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CONCLUSION

The objective of the study, as stated at the very outset, was to analyse the formation of prices of the small variety of cardamom grown in India. In this process, we have examined the movement in cardamom prices and the inter-relationship between its prices and conditions of supply. Our main findings are the following:

1 The cyclical fluctuations in prices are to a very large extent due to the very definite conditions of supply, *viz.*, the increases in output through new planting and replanting becoming effective after a significant time lag.

2. The cyclical fluctuations in prices have implicit bearing on the conditions of supply through farmers' response. This has become all the more signifiant in recent years owing to the emergence of large number of small growers in the sector.

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FACTORS AFFECTING MILK PRODUCTION: A STUDY

Milk production is a complex process and can be conceived as a function of several variables. The knowledge of relative importance of the resource inputs influencing milk production is essential for the dairy farmer for introducing desirable changes in his operation at the micro level and for the policy maker for formulating plans for improvements in dairy cattle productivity based on sound economic principles at the macro level.

Production of milk depends on feeding, breeding and management of the animals. There are a number of other factors which affect milk production, *e.g.*, age at first calving, season of calving, service period, advancement of lactation, number of lactations, dry period after the previous lactation, frequency of milking, age of the animal, body weight, etc. They all have considerable impact on the milk yield of animals. While analysing the feed, the important fodders are dry and green fodders and feeds are concentrates. The major available fodders are local grass, jowar, bajra, pillipesara and jute in green fodders, paddy straw, bajra straw, *ragi* straw, jowar stalks, horsegram straw and jute stalks in dry fodders. The important concentrate feeds are rice bran, rice husk, pulses husk, broken rice, cotton seed, bajra grain, jowar grain, groundnut cake and gingelly cake. Of all the factors affecting milk production, feed and labour are the principal inputs. In this connection, by using Farm

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Management data, Hanumantha Rao[1] attempted to analyse the effect of available feed and labour on the output of milk and dung. He observed that the elasticity of dung is lower than that of milk and the sum of the elasticities for feed and labour is not significantly different from unity. In analysing the elasticity coefficients of milk production with respect to different explanatory variables and to estimate the marginal value products (MVPs) of these factors, Sankhayan and Joshi[2] used two types of production functions, namely, linear and Cobb-Douglas. They observed that there exist vast potentialities for increasing returns from milk production through the extensive use of concentrates and green fodders. In the same way, Dhondyal and Singh,[3] Jacob *et al.*,[4] Singh and Jha,[5] Nair,[6] and Kumar and Singh,[7] conducted a number of surveys to identify the factors affecting milk production.

It is pointed out that the increase in the productivity of animals may stem from two directions, namely, feeding, management and breeding. The high-yielding ability of the cross-bred animals can be sustained only if proper feeding is resorted to. Better feeding is thus the most important method for increasing the milk yield of cows and buffaloes. The available experimental evidence shows that better feeding alone can increase the average yield of animals by 50 per cent or more.[8] Thus, an attempt is made in this paper to identify the factors affecting milk production.

Objectives

Following are the specific objectives of the present investigation: (*i*) to identify the factors affecting milk production; (*ii*) to work out the coefficients of elasticity of milk production with respect to different explanatory variables; and (*iii*) to estimate the MVPs of various factors at their respective geometric mean levels.

1. C. H. Hanumantha Rao, "India's Surplus Cattle: Some Empirical Results", *Economic and Political Weekly*, Vol. IV, No. 52, December 27, 1969.

2. P. L. Sankhayan and A. S. Joshi, "Resource Productivity in Milk Production of Cross-bred and Indigenous Cows in Rural Areas of Ludhiana District (Punjab)", *Indian Journal of Agricultural Economics*, Vol. XXX, No. 3, July-September 1975.

3. S. P. Dhondyal and Parmatma Singh, "Economics of Livestock Enterprise in Uttar Pradesh" *Indian Journal of Agricultural Economics*, Vol. XX, No. 1, January-March 1965.

4. T. Jacob, R. K. Srivastava and V. N. Amble, "A Study on Resource Productivity in Milk Production", *Indian Journal of Agricultural Economics*, Vol. XXVI, No 1, January-March 1971.

5. Parmatma Singh and Dayanatha Jha, "Economic Optima in Milk Production", *Indian Journal of Agricultural Economics*, Vol. XXX, No. 3, July-September 1975.

6. K. N. Nair, "Operation Flood: Some Constraints and Implications", *Economic and Political Weekly*, Vol. XV, No. 8, February 23, 1980. Also see K. N. Nair and M. J. Jacobson, "Breeding and Feeding for Milk Production in Operation Flood-II", *Economic and Political Weekly*, Vol. XVI, No. 52, December 26, 1981.

7. P. Kumar and R. P. Singh, "Dynamic Feed-Milk Relationship and Technological Change in Milk Production", *Indian Journal of Agricultural Economics*, Vol. XXXV, No. 4, October-December 1980.

8. N. C. Wright: Report on the Development of Cattle and Dairy Industry in India, Manager of Publications, Government of India, Delhi, 1957.

Data

Data are obtained from a research project entitled "Problem Oriented Farm Management Studies in the Command Area of Nagarjuna Sagar Project", organized by the Department of Co-operation and Applied Economics, Andhra University, Waltair. For the purpose of investigation, 407 she-buffaloes (indigenous breed) were taken into consideration distributed over 15 villages in the study area. A complete record of daily milk production along with feeds and fodders fed to each animal was maintained for a period of 15 days in each quarter[9] and the average values/quantities were taken into account. Information regarding other factors influencing milk production such as age of the animal, value of the animal, number of lactation, etc., was collected. Besides this, the data on the prices of milk, feeds and fodders were also collected. The reference period for the study is 1981-82.

Technique of Economic Analysis

To establish input-output relationships of milk production, production equations are fitted for different groups of farms, *i.e.*, marginal, small, medium, large and big farms. Linear and Cobb-Douglas types of production function were tried but the Cobb-Douglas production function is chosen for presentation of analysis because it gave a better fit to the data. The model is :

$$Y = f(X_1, X_2, X_3, X_4, X_5, X_6, X_7)$$

where
- Y = value of the average milk yield per animal per day (in rupees),
- X_1 = value of the dry fodder used per animal per day (in rupees),
- X_2 = value of the green fodder ued per animal per day (in rupees),
- X_3 = value of the concentrates used per animal per day (in rupees),
- X_4 = number of lactations completed (including current lactation),
- X_5 = labour hours (family and hired) used per animal per day,
- X_6 = value of the animal (in rupees), and
- X_7 = age of the animal.

The Cobb-Douglas form is :

$$\text{Log}_e Y = a + b_1 \log_e X_1 + b_2 \log_e X_2 + b_3 \log_e X_3 + b_4 \log_e X_4 + b_5 \log_e X_5 + b_6 \log_e X_6 + b_7 \log_e X_7 + U.$$

9. The four quarters are: July-September, October-December, January-March and April-June.

Production functions are estimated by the method of Ordinary Least Squares for different size-groups of farms. Before fitting the production functions to all size-groups of farms, zero order correlation matrices are worked out and the correlation coefficients are examined to detect the multicollinearity problem. If the value of the coefficient of correlation between any two explanatory variables is less than the value of the coefficient of multiple determination, then it cannot be treated as a problem of multicollinearity.[10]

It is observed from the correlation matrix that the variables, *viz.*, number of lactations, age of the animal and value of the animal are highly correlated and the intercorrelations among these three variables exceeded the value of the coefficient of multiple determination. Thus, the variables, age of the animal and value of the animal, are excluded from the analysis.

Results

The results of the estimated production function for different size-groups of farms are presented in Table I. All the explanatory variables considered together explained about 78, 74, 79, 80 and 82 per cent of the variation in milk yield in the marginal, small, medium, large and big farms respectively and these coefficients are found to be significant at one per cent probability level.

The elasticity coefficient with respect to dry fodder is positive in all size-groups and found to be significant between 5 and 10 per cent probability levels. The elasticity of milk yield with respect to green fodder registered the expected positive sign and found to be significant between one and 10 per cent probability levels. The magnitude of the coefficient is the highest on large farms and lowest on marginal and medium farms. Similarly, the elasticity coefficient associated with concentrates turned out to be positive and is found to be significant at one per cent probability level.

The elasticity coefficient associated with the number of lactations variable registered a negative sign and found to be significant at probability levels ranging between one and 10 per cent. Interestingly, the elasticity coefficient associated with human labour registered a positive sign in the estimated equations of different size-groups of farms and it is found to be significant at probability level ranging between one and 10 per cent.

Marginal Value Products

In order to test the resource use efficiency in dairying, MVPs of green fodder, dry fodder, concentrates and human labour are computered at the geometric mean levels and they are compared with their respective factor costs.[11] Further 't' statistic is used to test the deviation of MVP from the factor cost. The details regarding the MVPs of different inputs with the corresponding 't' values for different size-groups of farms are presented in Table II.

10. L. R. Klein: An Introduction to Econometrics, Prentice-Hall of India Pvt. Ltd., New Delhi, 1973, p. 101.

11. As green fodder, dry fodder and concentrates are expressed in value terms, the factor cost is equivalent to one while human labour is expressed in hours, the factor cost is taken as the average expenditure actually incurred on human labour per one hour work.

TABLE 1—RESULTS OF THE ESTIMATED REGRESSION EQUATIONS OF MILK PRODUCTION FUNCTIONS BY SIZE-GROUPS

Size-group (1)	No. of observations (2)	Constant (3)	Regression coefficients of					$\bar{R}^2$ (9)	F (10)
			X_1 (4)	X_2 (5)	X_3 (6)	X_4 (7)	X_5 (8)		
Marginal	47	1·61	0·22*** (1·69)	0·32*** (1·87)	0·62* (3·86)	—0·28*** (1·89)	0·27** (2·18)	0·78	54·60
Small	62	2·04	0·14*** (1·90)	0·38* (2·71)	0·52* (3·53)	—0·35* (4·81)	0·25* (2·65)	0·74	35·93
Medium	85	1·89	0·17*** (1·95)	0·32* (5·15)	0·41* (3·84)	—0·22* (3·99)	0·30* (3·35)	0·79	53·51
Large..	102	1·94	0·23** (2·53)	0·42* (5·72)	0·52* (5·41)	—0·26* (4·58)	0·14*** (1·68)	0·80	75·40
Big	111	1·97	0·20*** (1·66)	0·38* (5·75)	0·45* (6·69)	—0·24* (7·05)	0·19* (3·47)	0·82	94·39

Figures in parentheses represent the respective 't' values.

* Significant at 1 per cent probability level.
** Significant at 5 per cent probability level.
*** Significant at 10 per cent probability level.

TABLE II—MARGINAL VALUE PRODUCTS OF VARIOUS FACTORS AFFECTING MILK PRODUCTION BY SIZE-GROUPS

(*Rs.*)

Size-group (1)	Dry fodder X_1 (2)	Green fodder X_2 (3)	Concentrates X_3 (4)	Labour X_5 (5)
Marginal	1·17	1·65***	2·96*	0·99**
	(1·57)	(1·88)	(3·88)	(2·26)
Small	0·64**	1·55*	2·15*	0·85*
	(2·01)	(2·72)	(3·47)	(2·80)
Medium	0·85***	1·53*	1·82*	0·89*
	(1·89)	(5·16)	(3·85)	(3·32)
Large	1·20**	1·92*	2·38*	0·49***
	(2·55)	(5·72)	(5·41)	(1·74)
Big	1·01***	1·77*	1·94*	0·66*
	(1·66)	(5·48)	(6·45)	(3·97)

Figures in parentheses indicate 't' values.
* Significant at 1 per cent probability level.
** Significant at 5 per cent probability level.
*** Significant at 10 per cent probability level.

The MVP of dry fodder is greater than one in the case of marginal and large farms, less than one in the case of small and medium farms while it is almost one in the case of big farms. The MVPs associated with green fodder and concentrates are greater than unity in all the size-groups and are significant at probability levels ranging between one and 10 per cent. This implies that all the farms are under-utilizing these two inputs.

With regard to human labour, the MVP in all size-groups except marginal farms is less than the factor cost and significant at probability levels ranging between one and 10 per cent. This indicates that only the marginal farms are utilizing the human labour input in an efficient way while the other size-groups of farms are over-utilizing this input.

Conclusions

It is observed from the study that the inputs, green fodder and concentrates, are the principal factors affecting milk production in all size-groups of farms. The estimated MVPs of green fodder and concentrates are greater than factor cost implying that all the farms are under-utilizing these two inputs. Hence there is a possibility of increasing milk yield by further use of green fodder and concentrates. Regarding labour, only marginal farms are utilizing this input in an efficient manner while the rest of the farm groups are over-utilizing it.

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