AN ECONOMETRIC ANALYSIS OF FACTORS INFLUENCING MILK PRODUCTION AND SUPPLY RESPONSE OF MILK TO CHANGE IN PRICE AT THE PRODUCER'S LEVEL: A STUDY IN RANGA REDDY DISTRICT, ANDHRA PRADESH

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Over the last few decades, milk production in India has [1] undergone a sea change from the rock bottom level of about 17 million tones in 1950-51 to more than 50 million tones in 1989-90 and 66.1 million tones in 1995-96. It has been estimated that the milk production would reach at the level of 100 million tones by 2001[1]. The credit for such achievement is attributable to the efforts of the planners and policy makers who conceived of the National Dairy Development Board to replicate the experience of success of Kaira Milk Co-operative Society, popularly known as AMUL, on the one hand and the Indian farmers, who showed tremendous interests in cattle improvement through crossbred programme on the other. In rural India, despite sustained efforts of cattle improvement, low yielding non-descriptive cows and buffaloes outnumber the crossbreeds. Though vast majority of the farmers rear such non-descriptive and low yielding milch cows on sentimental grounds without any economic content fairly large number of farmers depend upon dairy units to supplement household income. Livestock is not only viewed from the angle of source of milk but also viewed from the angle of cheap source of manure and transport for farming and a source of employment for the households in the rural area.

The advent of "Operation Flood" has made the farmers in rural areas to realize the importance of dairy units as the potential source of additional income and employment. But the facts remain in the uneven distribution of gains from livestock enterprise across the country.

In Andhra Pradesh, the dairy sector is rapidly growing and it is the seventh largest milk-producing state in India. In 1995, milk production constituted 11 percent of Andhra Pradesh's agricultural economy (at current prices) and the sector was one of the biggest contributors after rice. The Andhra Pradesh Dairy Development Co-operative Federation (APDDCF) has through its own Operation

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1 Goel, A.K. Indian Agriculture from independence to 21st Century, Manage Publication.

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Flood become a major force in developing milk production, organizing its marketing and establishing milk producer's co-operatives.

Developing the sector will thus not only create economic growth in Andhra Pradesh, it will also help reduce rural poverty and empower women.

By 2020, Andhra Pradesh is expected to be among the top three producers of milk and milk products in India. Milk production alone will account for 12-15 percent of its agricultural GSDP[2]. To achieve this vision, Govt. of Andhra Pradesh has launched a comprehensive programme to develop the dairy sector.

In this backdrop, an attempt has been in this study to identify[2] the factors that influence milk production and to derive the short-run supply functions of milk for cows and buffaloes in the sample villages of Manchal Mandal of Rangareddy District, Andhra Pradesh, with the following objectives.

a) to study the economics of production of cow and buffalo milk.

b) to ascertain the factors that influence milk production, and

c) to derive the short-run supply function of milk for cows and buffaloes in the area under study.

Methodology

The primary data collected for the present study correspond to randomly selected, one Mandal (Manchal of Rangareddy District, A.P), two villages (Bandelmur and Chennareddyguda) and 60 farmers. All the farmers were classified into three categories i.e., marginal farmers (with operational holding less than one hectare) small farmers (with operational holding 1 to 2 hectares) and large farmers (with operational holding of above 2 hectares). Thus there were 27 marginal farmers, 19 small farmers and 14 large farmers.

The data used in the analysis relate to 1998-99 The Cobb-Douglas production function of the following form was used to estimate the parameters.

$$y = a_0 \; X_1^{b_1} \; X_2^{b_2} \; X_3^{b_3} \; X_4^{b_4}$$

2. Vision 2020, Swarna Andhra Pradesh, Govt. of Andhra Pradesh, 1999.

where,

y	=	Quantity of milk production in litres per year
X_1	=	Value of green fodder fed to milch animals in a year
X_2	=	Value of dry fodder fed to milch animals in a year
X_3	=	Value of concentrates fed to milch animals in a year
a_o	=	intercept term

Ordinary least square method was used to estimate the regression coefficients. Zero order correlation matrices were worked out to examine the problem of multi-co linearity. The results did not exhibit the seriousness of the multi-colinearity

$$Y = a_o \frac{1}{1 - b_1 - b_2 - b_3 - b_4} \left[\frac{b_1}{P_1}\right] \frac{1}{1 - b_1 - b_2 - b_3 - b_4} \left[\frac{b_2}{P_2}\right] \frac{1}{1 - b_1 - b_2 - b_3 - b_4} \left[\frac{b_3}{(p_1)}\right] \frac{1}{1 - b_1 - b_2 - b_3 - b_4} \left[\frac{b_4}{P_4}\right] \frac{1}{1 - b_1 - b_2 - b_3 - b_4} Py \frac{b_1 + b_2 + b_3 + b_4}{1 - b_1 - b_2 - b_3 - b_4}$$

problem. Hence the data in original form were fed to the computer for regression analysis.

From this production function, the supply function was derived and its general form was as follows:

$$Es = \frac{dy}{dp} \left[\frac{p}{y}\right]$$

RESULTS AND DISCUSSION

Results of the present study are presented and discussed below

TABLE – 1 : Per day Estimates of Feed cost, Milk yield and Feed cost/ Rupee of Milk Output of Cows and Buffaloes among different categories of Households.

Categories of Households	Animal	Feed cost	Milk yield per day per day	Feed cost per litre (litres)	Milk price per litre	Feed cost per Rupee of Milk Output
Marginal (27)	Cow	63.24	9.3	6.80	10.25	0.66
	Buffalo	67.56	10.1	6.69	11.17	0.59
Small (19)	Cow	65.83	9.9	6.65	11.25	0.59
	Buffalo	72.43	11.3	6.41	11.61	0.55
Large (14)	Cow	58.85	10.2	5.77	11.98	0.48
	Buffalo	71.95	12.6	5.71	12.67	0.45
Pooled (60)	Cow	63.04	9.7	6.50	10.97	0.59
	Buffalo	70.40	11.06	6.37	11.66	0.54

Where, P_1, P_2, P_3 and P_4 are the unit prices of X_1, X_2, X_3 and X_4 respectively and P_y is the price of 'y'. By substituting the estimated values of a_o, b_1, b_2, b_3 and b_4 in the supply function along with the prices, supply function was estimated. The supply response to changes in price can be studied by working out the elasticity of supply at different price levels. If Y = t(p), is the supply function, then the elasticity of supply (Es) is defined as

Table-1, presents the estimates of five economic variables relating to the cost of production of cows and buffaloes milk. These variables are milk yield, feed cost, feed cost per litre of milk, price per litre of milk and feed per rupee of milk output.

The results of the study irrespective of farm size classes, established the superiority of buffaloes over cows at least in respect of three important economic variables viz; feed cost, milk yield and milk prices. This was obviously due to the fact that the consumption and absorption of better quality feed as measured in terms of increased expenditure on feed fed coupled with inherent genetic

potentiality of buffaloes led to better quality of milk production. This was true for all the farm size classes. As such, the price per unit of buffalo milk was Rs.11.66 per litre. This suggested that the feed milk conversion quality attributes was the highest in case of buffaloes than that in case of cows. The increase per day milk yield of buffaloes over cows nullified the increased feed costs resulted in a lower feed cost per litre of milk in case of all farm size classes. But in case of large farms, the feed cost per litre of buffalo milk was the minimum (Rs.5.71) followed by cow's milk (Rs.5.77). The net outcome of this superiority of buffaloes over cows at the overall level was reflected in the low feed cost per litre of milk (Rs.6.37 in case of buffaloes as against Rs.6.50 in case of cows) and feed cost per rupee of milk output was Rs.0.54 in case of former and Rs.0.59 in case of the later respectively.

But a comparison of these estimates i.e., feed cost per day, feed cost per litre of milk and feed cost per day, feed cost per rupee of milk output obtained for cows and buffaloes reared by different categories of farmers did not show any marked difference. The superiority of large size farms over the marginal and the small farms in simultaneous rearing of cows and buffaloes was evident from the fact that the feed cost per rupee of milk output was less than 50 paise in case of the former, while in the remaining categories of sample farms, it exceeded 50 paise.

In sum, it is the feed milk conversion attribute, which was found to form the crux of the problem of milk production technology.

Further, with a view to examining the details of the factors that contributed to the level of milk production in the study area, production function analysis was carried out by disaggregating the feed costs into three broad constituents viz; cost of green fodder, cost of dry fodder and cost of concentrates. The relevant statistics to this effect are presented in Table-2.

The results of the production function analysis indicated that at the aggregate level, while green fodder and dry fodder fed to milch cattle had a negligible impact on the quantum of milk yield, the concentrate had a positive significant impact on milk yield of both cows and buffaloes. In addition, number of milch animal had an equal positive and significant impact on milk yield. Another noteworthy feature revealed by the functional analysis was that the elasticity coefficient of concentrates was substantially higher for buffaloes that those obtained for cows. This lends support to our earlier observation that absorption and conversion of concentrates into milk was higher for buffaloes than for cows.

TABLE–2 : Regression Coefficients and Other Related Statistics

Variables	Marginal		Small		Large		Pooled	
	Cow	Buffalo	Cow	Buffalo	Cow	Buffalo	Cow	Buffalo
Green Fodder (X_1)	-0.436	-0.284	-0.132	-0.249.	0.086	0.119	-0.327..	0.197..
Dry Fodder (X_2)	-0.172	-0.189	-0.284	-0.076	0.352.	0.182.	0.215..	-0.245..
Concentrates (X_3)	0.031	0.356..	0.128..	0.612..	0.297..	0.098..	0.118..	0.184..
Number of Milch Animals (X_4)	0.082..	0.024	0.084..	0.021	0.028.	0.175..	0.072..	0.089.
Constant	0.827	1.286	0.349	0.674	1.421	0.782	1.246	0.998
R^2	0.57	0.59	0.61	0.58	0.58	0.60	0.62	0.59
n	27	27	19	19	14	14	60	60

. significant at 5 percent level

.. significant at 1 percent level

Analysis of production function estimates between size groups indicated that in case of marginal and small farms both green fodder and dry fodder seemed to have least impact on milk yield of cows and buffaloes. The negative but significant coefficients associated with these two variables implied that green fodder and dry fodder fed to milch animals of these two categories of sample farms in excess of requirement. This is quite obvious in view of the fact that in the absence of adequate grazing land, the sample farmers generally collect grass from different fields after day's work or on off-days to feed the wet milk cows in anticipation of best substitute for concentrates, which was found to be of little relevance in the present study. But concentrates had a positive significant impact on milk yield of both cows and buffaloes. The number of wet milch animals appeared to be another important factor influencing milk yield of cows and buffaloes. But in case of large farms, green fodder, dry fodder and concentrates had a positive significant impact on milk yield of cows and

buffaloes. The milk yield also bore a direct positive relationship with the number of wet milch cows and buffaloes on this category of farms.

The supply function was estimated on the basis of pooled data. As it is evident from the table that all parameters were found significant in both the functions estimated for cows and buffaloes separately. By substituting the values of a_o, b_1, b_2, b_3 and b_4 in the supply function along with the prices of X_1, X_2, X_3, and X_4, we get

$$\text{Cows} \quad : \quad y = 0.0526\ p_y^{5.7296}$$

$$\text{Buffaloes} \quad : \quad y = 0.1867\ p_y^{4.4683}$$

The elasticity of supply for cow milk and buffalo milk was 5.7296 and 4.4683 respectively. This indicates that the supply of both cow and buffalo milk is highly elastic. One percent increase in the price of cow milk leads to 5.7296 percent increase in the supply of cow milk and one percent increase in the price of buffalo milk leads to .4683 percent increase in the supply of buffalo milk. This suggests that milk supply in the area can considerably be stepped up in the short-run by increasing the prices of milk.

CONCLUSIONS

Based on these findings, it may be inferred that the milk yield of cows and buffaloes is highly dependent upon the number of milch animals and the quantum of concentrates fed to these animals. Except in case of large farms, green fodder and dry fodder did not seem to influence the milk yield in the remaining two categories of sample farms. In other words, there exists scope for enhancing milk yield by feeding more of concentrates to milch animals instead of depending upon dry and green fodders alone. But in the absence of adequate purchasing power of marginal and small farmers to the needed concentrates, judicious and balanced combination of three components was not possible to take advantage of the inherent potentiality of crossbred cows. The milk supply in the area can considerably be stepped up by revising the price in favour of the milk producers.

The Andhra Pradesh Dairy Development Co-operative Federation (APDDCF) can play a key role in fulfilling the above task.

References

1. Goel, A.K. Indian Agriculture from Independence to 21st Century, MANAGE Publication.
2. Vision-2020, Swarna Andhra Pradesh, Govt. of Andhra Pradesh, 1999.