milk enterprise are to be maximised. This is possible only if crossbred animals with long periods of lactation are introduced on the farms. Again, the very low marginal value productivity for the value of the animal indicates that milch stocks on the farm are overpriced and the high cost of livestock acts as a deterrent to increase the milk production. Therefore, cross breed animals with long lactation periods may be made available at subsidised costs in the initial stages so that the milk enterprise could be a profitable venture.

Subsitution Relations: The marginal rate of substitution refers to the amount by which one resource is decreased as input of another resource is increased by one unit. In the farms under study, there is possibility for substituting concentrates and fodders according to availability. From Table II it will be seen that concentrates yield a return of Rs. 0.87 for every rupee investment. Such a situation arises owing to the indiscriminate use of fodder, since in most of the farm surveyed fodder is not generally purchased, but is grown on the farm itself as part of the cropping programme. Hence, there is an indiscriminate use of fodder input in relation to milk production. This calls for a reallocation of the resources if maximisation of production or profits is the criterion in view. The marginal rates of substitution of concentrates for fodder is calculated for an output of 2537 litres of milk keeping the production at geometric mean level. The levels of input and the substitution rates at different levels below the geometric mean level are presented in table III.

TABLE III.

Feed combinations in producing 2,537 litres of milk: Marginal rates of substitution of concentrates for fodder at geometric mean level of milk production (2537 litres) (figure in log values)

Particulars	Input of fodder	Input of concentrates	Marginal rates of substitution of concentrates for fodder.
At G. M. L. of Fodder	2.31655	2.71908	— 2.91246
At 10% below the G. M. L.	2.08490	2.62570	— 3.12500
At 20% below G. M. L.	1.85324	2.53235	— 3.39057
At 30% below G. M. L.	1.62159	2.43898	— 3.73215

A reduction in the input of fodder is thus followed by a decrease in the input of concentrates. In a situation where a reduction in the input of one factor cannot be replaced by an increase in another factor then the two factors are technical complements (Heady, 1952). In such cases, the ratio of substitution is either zero or greater. In the present study, the substitution ratio increases negatively, indicating the irrational use of both the factors, namely fodder and concentrates. Positively fewer of both the resources could be employed to attain the same output or less of one or both can be used while a greater product is obtained. Therefore, there appears to be considerable scope for reallocation of resources to maximise milk production.

Conclusion : The low yield of milk is positively correlated with the lactation days. Milk production could be increased substantially only if animals with long lactation periods are bred in future. Closely associated with this problem is the price of the animal. Generally, lactation period is a breed character and animals with long lactation periods appear to be in great demand and command a premium in the market. With production of a large number of livestock with long lactation periods price will not be a deterrent in keeping animals of good quality. It appears that there is considerable scope to reorganise the resources of fodder and concentrates that are being used as inputs. There is need to rationalise feeding methods so that they are realistic from the production point of view.

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Chemical Composition of the Clay Fraction of Some Alkali and Adjoining Soils of Uttar Pradesh

by

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Introduction : Clay colloids are the most important fraction responsible for the base exchange phenomenon in soils. Donahue (1958) considers the cation exchange capacity to be the single index of fertility. Therefore, the more clayey the soil, the more is its cation exchange capacity and hence the chances of its being fertile are greater. Hocking (1948) reported that clay minerals present even in the coarser fractions of the soil also contribute to the cation exchange phenomenon. The individual contents of silica, alumina, iron oxide, potash and magnesia in the clay are indicative of the dominant clay minerals (Grim 1953). The ratio between silica, alumina and iron oxide has widely been used in assessing the nature of clay minerals and process of soil formation. In the present investigation, the clay samples fractionated from alkali and adjoining soil profile samples have been analysed for their chemical composition with a view to studying the depthwise distribution of clay minerals content in the profiles.

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