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AN INQUIRY INTO THE COST, CONSUMPTION AND SUPPLY
ASPECTS OF MILK PRODUCED BY CULTIVATOR-FAMILIES
IN DELHI AREA

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The present study is an attempt to inquire into the economics of dairy enterprise in a selected agricultural tract of the Delhi region. The scale of operation as determined by the production levels of milk in various farms has been taken as the basis to study the consumption pattern and the supply behaviour followed in these farm units as well as to examine the changes in production costs resulting from changes in the quantities of the milk produced.

The study made here has drawn on the data collected by the former Agricultural Economics Section (now Division) of the Indian Agricultural Research Institute, New Delhi, during the years 1959-60 to 1961-62 and relates to the last year of the survey.

An aggregate analysis of the above data relating to all the sample farms, 60 in number, shows that of the total costs incurred on different inputs going into production, about 63 per cent is accounted for by feed (40.4 per cent by way of fodder and 22.6 per cent concentrates). The cost on capital services, viz., interest and depreciation charged on the imputed values of milch animals and cattle sheds is next in importance and accounts for about 21 per cent of the total. The remaining share, viz., 16 per cent is towards human labour which is predominantly of farmers' own and their family members. In view of the fact that only about 10 per cent of the fodder is purchased from outside by the farmers in the area under study (the rest being home grown), that the entire concentrates are procured from markets and that only about 2 per cent of the human labour employed is hired, the expenditure incurred on these three items works out to about 27 per cent of the total cost and can be considered as out of pocket cost. Thus as much as about 73 per cent of the total cost of milk production comes about as a result of imputed value of inputs, the sources for which, viz., land, labour and capital are already made available within the agricultural farms. This reveals the extent of dependence prevailing in the area of milk enterprise on that of crop.

Three cost concepts have been used here in order to gain an insight into the cost behaviour of the three principal items of inputs, viz., feed, capital services and human labour. These are : (i) feed cost (less the value of dung) defined as cost A, (ii) cost A plus the cost arising from interest and depreciation on the imputed

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values of the milch animals and cattle sheds termed as cost B, and (iii) total cost which includes human labour cost besides cost B, denoted as cost C.

An important point considered in studying these costs relates to those incurred on the dry animals which are invariably maintained by almost all the farmers. It is found that for every lactating animal present in the farm there is one dry animal. The above costs have therefore been obtained separately (i) for animals in milk only and (ii) after including the dry animals also.

Again the data show that there are 20 farm families which do not sell milk but produce solely to meet their own home requirements. The remaining 40 families sell about one-half of their total milk production either in fluid or converted forms. This quantity sold accounts for only about 38 per cent of the total milk production when the entire sample of 60 farms is taken into consideration. A comparison of these two groups of farms, *i.e.*, one which sells milk and the other which does not, shows some interesting differences in their gross earnings from crop enterprise, milk production and consumption levels, the corresponding figures for the two groups being respectively Rs. 4,250 and Rs. 4,952, 2,642 seers and 1,677 seers annually and 14.8 ozs. and 18.0 ozs. per family member per day; also the cost of producing a seer of milk is throughout more in case of farms not engaged in sale of milk. In view of the presence of these differences in the two groups it was decided to run the analysis of the costs-consumption and supply-output relationships for the 40 farms engaged in selling milk in exactly the same fashion as is done for all 60 farms in the sample. These two sets of figures are presented in the tables given later.

With this background, let us now turn our attention to the discussion of the present analysis and consider first the consumption pattern of milk produced by the farm families included under study.

TABLE I—AMOUNT OF MILK PRODUCED, CONSUMED AND SOLD ACCORDING TO VARIOUS LEVELS OF PRODUCTION

Level of production of milk (Seers/annual)	No. of holdings	Average milk production per farm (seers)	Average gross income from crops per farm (Rs.)	Per capita consumption of milk (as milk and ghee) per day (ozs.)	Production expressed as percentage to total	Percentage of sales to total production of milk in the group	Percentage of total sales
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Up to 1,000	6 (1)	713 (915)	5,306* (1,494)	9.2 (9.4)	3.1 (0.9)	6.6 (30.8)	0.5
1,001-2,000	23 (13)	1,576 (1,519)	3,534 (2,470)	15.0 (9.8)	26.0 (18.7)	22.5 (41.3)	15.5
2,001-3,000	19 (16)	2,427 (2,463)	4,218 (4,113)	17.1 (16.5)	33.1 (37.3)	39.0 (45.6)	34.2
More than 3,000	12 (10)	4,380 (4,562)	5,512 (6,098)	17.4 (16.8)	37.8 (43.1)	49.8 (57.4)	49.8
Overall average/total	All farms 60 Seller farms (40) Non-seller farms 20	2,320 (2,642)	4,484 (4,250)	15.8 (14.8)	100.0 (100.0)	37.8 (49.8)	100.0
		1,677	4,952	18.0		0.0	

N.T. Figures in brackets are obtained from holdings engaged in sale of milk.

* This high figure is due to inclusion of very large sized holdings having low level of milk production (with no sales).

On the basis of the evidence thrown up by columns 3, 4 and 5 of Table I, it was hypothesised that the per capita consumption (y) of milk in seers is a function of x_1 and x_2 where x is the per capita gross earnings from crops and x_2 is the total milk available (*i.e.*, produced on the farms) per family member. In the absence of data on the disposable income of the farmers the variable x_1 was considered as a suitable alternative in that it serves as a fair indicator of the income and social status. Various algebraic forms for the functions were attempted and the double-log type of models were finally chosen as these were found to give the largest goodness of fit to the data. The two equations thus fitted are :—

- (i) $\log y = 1.50 + 0.26 \log x_1$ and
- (ii) $\log y = 0.98 + 0.18 \log x_1 + 0.31 \log x_2$.

All the regression coefficients, *viz.*, 0.26, 0.18 and 0.31 of the above functions are found to be statistically significant, their respective standard errors being 0.01, 0.07 and 0.10. Tests have also shown that the second function (with $R^2 = 0.48$) which takes into account the production variable (x_2) provides a closer fit than the first one (with $R^2 = 0.31$) which contains only the income variable (x_1). The extent of dependence of milk consumption on income (status) alone or income (status) and production are well revealed by the above functions and are indicated by the corresponding elasticities, namely, 0.26, 0.18 and 0.31 respectively. In particular, the second function shows the degrees to which changes in consumption pattern of milk of the rural producers are sensitive to changes in production and their living status as reflected by x_1 .

Given this consumption behaviour, it is worthwhile to inquire into the supply pattern of milk to the market as well as the cost-return relationships.

The bracketed figures of column 2 of Table I show that the percentage of families engaged in sale of milk consistently increases with the production levels. While in case of low producers having upto 1,000 seers annually, only one out of 6 farmers sells milk, amongst the large producers with more than 3,000 seers, 10 out of 12 farmers dispose of their milk outside. But on examining the contribution of different families to total production and sale of milk, it is observed from columns 2, 6 and 8 of the table that considerable disparity exists in the production and supply distributions. Approximately, the lower one-half of the total 60 farmers contribute only 30 per cent of the total production and 16 per cent to the total sales and the other half makes up the remaining 70 per cent and 84 per cent respectively.

Also, column 5 of Table I shows that the low producers (with 2,000 seers and less) are able to enter the market after a considerable sacrifice of their consumption requirements. Thus in the first group consumption is lowest and in the second (having an annual production of 1,000-2,000 seers of milk) while every member of the 23 families consumes as much as 15 ozs. per day, this quantity drops to about 10 ozs. per member per day in those 13 families producing the same amount of milk but which effect sales. On the other hand, large producers make available to the market whatever milk is left unconsumed by them. This is shown by the fact that the daily per capita consumption (column 5) which is increasing with the production level upto 3,000 seers, becomes steady at about 17 ozs. from thereon

and that the divergence in the two sets of consumption figures of column 5 gets very much narrowed down as we move along higher production levels.

As the bracketed figures of column 4 of the table show, the low milk producers forego their consumption and sell milk outside as of necessity to augment their meagre crop income. In the case of larger producers, however, who are comparatively comfortable from the point of view of earnings from crop enterprise, the factor of indivisibility of milking animals compels them to sell in the market whatever is left over after their consumption, as these farmers possess on an average just one milking animal which is of course a better yielder.

Coming to costs of production, the effect of the level of production on the various costs as defined earlier is very well brought out in columns 4 to 9 of Table II.

TABLE II—COSTS (IN RUPEES) PER SEER OF MILK AT DIFFERENT LEVELS OF PRODUCTION

Levels of Production	No. of holdings	Average milk production per farm (seers)	Costs of producing one seer of milk in rupees by considering					
			only animals in milk			all milch animals including the dry ones		
			A	B	C	A	B	C
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Up to 1,000	6	713	0.56	0.66	0.76	1.12	1.49	1.73
	(1)	(915)	(0.40)	(0.58)	(0.63)	(0.71)	(1.07)	(1.17)
1,001-2,000	23	1,576	0.35	0.43	0.49	0.54	0.70	0.82
	(13)	(1,519)	(0.30)	(0.39)	(0.45)	(0.51)	(0.70)	(0.82)
2,001-3,000	19	2,427	0.32	0.42	0.47	0.45	0.63	0.72
	(16)	(2,463)	(0.30)	(0.42)	(0.47)	(0.43)	(0.61)	(0.70)
More than 3,000	12	4,380	0.27	0.39	0.43	0.36	0.52	0.59
	(10)	(4,562)	(0.27)	(0.39)	(0.43)	(0.36)	(0.52)	(0.59)
Overall average/	60	2,320	0.31	0.42	0.47	0.45	0.63	0.72
total	(40)	(2,642)	(0.29)	(0.40)	(0.45)	(0.41)	(0.60)	(0.68)
	20	1,677	0.40	0.45	0.52	0.60	0.74	0.87

N.B. : Figures in brackets are obtained from holdings engaged in sale of milk.

These columns exhibit the usual declining trend at a decreasing rate as the production levels go up. In particular, it can be seen that considerable reduction in cost is possible even if the production level could be pushed up from below 1,000 seers to only the next group, 1,000-2,000 seers.

The expenditures incurred on dry animals which are maintained invariably by almost all the farm families increase the overall average costs by about 50 per cent. It is found that the increase in costs on account of keeping dry animals is the maximum in case of producers with a level of production up to 1,000 seers annually where the feed cost increases by about 100 per cent and the other two costs (B and C) by about 125 per cent each. These increases in costs A, B and C reduce to about 40, 50 and 50 per cent respectively in case of families with range of production 2,000-3,000 seers and further drop to about 33 per cent for all costs in case of those producing more than 3,000 seers.

Comparing the sellers and non-sellers of milk, it can be seen that the cost (whether it be A, B or C) is always lesser in the case of the former group; however this difference is not statistically consequential.

Analysing the different constituents, *viz.*, of feed, capital services and human labour, we find from columns 4, 5 and 6 of Table II which relate to animals in milk alone, that the feed cost per seer of milk produced reduces to about one-half on farms producing more than 3,000 seers of milk annually as compared to the cost in those producing 1,000 seers and less; but it is also found that if the feed cost per animal is considered, this position is reversed as it works out to more than double for the former in comparison to the latter. The interest and depreciation charged on the imputed values of milch animals and cattle sheds which increases only by about 18 per cent over feed cost in the case of producers in the first level has shown an increase of 44 per cent for producers with 3,000 seers and more. On the other hand, the human labour spent on the maintenance of milking animals is minimum for these families and comes to only 4 *Paise* per seer of milk whereas for those producing less than 1,000 seers, it turns out to be 10 *Paise*.

The three costs with dry animals included present a similar picture.

Lastly, we consider the returns to these different costs on the basis of 50 *Paise* which a seer of milk fetched for the farmer at his farm gate during the period of enquiry. Taking into account first, the costs on lactating animals only, we find that the producers with 1,000 seers and less realise negative returns throughout. All others, on an average, make profits and the margins of profit are obviously determined by the levels of production. The profits earned are the maximum on farms producing more than 3,000 seers annually and are 85 per cent, 28 per cent and 16 per cent on costs A, B and C respectively. But when the dry animals are included, it is seen that none of the farm families would be in a position to meet out either cost B or C; even cost A (*i.e.*, on feed) would be covered only by those whose annual production exceeds 2,000 seers. The returns to feed cost in the largest group (more than 3,000 seers) which was found to be 85 per cent earlier when milking animals were alone included now reduce to as low as 39 per cent. Comparing the sellers and non-sellers of milk, it is found from the last two rows of Table II, that while the former are in a position to realise a profit of 22 per cent on feed cost even when dry animals are included, the latter are able to get nearly the same returns on feed cost only when milking animals are considered and are unable to cover the total cost (C) in any case.

The foregoing analysis thus helps to throw some useful indications and pointers. The consumption pattern shows that the daily per capita intake of milk in this region is well above the national average and from the point of view of minimum nutritional requirements is only slightly less for low producers with 1,000 seers and below and sufficiently higher for others. Neither the small nor the large milk producers appear to have taken up the milk enterprise at a commercial level; the study shows that whatever milk is marketed is not due to any wilful attempt on the part of the farmers. As explained earlier, the low as well as large producers of milk have reasons of their own for selling it. As a result of the enterprise being thus very largely considered as only incidental to that of the crop, the total cost incurred on producing a seer of milk always exceeds the

price it fetches to the producer when we consider the realistic situation of including the cost on the maintenance of dry animals on the farms. A relevant question one may then ask is : why do the farmers indulge in milk production at all and how do they (particularly the small producers) make any additional income out of this enterprise ? Answers to these questions readily follow. As said before, the out of pocket costs involved in running this enterprise is only of the order of about 27 per cent of the total costs as the remaining 73 per cent is easily met within the existing farm resources. Again, these farmers have just one lactating animal and carry on with milk production not so much for making milk available in the market as for meeting their own family consumption requirements. And lastly, these producers may consider the costs incurred on feed items alone as most relevant and important followed to some extent by the cost on depreciation on animals. The costs on human labour (which is predominantly that of the family) may be treated by them as of minor consequence in view of the fact that this has very little opportunity cost any way. Thus, as long as the price fetched by the milk sold outside covers cost A primarily, these producers (particularly the small ones) are prepared to look upon this enterprise as a source of additional income however small this income may be.

In these circumstances, then, the question of increasing the milk supply by cultivator-producers of this region, depends on the extent to which additional resource facilities (by way of more milch animals, feed availability at low costs, easy credit terms and so on) can be procured for them, arrangements for frequent salvaging of dry animals are made as these animals at present considerably drain the farm resources, suitable and adequate methods can be evolved to procure the surplus milk from the farmers in a way convenient and profitable to them and finally proper motivation drives are launched to inculcate the farmers to look upon and treat the milk enterprise as a commercial one and to make them aware of the potentialities of this enterprise.

AN ANALYSIS OF FEED-MILK RELATIONSHIP AND COST OF PRODUCTION OF MILK ON FARMS IN THE DELHI AREA

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Even though milk plays an important role in the Indian diet and the dairy animals and bovine draft animals occupy an important position in the organisation

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