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MILK PRODUCTION IN KERALA - AN
ANALYSIS OF THE PAST TRENDS AND FUTURE
PROSPECTS

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I

Review of Development in Kerala

1. Cattle dominates the bovine wealth of Kerala; their productivity is lower compared with many other regions in India.^{1/} This low productivity is due to the cumulative effects of (a) the rapid rise in human population leading to expansion in cropped area and greater intensity of cultivation resulting in a progressive reduction in the availability of grazing facilities to negligible level and accentuating the competition between man and animals on land; (b) the poor quality of the grazing land caused by the heavy rainfall leading to soil erosion and consequently to the deterioration in soil fertility; and (c) the dominance of monoculture in the cropping pattern.^{2/}
2. The poor livestock situation in Kerala was noted by a number of 19th and early 20th century writers on Kerala agriculture.^{3/} There were also attempts to improve the quality of the cattle population by cross-breeding the domestic stock with imported breeds of high quality from other parts of India and even from England.^{4/}
3. Organised attempts by the State to develop animal husbandary in Kerala started only during the Second Five Year Plan when the Key Village schemes were introduced and facilities were provided for artificial insemination.^{5/} Eight Key Village centres were established in the State during this plan period.^{6/} This scheme has continued to operate in the successive five year plans and currently fourteen of them are functioning in the State.^{7/} In 1963, as part of the all-India special programme for cattle development, an intensive cattle development project was started, and later one more unit was added.^{8/}

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4. Besides these schemes the Indo-Swiss project and the Department of Dairy Development have also taken up a major programme for Cross-breeding.^{9/} The Indo-Swiss project, located in the high ranges of Kerala, was started with the objective of creating a new species of cross-bred cattle adapted to Indian conditions and to encourage scientific production of fodder. The setting up of a semen bank and liquid nitrogen plant for deep freezing of bovine semen as part of this project was an important step in the cattle development of Kerala.^{10/} The extension work of this project was started in the high ranges during 1967-68 and later, in collaboration with the State Animal Husbandry Department, they extended their activities to the Haveli-kare region of the ICDP. The Dairy Development Department's scheme was taken up under the Special Employment Programme and it proposed a massive cross breeding to cover one million cattle of breedable age by using semen from the exotic bulls of high production potential. About 1000 inseminators were trained under this scheme and they were provided facilities to undertake artificial insemination on a payment basis.^{11/} This scheme was launched in 1972-73.

5. In the cattle breeding projects outlined above, three exotic breeds were used for cross breeding. In the Koy Village scheme Sindhi was mainly used for cross-breeding. Jersey was also used in one of the ICAR-sponsored cross-breeding schemes in the State, but on a small scale. In the ICDP unit started in the Fourth Plan, in three sub-units Jersey and in one unit Brown-Swiss were used. In the second ICDP, Jersey was used. When the massive cross-breeding programme was started Brown Swiss in the four southern districts and Jersey in the remaining districts were used for cross-breeding. Steps were also taken during the plan periods to establish bull stations and semen storage facilities.^{12/}

6. Along with the programme for breed improvement there were also attempts to provide facilities for procurement of milk from the rural areas and for its processing and distribution in urban centres. At present, there are over 500 dairy co-operatives in the State involved in the procurement of milk and supply of inputs to milk producers.^{13/} Steps were also taken to install 24 chilling plants and 7 dairy plants with a total handling capacity of 50000 and 61000 litres per day respectively in the State.^{14/} There has also been significant improvement in animal health services. At present there are 532 veterinarians

Table 1

Investment in animal husbandry and dairy development project in successive plans in Kerala

Item	Plan periods				(Rs. lakhs)
	II ¹	III ²	IV ³	V ⁴	
1. Animal husbandry	112	62	126	163	
2. Dairying and milk supply	-	37	161	141	
3. Total	112	99	437	304	

Source: Government of Kerala, Department of Planning

- (1) Third five year plan, Draft outline pp 50
- (2) Fifth Five year plan A draft outline pp 75
- (3) Fifth five year plan A draft outline
- (4) Fifth plan figures relates to the first 3 years only

The outlay figures for these years are taken from the background paper on livestock development, prepared by the State Planning Board, Trivandrum.

hospitals functioning in the state.^{15/} Out of this 408 hospitals are managed by veterinary surgeons, 12 are mobile veterinary dispensaries and the remaining are veterinary sub centres with out adequately qualified technical personnel. In other words for every seven thousand cattle units there is one veterinary institution providing health care in the State. The total investment in Animal Husbandary and dairy developnent schemes are given in Table 1.

7. Except in the case of Indo-Swiss project, the achievements and shortcomings of the animal husbandary and dairy developnent schemes undertaken in the past have not been evaluated so far. The evaluation study of the Indo-Swiss Project done in 1973-74, showed that compared to indigenous breeds, cross-bred cows (1) Calve much earlier; (2) Calve more frequently; (3) the lactation period lasts longer; (4) Produce larger quantities of milk per day and per lactation; and (5) at a lower cost per unit of milk.^{16/} In this paper we attempt an overall evaluation of the trends in milk production and consumption in Kerala,

and of the factors which have contributed ^{to} the increased production (especially of the contribution made by the cross-breeding program). This is followed by a description of the structure of dairying industry in the State. The concluding section discusses certain issues relating to the future strategy of dairy development.

II

Increase in Milk Production

8. The trend in total milk production in the State can be estimated on the basis of data relating to the average yield per cow, lactation length and proportion of animals in milk, available for the State as a whole and for different regions, from Surveys conducted in the mid-sixties and mid-seventies.

9. The Institute of Agricultural Research Statistics (IARS) conducted a sample survey in 1964-65 to collect data pertaining to the yield rates of milch animals and other bovine practices in Kerala. This survey, covering a total of 134 villages and 4308 households in rural areas, provides data on milk production relating to 4191 cows and 566 she-buffaloes in milk. The survey used a stratified multi-stage sample design. The State was divided into a certain number of basic strata, each stratum being roughly equivalent to a district in size. A cluster of two adjoining villages in each stratum was the unit at the primary stage of sampling. At the second and third stages of sampling, the units were a cluster of two households and an animal in milk respectively. Data on milk output and feed input were collected ^{by} actual weighing method. The entire survey period of one year is divided into three seasons and data were collected for each season separately.

10. The second source of data for mid-seventies is the 30th round of the National Sample Survey (1975-76).^{13/} A stratified two stage design was used in this survey. The first stage units were the 1971 Census villages in rural areas and urban blocks in urban areas. The second stage units were the households. The survey period of 12 months has been divided into four sub-rounds of 3 months each. The other main differences between this survey and that of the IARS is that the former relied not on actual weigh-

Table 2
Average daily yield per cow and she buffaloes in rural and urban areas of Kerala

State/region/ species	Average daily milk yield (kg)		HSS (1975-76) ²		% change	
	I A R S (1964-65) ¹		a	b	a	b
	a	b				
Region I						
(i) Rural						
(a) cow	0.790 (7.2)	0.535 (6.6)	1.270	0.517	60.70	84.17
(b) she buffalo	1.370 (6.1)	0.975 (5.9)	1.340	1.090	32.40	12.71
(ii) Urban						
(a) cow	1.435 (4.9)	0.717 (4.2)	1.900	1.209	46.50	68.61
(b) she buffalo	2.795 (6.8)	1.537 (6.8)	3.230	2.341	15.56	52.30
Region II						
(i) Rural						
(a) cow	1.070 (4.2)	0.436 (3.8)	1.740	0.953	52.60	98.14
(b) she buffalo	2.040 (5.4)	1.060 (4.8)	2.440	1.576	19.60	48.67
(ii) Urban						
(a) cow	2.460 (4.9)	1.279 (5.2)	2.830	1.604	15.94	25.41
(b) she buffalo	2.935 (6.3)	1.671 (7.4)	4.070	2.305	36.34	37.94
State						
(i) Rural						
(a) cow	1.010 (5.0)	0.430 (6.4)	1.590	0.840	57.42	75.0
(b) she buffalo	2.019 (5.2)	0.980 (6.6)	2.540	1.262	25.80	28.77
(ii) Urban						
(a) cow	2.319 (5.7)	1.115 (6.3)	2.540	1.644	9.52	47.44
(b) she buffalo	5.154 (6.2)	1.871 (5.9)	3.790	2.860	20.16	52.85

Source: (1) Institute of Agricultural Research Statistics (ICAR), Estimation of milk production and other bovine and goat Practices in Kerala (1964-65) (mimeo) New Delhi (undated)

(2) GOI, Department of statistics, National Sample Survey Organisation, Draft Report No.221/3 30 round. Report on Livestock Number and Product. Some estimates on the Production of Livestock products and related characteristics, New Delhi 1973.

(a) gives daily output per animal in milk

(b) gives average daily yield for the entire herd figures in bracket gives the standard error of estimate; Regional II corresponds to the area under the former Travancore Cochin State and region one that of the Malabar districts.

but on the respondents' recall of the quantum of output, feed etc. Though the fact that the reference period of a week prior to each visit may minimise errors in reporting, it will not eliminate them. For these reasons the estimates from the two surveys are not strictly comparable. This limitation should be borne in mind while judging growth of output on the basis of these two surveys.

11. According to the IARS Survey (1964-65) the daily milk yield per cow in milk was 1.91 kg. and was 2.31 kg for she-buffaloes in rural areas. The average yield per cow in milk was 2.31 kg and that of she-buffaloes was 3.15 kg in urban areas. In 1975-76, the average daily yield per cow in milk was 1.59 kg and 2.54 kg for she-buffaloes in rural area. The average daily yield per cow in milk was 2.54 kg and 3.79 kg for she buffaloes in urban area (see table 2). This shows that the output per cow in milk increased by 60 per cent in rural area and 10 per cent in urban area; while that of she-buffaloes increased by 26 per cent in the rural area and 20 per cent in urban area. The increase in yield rate per milch animal is found to be higher than that per animal in milk. This reflects an increase in the proportion of total adult females which are in milk and is indicative of improvement in the lactation length.

12. Total milk production in 1964-65, according to the IARS estimate is 2.0 lakh tonnes. In 1975-76, the estimated milk production by the National Sample Survey Organisation is 5.5 lakh tonnes. It is revealed in both the surveys that over 35 per cent of the milk produced in the State is contributed by the cows. The estimated number of milch animals in 1964-65 is 9.5 lakhs. The estimated number of milch animals in 1975-76 by the NSS comes to 9.3 lakhs.^{20/} In other words, while the estimated milch animal population increased but marginally, the total milk production increased by 70 per cent. If we apply the yield rate of milch animals as obtained from the two surveys to the milch animal population obtained from the Livestock Censuses, the total milk production is seen to be slightly higher ~~higher~~ than the survey estimate. But the rate of increase does not show any significant difference.²

Table 3
Change in total milk production and estimated number
of milch animals in Kerala

	1964-65 ¹	1975-76 ²	% change
Total milk production (000 tonnes)	204	354	73.2
Estimated number of milch animals* (000)	943	935	3.9

Source: Same as for table 1.

* Number of animals in milk together with dry animals constitute milch animals.

15. Since there is some question about the comparability of production estimates from the IARS and NSS Surveys, we have made an alternative estimate based on milk consumption at the two points of time from an independent source, namely, the consumer expenditure surveys conducted by the NSS. These surveys have used uniform concepts and methods of data collection for over 2 decades and therefore do not suffer from problems of comparability. The published NSS reports give data on the per capita consumption expenditure on milk and milk products as well as the unit price of milk for rural and urban areas, for a number of years. There is adequate evidence that the habit of converting milk into by-products is only marginal in Kerala and that the consumption is mainly in the form of liquid milk. Data from the 25th and 28th rounds of the NSS.^{22/} show that in terms of its value, barely 10 per cent of the expenditure on milk and milk products is accounted by milk converted into products in rural areas and 15 per cent in urban areas. It is, therefore, possible to get a fairly good measure of the quantum of milk consumption by dividing the total per capita consumption expenditure on milk and milk products by the unit prices of fluid milk both obtained from NSS.

14. The estimates of per capita consumption derived on this basis (See Table 4) shows that between 1965-66 and 1975-76, per capita liquid milk consumption in rural areas increased by 40 per cent whereas in urban areas it increased by 90 per cent. Allowing for population increase during the decade, the total milk consumption

in the State as a whole is estimated to have risen by 65 per cent. These estimates are fairly consistent with the estimates of change in production obtained from the IAMS and NSS surveys. It is therefore possible to assert with some confidence that there has been a substantial rise in milk production and consumption in Kerala during the past decade.

Table 4

Trend in Percapita milk consumption*

Year	Per capita monthly consumer expenditure on milk (Rs)		Price of milk (Rs/kg)		Per capita quantity consumed for 30 days (kg)		Agg. cons. whol (00)
	1	2	3	4	Rural	Urban	
	Rural	Urban	Rural	Urban	Rural	Urban	
1965-66	0.79	0.79	1.02	0.94	0.915	1.039	24
1969-70	1.20	2.22	1.24	1.69	0.965	1.308	25
1970-71	1.59	2.59	1.46	1.72	1.090	1.501	26
1973-74	1.82	3.95	1.64	2.12	1.203	1.862	36
1975-76	na	na	1.92	2.250	1.271	2.080	35

Source: 1 and 2, Government of India, Department of Statistics National Sample Survey (a) Report Number 17a Tables with Notes on consumer expenditure (19th round July 1964-June 1965) (b) Report Number 209, Tables with Notes on consumer Expenditure (20th round, July 1965-June 1966) (c) Draft Report Number 271, Tables with Notes on Consumer expenditure (24th round, July 1969-June 1972); (d) Draft Report No. 250, Special tables on consumer expenditure for the National Commission on Agriculture (25th Round July 1970-June 1972) (e) Draft Report No. 273/A Consumer Expenditure (28th round June 1973-October 1974) 3 and 4, National Sample Survey unit, Bureau of Economics and Statistics, Government of Kerala.

15. The increase in total milk production over the years can be due to (a) rise in total milch animal population and the proportion of animals in milk; (b) increase in the proportion of cross-bred cows in the breedable population; and (c) the rise in the average milk yield of nondescript stock mostly due to better feeding and management. This may be symbolically expressed as follows:

$$O_{75} - O_{64} = Y_{64} (P_{m75} - P_{m64}) + (Y_{c75} - Y_{i64}) (P_{mc75}) + R$$

Where,

O_{75} = milk output in 1975-76;

O_{64} = milk output in 1964-65;

Y_{64} = yield rates of cows in 1964-65;

P_{m75} = Population of milch cows in 1975-76;

P_{m64} = Population of milch cows in 1964-65;

Y_{c75} = Yield rates of cross-bred cows in 1975-76;

Y_{i64} = Yield rates of indigenous cows in 1964-65;

P_{mc75} = Population of cross-bred cows in 1975-76.

R = effect of increase in yield rates of indigenous cows.

16. The first term on the right side of the equation will give the effect of the increase in population of milch cows (the population effect) and the second term will give the effect of increase in cross-bred population (the breed effect) to the additional milk output. The third term, which is the residual, will give the effect of the increase in productivity (yield effect) of the indigenous cows. In this equation we know the values of all variables, except the increase in population of cross-bred cows between 1964-75 and change in their productivity.

17. Direct estimates of the population of cross-bred cows in the State are not available from any source.* But the number of artificial inseminations done under the Key Village, ICDF and other agencies are available from early sixties. This data is compiled by the Animal Husbandary Department and is published in the Half Yearly Bulletin on Animal Husbandary Statistics.^{23/} Upto 1972-73, since inseminations were done free of charge in the AI units, there is a chance that the project officials may have tended to overreport the number of inseminations in order to demonstrate their performance. With the levy of a nominal fee for inseminations from 1972-73 and the necessity to maintain record of names and addresses of beneficiaries - records which are subjected to audit - it is believed that the reporting from this year on is more accurate.^{24/}

13. The fertility rates of artificially inseminated cows are usually assessed under certain assumptions about their effectiveness based on the information on the "non-returns" of the inseminated animals for reinsemination within 60 to 90 days. But discussions with the officials involved in this programme showed that there are no estimates of the total calves born to inseminated cows for the State as a whole. Estimates of particular areas are available but these are not based on any uniform procedure: They have been estimated in different areas by different methods, e.g., pregnancy or actual calving reported. Because of this difficulty, we discussed with the people who have long first-hand experience of the working of the cross-breeding programme. Their collective judgement is that the number of calves born as a proportion of total inseminations be around 20 per cent.^{25/} This together with the total number of inseminations done in each year provides the basis of our estimate of the number of cross-bred calves born. The size of the cross-bred population reaching the reproductive age in each of the successive years is obtained by applying the age specific survival rates of female cattle in the State. The estimated population of reproductive cross-bred cows in 1975-76 is given in Table 5. The details of the method of estimation are described in Appendix I.

Table 5

Estimated number of improved animals in Kerala

Age in completed years	estimated No. of animals (000s)
2	40.5
3	24.5
4	18.8
5	14.6
6	9.6
7	7.2
8	6.2
9	3.0
10	2.6
11	0.6
Total	127.4

Source: For source of data and assumptions behind the estimate see Appendix I.

19. While interpreting the above results the following limitations should be kept in mind: (a) The 20 per cent birth rate, being based on the informed judgement of officials rather than actual surveys, must be treated with caution, especially because there is no unanimity on this matter among officials. Many consider the 20 per cent birth rate to be an overestimate under the existing feeding management and technical efficiency of AI in average Kerala conditions; (b) The age at which the female bovines reach the reproductive age depends on the genetic characteristics of the animal. There is evidence to suggest that the age at first calving for the Swiss-brown crosses (2.5 to 3 years) is lower than for nondescript cows (around 4.5 years).^{26/} We have assumed that female cross-bred calves which survive two years after birth will be in the reproductive group. But to the extent that the time required to reach maturity itself is a function of feeding and management of calves, and that farmers in-the-mass may not achieve the standard reached in the areas of intensive development, this estimate may be open to question. (c) In order to estimate the cross-bred cows in a certain year, we need to know the age specific survival rate of cross-bred population which in turn requires age distribution of cross-bred population. But

this type of data is not available. The only detailed age distribution data for female cattle in the State is from the 30th round of the NSS and this relates to the entire female herd, which includes both cross-bred and non-descript animals.^{27/} To estimate the total cross-bred population in 1975-76, we applied the age specific survival rate of the entire female-herd. Since the productivity of cross-bred animals are significantly higher than the non-descript animals, the level of feed input and management may be better for the cross-breds than for the non-descript and thus the survival rate of the cross-bred is likely to be higher. In such situations the application of combined survival rate may lead to underestimation of the cross-bred population in the productive age. Subject to the above limitations, the number of cross-bred cows in 1975-76 may be placed at 1.3 lakhs accounting for 15 per cent of the total cows in the State.

20. There is no data available on the productivity of cross-bred cows (i.e. the value of $Yc75$) for the State as a whole. But a series of surveys conducted in different parts of the State around the mid-seventies by three independent agencies gives information on the yield per cross bred cow in milk and the average yield for the herd. Out of the different surveys, the survey conducted by the Indo-Soviet Project (1973-74) provides the most reliable source of data on the performance of cross-bred animals. The survey gives data on the yield rates of cross bred cows for the plains, midland and highland under intensive and average management conditions. In order to arrive at a fair idea of the average productivity of cross-bred cows in the State we estimated weighted yield by pooling the data for the different ecologies and also for different classes of producers: the weight being the number of observations in each case. The weighted yield per cross-bred milch cow comes to 1.9 kg. per day.

21. The values of the different variables used in the output decomposition equation is given in Table 6. Solutions of this equation shows that the contribution of the increase in milch animal population to the additional milk output is negligible. The two factors which are responsible for the increase in milk production is the increase in the population of cross-bred cows and increase in the productivity of non-descript animals. The contribution of the 'breed effect' to the additional milk output is of the order of 65 thousand tonnes (i.e. 50% of the additional output) ^{and} that of 'yield effect' is about 64 thousand tonnes. In other words the 'breed effect' and the 'yield effect' contributed equally to the growth in additional milk output. In order to understand the factors which stimulated a sizable improvement in overall yield, it is necessary to examine the trends in the demand for milk and the profitability of milk production.

Table 6

Values of Variables in the Output Decomposition Equation

Variable	Value
O75	235 ^{1/}
O64	156 ^{2/}
Y _i 64	0.51 ^{3/}
Y _e 75	1.90 ^{4/}
P _n 75	862 ^{5/}
P _n 64	857 ^{6/}
P _{nc} 75	127 ^{7/}

Source: (a) ^{1/} and ^{5/} NSS op.cit., Table 2

(b) ^{2/}, ^{3/} and ^{6/}, IARS, op.cit. table 2

(c) ^{4/}, R.K.Patel et..al. Economics of Cross-Bred Cattle - A Study of the Cattle Breeding Programme of Indo-Swiss Project Kerala, National Dairy Research Institute, Karnal, Indo-Swiss Project, Kerala, 1976.

(d) ^{7/} estimated.

The value of O75 and O64 are given thousand tonnes. The productivity of nondescript and cross-bred (i.e. Y_i 64 and Y_e 75) milch cows are given kilograms per day. The population of milch animals are given in thousands.

III

Growth in Demand for Milk

22. The growth in demand for milk generally depends on (a) growth in human population and per capita income and (b) prices of milk and substitutes.

23. *Milk is the source of two important nutrients in human diet, namely, fat and protein. As a source of fat milk is the main substitute for edible oils. But milk is far less important as a source of fat than it is as a source of animal protein. The principal sources of animal protein other than milk (hereinafter referred as 'others') are fish, meat and eggs. In an earlier paper which sought to highlight the inter-State differences in milk consumption we had shown apart from differences in per capita income, the only other factor which has a significant effect on the inter-state variation in milk consumption is the availability and cost of other sources of animal protein.^{29/} In regions where protein from other animal sources are abundant and/or are cheaper than milk protein, the per capita consumption of milk is also found to be lower. The consumption and price of fat from edible oil have no significant influence on the demand for milk.*

24. Out of the total animal protein intake in Kerala during 1961 (the only year for which break up of source-wise consumption of animal protein is available) about 75 per cent was contributed by fish, 13 per cent from milk and the rest was from meat and egg. Both in absolute terms and as a proportion of the total animal protein milk is much less important in Kerala than in other States. This is consistent with the fact that the cost of milk protein relative to the cost of proteins from other animal sources was also much higher in Kerala than in other States.*

* The per capita intake of animal protein for the country as a whole was about 140 grams (for a period of 30 days) in 1961-62. Out of this 50 per cent was derived from milk and the rest from meat, fish and egg.

Table 7

Source and quantum of animal protein intake in Kerala
(rural 1961-62) for a period of 30 days

Source	Quantity consumed for 30 days (g)	cost per kg. of protein (Rs)
(a) Milk	0.027	21.45
(b) Other animal sources	0.256	3.35
1. Fish	0.222	-
2. Meat	0.031	-
Egg	0.003	-
Total	0.283	-

Source: K.N.Nair and A.Vaidyanathan, Interstate differences in Milk consumption in India - A preliminary Analysis, Working Paper No.52, Centre for Development Studies, Trivandrum.

25. However, over the last decade, there has been substantial change in relative prices of milk and other sources of animal protein, the latter becoming increasingly more expensive than milk. (see table 3). Given these changes in relative prices, we may expect it to result in a significant shift in consumption pattern of animal protein in favour of milk. As a matter of fact the per capita consumption of milk has risen appreciably in the past decade while the per capita intake of other sources of animal protein has recorded a decline. These shifts, however, reflect not only the changes in demand patterns but also those in condition of supply. In order to assess the relative effect of these two sets of factors, it is useful to have an idea of the likely level and composition of animal protein demand which would have obtained given the increases in real incomes and population, if there were no changes in relative prices.

Table 8

Index Number of Prices of Milk and Other Sources of Animal Protein in Kerala
(Meat, fish and Egg)

Year	Milk price ¹ Index	Other sources of animal protein ² price index	Aggregate animal pro- tein price Index	Aggregate consumer price ³ Index	Food price in
1964	100	100	100	100	100
1965	112	94	98	110	116
1966	124	90	96	120	127
1967	137	125	128	130	135
1968	150	124	132	140	157
1969	157	182	179	146	163
1970	164	233	228	152	174
1971	168	227	226	153	169
1972	178	242	238	162	177
1973	223	262	258	196	216
1974	263	375	364	258	228
1975	296	429	413	231	325
1976	273	497	486	256	330

Source: 1. Milk Price Index is computed from the Bulletin of Animal Husbandary Statistics

2. The price of meat and egg are computed from the Bulletin of Animal Husbandary Statistics, The fish price is taken from John Kurien: Towards an Understanding of the Fish Economy of Kerala State: A Preliminary study of the current situation and trends in organisation technology, production and distribution of incomes, working Paper 8 Centre for Development Studies, Trivandrum. The weighted price Index is computed by weighting the price of milk, fish egg and meat by the output of these items in different years.

3 and 4. Government of Kerala, State Planning Board, Economic Review, Kerala, 1978,

26. The growth in demand for milk, meat, fish and egg at constant relative prices are estimated for the period 1965-66 to 1975-76 on the basis of the rise in population and per capita demand. The latter is computed from the expenditure elasticities of demand for these items derived from NSS data and the increase in per capita real income in the State taken from official estimates.^{30/} The projected per capita demand multiplied by the population in the corresponding year gives the aggregate demand.^{31/} The estimates are presented along with the estimates of supply in Table 9.

Table 9

Estimated demand and supply of Milk, Meat, Fish and Egg in Kerala (1965-75)

Item	Estimated demand			Estimated supply		
	(000 tonnes)			(000 tonnes)		
	Year 1965-66	1969-70	1975-76	1965-66	1969-70	1975-76
Milk	208.0	271.0	336.0	208	261	354
Fish	308.0	369.1	445	308	344	332 ^{1/}
Meat	35.1	40.3	65.4	35.1	37.1	52.5 ^{2/}
Egg	12.5	17.0	23.9	12.6	13.3	17.8 ^{3/}
Total	563.6	706.3	891.4	563.6	655.8	756.2

Sources: 1. Fish Production Estimates are taken from John Kurien, op.cit.
 2. Milk Production estimates are based on the milk production surveys.
 3. Meat and egg production estimates are obtained by using the methodology suggested for the arriving at the State income estimates from this sources. State Income Estimate, Bureau of Economics and Statistics, Kerala, 1973-74, Trivandrum 1975.

27. The total consumption of meat, fish and egg in Kerala during 1965-66 was 5.6 lakh tonnes. At constant prices, the total demand for these products, given the increase in population and per capita income, would have been 8.9 lakh tonnes by 1975-76. If there were no changes in relative prices, the demand for fish would have risen by 50 per cent, for milk by 60 per cent, for meat and eggs by 35 per cent.

28. The price of animal protein increased at a faster rate than the general price level, because the increase in overall production of animal proteins (34 per cent) fall short of the rise in demand at constant prices (60 per cent). The gap between constant price demand and actual supply, however, varies a great deal between different sources of animal protein. The output of fish for internal consumption which contributes the bulk of the animal protein intake in Kerala, has been more or less stagnant for the past decade, and has in fact declined in per capita terms despite the steep rise in the price of domestically consumed fish.^{32/} The tardy supply response of fish output to price rise seems to be due in large part to the prevailing pattern of ownership of means of production and the marketing system which makes it difficult for the traditional sector of the fish economy, which accounts for the bulk of the domestically consumed fish output, to use improved technology to extend their area of operations and income productivity. Although the encouragement of the modern mechanised fishing was intended to improve the productivity of traditional fishermen, in actual fact they have not benefitted the latter to any significant extent. Moreover, they have tended to concentrate almost exclusively on prawn fishing. The output of the mechanised sector has indeed risen, and risen substantially, but the bulk of it consists of prawns. One reason for this concentration is that though the returns on domestically consumed fish rose those of prawns (which are mostly exported) rose much faster. There is also some evidence to suggest that even at the prevailing high price of fish, it may not be profitable for mechanised boats to depend wholly on catching domestically consumed species of fish.^{33/}

29. Whatever the reason, the stagnation in the production of fish and increase in its price relative to those of eggs and meat, might have induced a shift in the consumption of animal protein in favour of meat and egg. Moreover, the general rise in animal protein price has induced a stronger supply response in the case of meat and egg; in the case of fish through (a) a higher rate of slaughter, mostly adult males, and young stock bovines; (b) a sharp rise in the input of live animals which are mainly meant for slaughter; and (c) better feeding and management of the poultry birds resulting in an increase in their productivity. The overall increase in meat and egg production

during the past decade was nearly 50 per cent. But this is still well below the quantity of constant price demand for these items. Total animal protein supply from fish, meat and eggs, therefore fell considerably short of demand.

30. In sharp contrast, the supply response of milk to the rise in prices has been very striking: The increase in supply (70 per cent) was actually significantly larger than the projected growth of demand at constant prices. As a result, though the overall shortage in animal protein resulted in a higher-than-average rise in milk prices relative to the general price index, the increase in milk prices was much less than that in other animal protein sources, especially fish. The cheapening of milk relative to other animal protein must have resulted in a substitution of the former for the latter. There has evidently been a significant shift in this direction during the past decade. However the fact that the price of different animal protein sources did not change uniformly suggests that they are not perfect substitutes for each other.

30. The impact of the shortages and rising cost of other sources of animal protein relative to milk has naturally not been uniformly felt by all sections of the population. It would appear from the NSS data that the consumption of fish (is by far the largest component) has been and remains more widely diffused than that of milk. This can be seen from the concentration ratios (gini coefficient) of consumption of two groups presented in Table 10. What is more significant in the context of the present discussion is the markedly different trends in the gini coefficient over time. Thus the degree of concentration in the consumption of fish, meat and egg seems to have increased in both rural and urban areas, whereas that of milk has fallen apparently. In other words, while the consumption of milk and milk products has become more widespread, that of fish, meat and egg has become more concentrated in the upper income groups. This seems to indicate that the substitution of milk for other animal protein in response to a sharp change in relative prices has occurred largely in the lower income groups.

Table 10

Value of Gini-Coefficient for Milk, Meat, Fish and Egg,
in Rural and Urban areas of Kerala

Year	Milk and Products		Meat, fish and Egg	
	Rural	Urban	Rural	Urban
1965-66 ¹	0.608	0.596	0.301	0.304
1969-70 ²	0.547	0.558	0.326	0.319
1970-71 ³	0.532	0.546	0.338	0.336
1973-74 ⁴	0.526	0.533	0.346	0.349

Source: 1. Government of India, Department of Statistics, National sample survey, 20th round (1965-66)
 2. Government of India, 24th round (1969-70)
 3. -do- 25th round (1970-71)
 4. -do- 26th round (1973-74)

IV

Increase in Profitability of Milk Production

32. The relatively strong supply response of milk production to price changes was due to several factors. As pointed out earlier, part of the increase in production, has come about as a result of the higher yield per animal which must have been due primarily to better feeding and management. Over the last decade, the price of milk has risen somewhat faster than the price of food (especially concentrates). This implies that milk production has become increasingly more profitable. The significant increase in the proportion of cross-breds is also a cost reducing technological improvement which reinforces the effects of increased price of milk relative to feed. There is further evidence that faced with growing economic returns to milk and the intensification of population pressure on land people have been progressively reducing their holdings of draught animals and increasing the stock of milch animal.^{35/} Also perhaps as a result of better breeding and management, the proportion of dry animals has fallen.^{36/} That the quality and productivity of milch animal has also is also corroborated by the rise in price of milch cattle relative to draught cattle.

Table 11

Relative Price Ratio

Year	Price of draught cattle	Index draught cattle	Price of milch cattle	Index milch cattle	COW									
					Cow Milk Paddy straw	Cow Milk Oil cake	Cow Milk Cotton seed	Cow Milk Paddy straw	Beef Oil cake	Beef Cotton-seed	Milch cattle Draught cattle	Sow milk Beef		
1962-63	206.0	100.0	136.0	100.0	0.0094	2.1322	1.3966	0.0162	3.6630	2.3921	0.550	0.530		
1963-64	290.8	101.7	191.2	102.8	0.0095	2.1505	1.3942	0.0162	3.5364	2.3953	0.559	0.590		
1964-65	290.1	101.3	193.9	104.3	0.0095	2.1277	1.3940	0.0160	3.5971	2.3505	0.566	0.592		
1965-66	292.0	102.1	197.5	106.2	0.0095	2.1592	1.4104	0.0159	3.6232	2.3697	0.576	0.595		
1966-67	294.0	102.3	201.3	108.5	0.0096	2.1090	1.4154	0.0150	3.5791	2.3641	0.586	0.599		
1967-68	295.1	103.2	216.8	111.2	0.0096	2.1552	1.4537	0.0159	3.5101	2.3692	0.701	0.597		
1968-69	296.0	105.1	211.2	115.6	0.0096	2.1034	1.4560	0.0159	3.6101	2.3692	0.701	0.597		
1969-70	294.3	104.1	216.3	116.3	0.0097	2.0225	1.4514	0.0153	3.5714	2.3474	0.734	0.617		
1970-71	297.7	105.6	221.7	119.2	0.0097	2.1970	1.4555	0.0156	3.6104	2.3354	0.743	0.613		
1971-72	295.2	102.9	227.1	122.1	0.0098	2.2321	1.4706	0.0137	3.5971	2.3316	0.772	0.623		
1972-73	294.2	103.1	236.8	127.3	0.0098	2.2573	1.4795	0.0157	3.5842	2.3310	0.803	0.633		
1973-74	294.8	103.8	239.9	129.0	0.0099	2.2727	1.4301	0.0360	3.5336	2.5336	0.808	0.642		

Sources: These ratios are computed from the Bulletin of Animal Husbandry Statistics, Animal Husbandry Department, Govt. of Kerala, Trivandrum.

Notes: 1. The price of draught animal is for draught animals whose physical condition is good. The price of milch animal is reported for one litre of morning milk yield in (1-3) months lactation. The prices of milk, beef, straw, oilcake, and cotton seed are reported for one kg.

2. The prices of milch cattle, draught cattle, concentrates and paddy straw are given at constant prices.

33. The increase in profitability of milk production over the years also seems to have attracted small cultivators as well as landless rural households to take up dairying as a source of subsidiary occupation. This is evident from the changes in the size and pattern of bovine holdings by size group of farms during the past decade. A comparison of the data from the 16th and 26th rounds of the NSSC showed (a) sharp reduction in the share of draught animals and (b) corresponding increase in the share of milch animals held by the bottom half of the rural households arranged according to the size of their operational holding. This is quite possible in a situation where there is severe constraints on resource endowment and production is taking place in the smaller size of farms. Since the production system is dominated by smaller size of holdings, the rise in profitability of milk production might have resulted in a strong tendency for this group of farms to keep the number of draught animals to the minimum and to increase the number of milch animals so as to take up dairying as a source of supplementary income and employment. Since the availability of feed resources is limited, the increase in number of milch animals reared and the rise in their productivity might have been possible only by releasing feed by reducing the number of draught animals. This is consistent with the strong trend towards the substitution of milch animals for draught animals in the smaller farms. ^{35/}

Table 12

Decile distribution of Land and Livestock in Kerala

Decile Group	Share of draught animals		Share of milch animals		Percentage change		Share of operational area ²	
	1961-62 ¹	1971-72 ²	1961-62 ¹	1971-72 ²	(a)	(b)		
Bottom 50	6.0	1.8	11.0	15.6	-70.5	+43.4	7.8	0.0
50 - 60	8.1	6.1	9.9	9.8	-25.1	1.3	5.0	0.3
60 - 70	9.5	6.0	14.2	13.5	-35.5	30.8	6.4	0.1
70 - 80	13.1	12.8	16.5	17.4	- 2.2	5-5	12.2	0.1
80 - 90	14.9	19.4	19.8	17.5	-29.5	- 1.4	18.8	1.1
90 - 100	48.3	55.9	28.5	18.9	+11.5	-35.9	49.2	3.1

(a) Percentage change in draught animals, (b) Percentage change in milch animals;

- Source: 1. Government of Kerala, Bureau of Economics and Statistics, National Sample Survey Report No.10, Report on the Operational Holdings in Kerala, Rural, 16th Round (1960-61) Bureau of Economics and Statistics, Trivandrum.
2. Government of India, Department of Statistics, National Sample Survey, 26th round (1971-72), Tables on Landholdings, State, Kerala.

34. It is also clear from Table 12 that the small farmers with little or no land account for a sizeable proportion of the milch animal stock. Thus the bottom 50 per cent of the rural households with an average holding of barely 0.08 acres own 16 per cent of the milch animals and holdings below 0.4 acres account for 45 per cent of the total milch animal stock. At the same time the top 10 per cent of the rural households with an average size of holding of 3.6 acres and accounting for 49 per cent of the operational area own about 19 per cent of the milch animals. About 6 per cent of the milch animals in the State is owned by households who operate no land.

35. About 35 per cent of the rural households in Kerala own milch animals. Out of the total households owning milch animals, 35 per cent own only one animal and another 38 per cent of them owns two animals. Only 27 per cent of the households own three or more animals. Households which own only one milch animal contribute about 29 per cent of the total milk production and their share in the total marketed surplus of milk is about 36 per cent. The households owning two animals each contribute 45 per cent of the total milk production and 52 per cent of the total marketed surplus of milk. The remaining households who own 27 per cent of the milch animals contribute to 24 per cent of the total milk production and 19 per cent of the total marketed surplus of milk. This in turn indicates that households who are involved in milk production in the State are essentially producing for the market and the level of commercial milk production (judged by the percentage of marketed surplus of milk to total production) is higher for the smaller producers.

Table 13
Distribution of milch animals, total milk production and
Marketed surplus of Milk according to the number of milch
animals owned by rural households in Kerala

Average number of milch animals per household	Percentage distribution of households by number of milch animals	Percentage distribution of total milk production	Percentage distribution of total marketed surplus
1	34.81	34.82	45.75
2	38.23	38.31	32.74
3	12.75	12.75	10.13
4	7.19	7.19	6.42
5	3.24	3.23	2.28
6	1.65	1.64	1.20
7	0.79	0.78	0.62
8	0.50	0.50	0.24
9	0.26	0.25	0.19
10	0.48	0.47	0.30
11	100	100.00	100.00

- Sources: 1. NSS report No.231/3
2. Percentage distribution of total milk production and of marketed surplus is obtained from the State Sample Estimates.

36. Dairy farming in Kerala is essentially a small scale and wide diffused activity depending largely on purchased (as distinguished from home grown) feed. This dependence is greater in Kerala because the State as a whole depends on imported feed to a much larger extent than other parts of the country. According to the 30th round of the NSS, 1975-76, about 2.1 lakh tonnes of concentrate feed was used to produce 3.5 lakh tonnes of milk of which only 30 per cent is estimated to have been produced within the State, the remaining being imported.^{31/} That dairying is a small scale dispersed activity and is becoming increasingly so are very significant facts to be borne in mind while planning for the future. Equally important is the fact that ownership of milch animals seems to have a direct-bearing on the extent of milk consumption.

37. According to the NSS estimates (1975-76) the per capita annual consumption of milk in Kerala is 15 kg. The monthly household milk consumption (per reporting household) ranges from 6 to 27 kg. across

different expenditure groups, the corresponding urban range being 9 to 25 kg. The percentage of households reporting consumption of milk comes to 50 in rural and 54 in urban areas. The monthly consumption of milk per reporting household in rural areas is 13.3 kg. and 20.5 kg. in urban areas.

38. Analysis of the total consumption of milk across different size-class of population showed that about 60 per cent of the total milk consumption in urban areas and 70 per cent in rural areas are consumed by the top 30 per cent of the population. The top 10 per cent of the population share: about 30 per cent of the milk consumption.

Table 14
Decile distribution of Milk consumption in Kerala
(1973-74)

Decile Group of Population	Cumulative share of milk consumption	
	Rural	Urban
1	0.34	3.96
2	0.60	3.64
3	1.54	19.50
4	6.00	21.50
5	13.04	28.98
6	16.95	35.23
7	30.35	43.75
8	44.11	53.97
9	67.02	75.21
10	100.00	100.00

Source: Government of India, Department of Statistics, National Sample Survey, Report No.274/4, Consumer Expenditure 28th round (June 1973 October 1974)

39. On an average in rural areas 60 per cent of the milk consumed is home produced and the rest is purchased. The percentage of purchased milk to total milk consumption is found to decline with rise in expenditure class in rural areas. There is a significant positive correlation ($r = 0.95$ significant at 0.1 level) between per centage

of households reporting milk production and the percentage of households reporting milk consumption in rural areas; but in urban areas the relationship is not significant. In other words, the ownership of milch animals is an important factor which determines milk consumption in rural areas. The quantity of milk consumption is also seen to be positively correlated with the percentage of households reporting ownership of milch animals across different expenditure groups.

Table 15

Percentage of households reporting consumption of milk to all households and quantity of milk consumed in rural and urban areas of Kerala

Per capita expenditure group	Percentage of households reporting consumption to all households		Quantity of milk consumed ^{1/} (kg.) per reporting household		Percentage of households reporting milk in rural
	Rural	Urban	Rural	Urban	
0 - 9	47.83	33.56	6.00	9.00	-
10 - 19	22.73	30.00	4.53	2.19	13.1
20 - 29	30.70	31.59	5.73	2.97	15.6
30 - 39	39.18	45.21	7.95	4.16	23.1
40 - 49	48.64	56.52	9.99	5.79	29.3
50 - 59	60.20	64.02	12.67	7.13	37.4
60 - 69	58.78	66.61	14.93	8.38	35.4
70 - 79	74.15	71.73	18.07	10.40	43.1
80 - 89	73.10	84.24	12.55	13.79	45.3
90 - 99	67.88	63.39	18.43	13.58	45.1
100 & above	75.55	57.01	27.13	23.42	49.3
All	50.01	54.23	13.30	10.74	35.1

Sources: 1. NSS Draft Report under 23 1/5.

2. This is obtained from the State Sample tabulation.

10 percentage points in the next fifteen years which is roughly the rate of change which occurred between 1965 and 1975. This means that the requirement of milk will be 6 lakh tonnes by 1985 and 8 lakh tonnes by 1990. A major task of the cattle development programme is to increase milk output by 4.8 lakh tonnes between 1975 and 1990.

Table 16

Rate of Growth in Demand for Milk and other Sources of animal Protein in Kerala (1975-1990)

Item	Year:	Estimated demand (000 t)		
		1975	1985	1990
1. Milk		350 ^{1/}	540	670
2. Fish		330 ^{2/}	490	595
3. Meat and egg		70 ^{3/}	115	145
4. Total		750	1145	1410

Source: ^{1/} Government of India, Department of Statistics, NSS Draft Report No.281/3.

^{2/} John Kurion op.cit. Table

^{3/} Op.cit. Table

42. The eight lakh tonnes of milk that may be required by 1990 can be obtained by adopting a combination of the following strategies: (a) by increasing the size of the milch animal herd; (b) by increasing the proportion of cross bred animals to the total milch stock in a planned and phased manner; and (c) increase in average yield per animal. The strategy of the State programme has so far rested heavily on (b). But in order to get a proper appreciation of the relative emphasis to be given to the different elements it is necessary to consider their ultimate impact. For this purpose we will first evaluate the increase in production which can be obtained on the basis of the expected rate of growth of total milch animal stock.

43. On the basis of the IARS and NSS Surveys the estimated number of milch stock in 1965 was 9.5 lakh and by 1975 it increased to 9.8 lakh or barely 0.3 per cent increase per annum.^{41/} Assuming that this rate will continue in the future the estimated population of milch

Future Prospects

40. The future strategy for milk production in Kerala has to serve two objectives: (a) meeting the rising demand for milk to the growing population, and (b) developing dairying as a source of supplementary income and employment to the weaker sections of the rural population. These obviously are also the aims of the new strategy of dairy development. However, there is some doubt whether the new strategy can meet both these objectives. In order to understand the problem it would be useful to relate the strategy to the expected growth of demand for milk and evaluate its implications for the size of the herd required to meet it.

41. The estimates of the growth in demand for all sources of animal protein over the next decade and a half are given in table They are based on the following assumptions: (a) population growth will decelerate from 2.3 per cent per annum in the last decade to 2 per cent in the coming decade,^{32/} (b) the rate of growth of per capita income will continue roughly at the same rate as in the past decade,^{32/} (i.e., 1.5 per cent per annum) and (c) the income elasticity of demand for milk, fish, meat/egg will be 1.6, 1.5 and 2.2 respectively. On the above basis aggregate demand for these products taken together at constant prices will rise from 7.5 lakh tonnes in 1975 to 11.4 tonnes in 1985 and 14 lakh tonnes in 1990. If relative prices were also constant, the demand for milk will rise from 3.5 lakh tonnes in 1975 to 5 lakh tonnes in 1985 and 6.7 lakh tonnes in 1990, account for about 47-48 per cent of the total demand for all the products. But since there are severe constraints on the expansion of fish output and since meat and egg cannot rise sufficiently to compensate the deficit in fish output it is highly probable that the prices of fish will continue to rise relative to that of milk. Correspondingly the demand for milk may be expected to rise at a faster rate than demand estimate made under constant relative prices. In the absence of reliable estimates of the responsiveness of milk demand to change in the relative prices and more importantly because of the difficulties in evaluating the relative price elasticities and cost trends of different animal products in the future, we have assumed that the share of milk demand in total animal products will increase by

animals will be around 10.3 lakh in 1990. Out of this let us assume that the proportion of she-buffaloes will be 10 per cent and their contribution to total milk output will remain at 70000 tonnes. This is not an unrealistic assumption because very little is being done to upgrade the buffaloes.^{42/} This implies that the total stock of milch cows in 1990 will be around 9.5 lakh and they will need to produce 7.3 lakh tonnes of milk or an increase of 4.5 lakh tonnes.

44. As regards to the breeding programme we have alternatives: (a) Maintaining the pace of the cross-breeding programme at such a rate as to sustain the current annual rate of addition to productive cross-bred cows during the next 10-15 years; and (b) accelerating the pace of the cross breeding programme so that by 1990 the entire non-descript stock is replaced by cross breeds. If we proceed with alternative I by 1990 there will be 320 thousand cross-bred cows in the State. Assuming that 60 per cent of the cross-bred animals are in milk, the number of productive cross-breeds in 1990 will be 192000. The population of non-descripts will be 607000 of which (around 53 percent in milk) cows in milk will be 321000. If the average output per non-descript and cross-bred cows in milk are maintained at the present level (namely 0.520 tonnes and 1.12 tonnes per annum respectively) the total milk production by 1990 (including buffaloes milk) will be only 4.3 lakh tonnes against 7.1 lakh tonnes and 6 lakh tonnes respectively. In other words, the implementation of the cross-breeding programme at the current level cannot meet the milk requirement of the State unless there is a further around increase in yield per animal. Even if the entire non-descript herd could be replaced by 1990 with improved cross-bred animals, production at the current levels of yield per animal will be substantially larger (6.4 lakh tonnes) but still short of requirement. However, if the cross-breeding programme could be accelerated and made more effective so as to upgrade the entire stock by 1985, the requirement for that year will not without improvement in yield, but there will still be shortage in 1990.

Table 17

Alternatives in Milk Production

	<u>1965</u>	<u>1975</u>	<u>1985</u>	<u>1990</u>
A. Number of milch animals	950	980	1010	1030
1. Milch cows	885	882	909	921
2. She buffaloes	95	98	101	109
B. (a) Alternative I				
1. Number of cows in milk (000)	469	467	481	491
2. Number of cross-bred cows (000)	Nil	127	250	320
3. Number of cross-bred cows in milk (000)	-	76	150	194
4. Number of non-descript cows (000)	885	755	659	601
5. Number of non-descript cows in milk (000)	469	400	349	321
(b) Production of milk at 1975 levels of yield (1000 t)				
1. Cross-bred (1.120t/year) per animal milk	-	81	157	195
2. Non-descript (0.520t/year) "	-	208	181	167
3. Sub-total	-	289	338	363
4. Production of buffalo milk	-	67	70	70
5. Total milk production	-	356	408	433
C. Alternative II				
(a)				
1. Number of cows in milk	-	467	494	510
2. Cross-breds in milk	-	67	363	510
3. Non-descript cows in milk	-	400	131	-
(b) Total milk production (000 t)				
1. Cross-bred cows (1.120 t/year per animal milk)	-	81	406	571
2. Non-descript (0.520 t/year per animal milk)	-	208	63	-
3. She-buffaloes	-	67	70	70
4. Total	-	356	540	641

45. It should be noted that this rate of acceleration in upgrading depends not only on achieving the target rate of insemination (4 lakh per annum) but a near doubling of the conception rate. Whether and under what conditions this is feasible will need to be carefully examined. It would seem that there are quite difficult organisational and extension problems, especially in the plains and the midlands where much of the cattle is located, to be overcome before significant increase in the coverage and efficiency of AI can be achieved. It would, therefore, be prudent to be cautious in projecting the rate at which cross-bred stock can be expanded. Also what we need is not so much an expansion of the scale of the AI programme, as much greater attention to the improvement of its efficiency. In any event, the programme for upgrading breeds is unlikely in the foreseeable future to bring about a reduction of the milch herd needed to meet the milk requirements.

46. Assuming that alternative II is closer to the limit of feasibility (as far as the expected number of cross-breds are concerned), it is clear that the projected requirement of milk cannot be met unless there is a substantial increase in the productivity per animal. One way of doing this would be to increase ratio of animals in milk to total milch animal stock. We do not know enough about the extent to which this can be done in the conditions (ecological and social) prevailing in Kerala. This aspect of the problem deserves much greater attention. In any case it should be noted that even in countries with a sophisticated dairying industry the proportion seldom exceed 70 per cent. Therefore it seems that the primary source of increasing yield will have to be on better feeding and management.

47. The future availability of feeds and fodder at least at the present level of its cost is an important condition that is necessary for realising the increases in production of the order visualised. The cost of milk production is higher in Kerala than ⁱⁿ any part of India mainly due to high cost of feed. At present about 60 per cent of the cost of milk production is accounted by concentrates which are the main source of digestible crude protein (DCP) in milk production.^{43/} As we had seen earlier, out of the total quantity of concentrates used for milk production in 1975-76 about 76 per cent

was imported from other States and the rest was produced in the State itself.^{44/} There are two aspects to this problem. Enhancing physical supplies of the required quantity and the cost of the feed. The main source of concentrate feed in Kerala are coconut cake, rubber-seed cake and rice bran. The average annual production of coconut oilcake in Kerala is about 50 thousand tonnes.^{45/} Out of this 15 per cent directly goes into milk production. The remaining quantity is marketed to other States and part of it is again imported to Kerala in the form of compounded feed. According to the estimates on rubber seed production, it is seen that about 37 thousand tonnes of cake can be obtained from this source.^{46/} This source remains completely untapped. The annual availability of rice bran is estimated to be around 75 thousand tonnes which is already fully utilised as a animal feed.

48. If all the available sources are fully tapped, the total supply of concentrate feeds from indigenous sources will be only 1.5 lakh tonnes, and even allowing for possible increases due to higher output of coconut and rice, the quantity may not exceed two lakh tonnes. This will be inadequate to meet the DCP requirements of growing youngstock dry animals and draught bullocks, which is estimated to be 2.25 lakh tonnes.^{47/} It is clear therefore that even if we fully utilise all the local resources currently available, there will be a large deficit in relation to the demand for concentrates for all categories of cattle and buffaloes.

49. During 1975-76, in order to produce 1 kg of cow milk 0.556 kg of concentrate feed was used in the State; the corresponding concentrate required for she-buffaloes was 0.919 kg.^{48/} If we assume that the composition of concentrate feed will not undergo any significant change in the coming decade, then the total demand for concentrate feeds to produce the expected level of milk output by 1985 will be 3.85 lakh tonnes and 4.75 lakh tonnes by 1990. The State at present imports at least 1.5 lakh tonnes of concentrates from other States and produces 10,000 tonnes of compounded feed.^{49/} The realisation of milk production target will then require a manifold increase in feed supplies either by import of concentrate feed from other States, or expansion of local production of compounded feed with raw materials imported from other States or accelerating the internal production of crops (like Berseem lined etc.) which are a source of protein. Whether or not imports on this scale is feasible and at reasonable cost is however difficult to judge, because the intensive cattle-development activities in other States will also generate larger demand.^{50/} If the overall

supply of concentrate feeds in the country as a whole does not meet all necessarily raise feed prices and this in turn would adversely affect the growing demand, the resulting shortage/affect the profitability of milk production and hence the incentives for expansion of output on the required scale.

59. In this context, the following aspects need to be examined carefully: (1) How does the cost of concentrate feed (per unit of DCP) in Kerala compare with the cost in other States? (2) Is it possible and, if so, by what means can the cost per unit of DCP be kept down to the minimum? (This would include search for alternative sources of DCP which are less bulky and can be converted more efficiently by the animal and (3) the possibilities of, and the impediments to, the expansion of new crops (like barsoor) with a large protein content within Kerala. The last mentioned aspect has received some attention in the State programme but has not shown any striking results. It is to be mentioned in this context that the diversion of more land for the production of fodder within the State, which is already faced with a severe land constraint, presents difficulties as the competition for land for producing human food is acute. Also, even if protein rich fodder could be increased, it is unlikely to benefit the very substantial number of small farmers and landless people who are involved in milk production. For then economic attraction of milk production will depend not only on the relative price of milk and feed but more importantly on their ability to secure the necessary feed supplies from the market at reasonable prices. An effective organisation for procurement and distribution of feed at reasonable prices is critical for their survival and growth. In this context a close link between, and integration of, milk co-operatives with feed production and distribution can play a major role.

VII

Conclusion

51. As part of the national strategy for augmenting milk production cross-breeding and upgrading of milch animals were taking place in Kerala during the last two decades. This programme was moving at a slow pace in the fifties and sixties; but in the seventies, it has attained more importance and there has been considerable effort to improve the coverage and efficiency of this programme. In this paper we made an attempt to examine the contribution of animal husbandry and dairy development programmes to the increase in milk production and to explore the future prospects for augmenting milk production in Kerala. The following are our main findings:

- (1) There was considerable increase in productivity of milch animals and total milk production in Kerala. The rise in milk production was partly by the increase in cross-bred population and largely by the increase in level of feed input of milch animals.
- (2) The rise in profitability of milk production has gone up over the years. This was due to (a) the expansion in the size of the market for milk created by the increase in population and per capita income and the shortage in production of other sources of animal protein especially fish and (b) the new cost reducing technology in milk production. This, along with the pressure created by lack of alternative employment, has stimulated the smaller size of rural households to take up dairying on an increasing scale as a source of subsidiary occupation.
- (3) Milk production in Kerala is mainly undertaken by small and marginal farmers and agricultural labourers. More than 40 per cent of the households own only one milch animal and about 35 per cent own 2 animals each and bulk of the total milk production and marketed surplus of milk is contributed by this class of producers. The ownership of milch animals is seen to be an important factor which determines milk consumption in rural areas. The consumption of milk is highly concentrated in the upper income groups. For 50 per cent of the households in Kerala milk is an important source of animal protein. All this underlines the

necessity to give a pronounced small-farmer focus to the State's Dairy Programme.

52. Keeping in mind the factors underlying the growth in milk production and the technical relationship between production and consumption of milk we tried to estimate the future prospects for milk production in Kerala. It is seen that the demand for milk will increase to 6 lakh tonnes by 1985 and 8 lakh tonnes by 1990. While intensive cross-breeding programme aimed at replacing the entire indigenous milch stock with improved breeds by 1990 and if possible earlier is desirable it is likely to encounter several difficulties and in any case cannot by itself increase output to the desired extent. The main bottleneck for increasing milk production in Kerala in the coming decade will be the shortage of feeds especially concentrates for which the State has to heavily depend on import. Massive production of compounded feed by using domestically available resources like dry matter and internally produced as well as imported concentrates as the main source of digestible crude protein will be helpful to reduce the degree of dependence on imported feed. Along with this attempts should be also made to undertake a fodder production programme especially as intercrop in gardenlands. All this, combined with a viable organisation which can mobilise the small rural producers for the efficient marketing and distribution of milk and ensure them the supply of feed inputs at economic prices will help a great deal in improving the employment and income of the weaker sections of the rural population in Kerala.

Appendix I

The size of the cross-bred milch animal stock is estimated by using the following method.

Let B the size of the cross-bred milch stock in the year t and n be the average life span of a cross-bred cow.

Then

$$B = \sum_{i=1}^n b_i \dots\dots\dots(1)$$

Where b_i = cross-bred population in the i th age group.

If M_{t-i} , is the number of cross-bred female calves born in the year $t-i$ and if r_i is the survival rate of cross-bred female cattle,

Then $b_i = (M_{t-i})r_i \dots\dots\dots(2)$

$\therefore B = \sum_{i=1}^n (M_{t-i})r_i \dots\dots\dots(3)$

Let I_{t-i} be the number of inseminations done in the year $t-i$ and c be the conception rate and the probability that a calf born in the year t_{i-1} will be a female is 0.5,

Then

$$M_{t-1} = (I_{t-i}) \frac{c}{2} \dots\dots\dots(4)$$

$\therefore B = \sum_{i=1}^n (I_{t-i}) \frac{c}{2} r_i \dots\dots\dots(5)$

If M_{t-i} is the number of cross-bred female calves born in the year $t-i$ and if b_i is the population that survives to the age t then the probability that a cross-bred female calf born in the age $t-i$ surviving to that t^{th} year will be $\frac{b_i}{M_{t-i}}$

$\therefore r_i = \sum_{i=1}^n \frac{b_i}{M_{t-i}} \dots\dots\dots(6)$

In order to use (5) to obtain the number of cross-bred animals in the t^{th} year, we have to get the values of I_{t-1} , e and r_1 .

The data pertaining to the number of inseminations from 1964-65 onwards is given in Table I below. The value of e is taken as 0.20. The survival rate of cross-bred female cattle in different age groups is not possible to estimate as we have no information on the age distribution of cross-bred population in the State. But the 30th round of the National Sample Survey gives age distribution of the entire female herd. The number of female calves born in different years can be estimated from the livestock census and using the same method we discussed to estimate the survival rate of cross-bred females, the survival rate of female cattle in the entire female herd is estimated. This estimated values of r_1 are given in Table 2. The estimated number of cross-bred cows in the State is obtained by using the values of r_1 and e in equation (5). We also assumed for this purpose that a cross-bred calf will enter the productive age in the 3rd year of life. So the estimates of cross-bred cow population in the year t , will be obtained from the insemination data up to the $t-2$ year.

Table 1

Total number of artificial inseminations done in Kerala

Year	Number of inseminations (000)	Number of female calves born
1964-65	154	15.4
1965-66	142	14.2
1966-67	153	15.3
1967-68	145	14.5
1968-69	154	15.4
1969-70	163	16.3
1970-71	235	23.5
1971-72	261	26.1
1972-73	289	28.9
1973-74	450	45.0
1974-75	420	42.0
1975-76	400	40.0

Source: Government of Kerala, Department of Animal Husbandry, Bulletin of Husbandry Statistics, the data is compiled from the different issues of this Bulletin.

Table 2

Survival rate of female cattle in different age

<u>Age</u> (in completed years)	<u>Probability of survival</u>
1	0.910
2	0.900
3	0.840
4	0.720
5	0.600
6	0.570
7	0.470
8	0.430
9	0.186
10	0.183
11	0.040
12	0.090
13	0.035
14	0.015
15	0.034
16	0.010
17	0.005
18	0.009

Source: Single age distribution data is obtained from the State tabulation of the 30th round of the NSS.

NOTES AND REFERENCES

1. Out of the 3 million bovines reported in the 1972 livestock Census 2.9 million are cattle and the rest are buffaloes. An idea of the differences in the level of productivity of milch animals in Kerala compared with few other regions in India are given below:

State	Year	Proportion of animals in milk		Average daily milk yield per animal in milk (kg)	
		Cows	She buffaloes	Cows	She buffaloes
Andhra Pradesh	1966-67	35	52	0.79	1.40
Bihar	1965-66	43	51	1.23	3.14
Gujarat	1963-64	46	61	1.67	3.03
Kerala	1964-65	45	59	1.11	2.01
Madhya Pradesh	1966-67	35	40	0.51	1.77
Tamil Nadu	1965-66	43	53	1.22	1.96
Maharashtra	1965-66	32	53	0.61	2.26
Karnataka	1965-66	46	51	0.72	1.32
Orissa	1960-61	42	na	0.50	na
Punjab	1966-67	54	62	2.28	3.99
Rajasthan	1962-63	34	52	2.12	2.02
Eastern U.P	1962-63	33	46	0.62	1.31

Source: Daroga Singh, et.al. Monograph on Estimation of Milk Production Institute of Agricultural Research Statistics (ICAR), New Delhi (undated). Average milk yield relates to yield per animal in milk.

2. Around 0.5 per cent of the net sown area is under permanent pastures and grazing land and 35 per cent of the total cropped area is under-paddy. The effect of population growth ecology and cropping pattern on livestock holdings in Kerala are discussed in a forthcoming paper.
3. See for instance, Ward and Corner, Geographical and Statistical Memoir of the Survey of Travancore and Cochin States, 1816-1820, Surveyor General's Office, Madras, December 1827, Travancore Circar Press, 1863.
4. Reviewing the cattle wealth of Travancore and the attempts to improve it, the Travancore State Manual States:
The improvement of cattle is a vital problem in Travancore. Agricultural prosperity depends to a great extent on the betterment and efficiency of cattle. The cattle problem turns around a vicious circle of want of good feed and good breed. Even at the time of the survey of Ward and Corner, the cattle were small in stature. The climatic conditions are unfavourable for the rearing of good cattle. The heavy rainfall and the comparative poverty and insufficiency of pasture lands are particularly unsuited to the breeding of good cattle. Though the country gets both the monsoons and there is an abundance of pasture during the sowing season, the fact that the rains are not spread throughout the year creates a dry season, when it is not possible to raise any kind of pasture. During the rainy season the rains pour so heavily and continuously

that it is not possible for the cattle to graze in the open and feeding is a difficult problem in dry and wet seasons. The stock is also very poor. The degeneration of the domestic cattle is due to promiscuous mating and improper and insufficient feeding. The agricultural department therefore experimented with bulls from adjoining British Indian States. Ongole, the Kangayan and Anral Nohals are among the first batch of foreign breeds to be tried. The results were not satisfactory. Bulls from the upper India breeds like the Sindhi as well as English breeds were then imported and tested. The Sindhi breed was found to adapt itself to local conditions. Efforts were therefore made to popularise the Sindhi cattle. Herds of selected bulls and cows were imported from the State and maintained at the Government farms. Calves born to them were weaned and were sold generally in pairs to individuals and institutions interested in cattle breeding. Complete extermination of the whole stock of local cattle was not possible. It was therefore thought that more extensive results could be obtained quickly and cheaply though less perfectly by grading up the local cows with bulls of superior strains. See, T.K.Velu Pillai, Travancore State Manual Part III, Economic Conditions, Chapter 4, Agriculture.

5. At the end of the first plan there were only one veterinary hospital and 9 dispensaries in the State.
6. Government of Kerala Planning and Development Department, Third Five Year Plan, Draft Outline, 1960, pp.112.
7. Formulation of five year plan (1973-83), Background Paper, Livestock Development, Agriculture division, State Planning Board Trivandrum, 1977 (mimeo)
8. The Key Village Scheme introduced during the First Five Year Plan was intended to the multiplication of superior germplasm from the established farms in selected breeding tracts by providing simultaneous attention to better feeding, improved breeding and effective disease control, scientific management practices and organised marketing facilities. However, since even after one and half decades of operation it failed to create any notable impact, a new scheme called intensive cattle development project (ICDP) was launched towards the end of the Third Plan. This was designed to improve the genetic potential of cows by artificial insemination in tracts which forms the milkshed areas of large dairy plants with a view to enable the dairy plants to collect and process the milk upto the installed capacities. For a detail discussion of the achievements and shortcomings of these schemes see Government of India, Ministry of Agriculture and Irrigation, Report of the National Commission on Agriculture (1976), Part VII, Animal Husbandry.
9. The Indo-Swiss Project, part of the Animal Husbandry and Dairy Development Department were combined and a new organisation called the Kerala State Livestock Development and Milk Marketing Board was formed in 1976. This organisation is currently responsible for the overall dairy development and milk marketing in Kerala.

10. One of the important breakthrough in animal production technology was the successful attempt in the western countries in deep freezing bovine semen using liquid nitrogen as the safe refrigerent. This made it possible large scale field application of artificial insemination in cattle breeding. Organised field application of frozen semen was introduced in India under the Indo-Swiss Project (Kerala) in 1965. It is this technological breakthrough which gave a significant push to the cross-breeding programme in India.
11. Under the self-employment programme this inseminators are entrusted to charge five rupees per insemination as their fee. The necessary equipments and semen for insemination are provided by the department of dairy development and other related agencies.
12. Currently there are three bull stations and three semen banks functioning in the State.
13. According to the data furnished by the department of dairy development, about 150 dairy cooperatives were supplying an average 200 litres of milk per day to the chilling plants. The remaining societies were practically inactive and were supplying only 50 litres per day.
14. Data relates to December 1977. These plants all taken together are currently operating 40 per cent below their installed capacity.
15. Government of Kerala, Department of Animal Husbandry, Bulletin of Animal Husbandry Statistics, July-December, 1976.
16. The average daily milk yield of Brown-Swiss cross-bred, non-descript and graded milch cows in the three extension centres of the project surveyed for the evaluation study, are given below:

Area/Group	Daily milk yield per cow in milk			Daily milk yield per milchcow			Cost of milk prodn. (Rs./kg.)		
	BS	ND	GC	BS	ND	GC	BS	ND	GC
Plains	5.17	1.99	4.07	3.70	1.21	2.68	1.26	2.33	1.54
Selter farmers	4.15	1.82	3.98	3.10	0.92	2.49	0.68	0.98	0.81
Tea labourers	3.38	1.91	2.52	2.29	0.93	1.62	0.39	0.29	0.40

BS: Brown-Swiss; ND: Non-descript; GC: Graded cows.

Source: R.K.Patel, et.al. Economics of Cross-bred cattle - A Study of The Cattle Breeding Programs of Indo-Swiss Project, Kerala, National Dairy Research Institute, Karnal, Indo-Swiss Project, Kerala 1976.

17. Institute of Agricultural Research Statistics (ICAR) Estimation of Milk Production and other bovine and goat practices in Kerala (1964-65), New Delhi, (Minco) undated.
18. Government of India, Department of Statistics, National Sample Survey, Report No.281/3, 30 round (July 1975-June 1976), Some Estimates of the Production of Livestock Products and related characteristics, Kerala, March 1978, New Delhi.

19. Considerable variation in the yield levels of cows and she buffaloes are observed between rural and urban as well as the Northern and Southern regions of the State. A Study of the Factors responsible for this variation will be taken up in a separate paper.
20. The increase in milch animal population between 1966-1972 according to the Livestock Census data was 7.5 per cent. The rate of increase in the estimated milch animal population between 1965 and 1975 by the NSS and IARS surveys was only 4.5 per cent. While the milch animal population estimated from the IARS and Surveys includes only dry and animals in milk, the population reported in the livestock Census includes, other categories such as heifers.
21. The population of milch animals in 1975-76, based on the growth rate in the last decade is about 14.7 lakhs. The population of milch animals reported by the 1966 Census is about 13.5 lakhs; the rate of increase between 1966 and 1976 being about 9 per cent. The estimated milk production in 1966 and 1976 by applying the IARS and NSS yield rates respectively are given below:

Year	No. of milch animals (lakh)	Total milk prod (000 t)
1966	13.5 ^{1/2}	267
1976	14.7 ^{2/2}	477
Percentage change 1966/72	8.3	790

Source: 1. Livestock Census, 1966
2. Estimated

22. The average per capita expenditure on milk and milk products were supplied separately for the 25th and 26th rounds of the NSS from the state sample estimates. The average rural and urban price of milk were also obtained from the State Sample Data for different rounds.
23. See, Government of Kerala, Department of Animal Husbandry, Bulletin of Animal Husbandry Statistics, Data on the number of artificial insemination are available from 1954-65 in this half yearly publication.
24. A fee of five rupees per insemination is charged from 1972-73.
25. We had analysed the data pertaining to the number of inseminations done in 1975 and the number of calves born in 1976 from 12 artificial insemination centres in the State located in the four districts. The conception rate is seen to vary between 15 to 27 per cent. In two of the insemination centres, in the high range the conception rate was near to 27 per cent.
26. Op.cit. Economics of Cross-bred cattle.
27. The data is obtained from the State tabulation of the 30th round of the National Sample Survey.

28. One of this surveys is the evaluation study of the Indo-Swiss Project. The second one is a pilot survey conducted in different parts of the State by the National Dairy Development Board. See for details (a) Economics of Cross-bred cattle op.cit. (b) Dairy Development Projects for the districts of Trivandrum, Quilon, and Alleppey, Kerala, National Dairy Development Board, Anand 1976.
29. See K.N.Hair and A.Vaidyanathan, Inter-State differences in Milk Consumption in India, A Preliminary Analysis, Working Paper No.62, Centre for Development Studies, Trivandrum.
30. The estimates of per capita income in Kerala suffers from two major difficulties: (a) it does not take into account the remittances of money from outside the State; (b) the export price of the commodities was moving at a faster rate than the general price level in the last one and a half decade and so the actual export income obtained may be much higher than what has accounted in the State income estimates. These in turn will lead to under-estimation of the per capita income and thus the estimated of growth in demand for milk and fish will be lower than the actual rate of growth.
31. The per capita demand for milk and other items are estimated using the following method $P_t = P_o (1 + \frac{I_t - I_o}{I_o})^b$ where p_t per capita demand in the t^{th} year, P_o : base year consumption, I_o : base year per capita income, and b : expenditure elasticity of demand. The expenditure elasticity of fish, meat and egg are obtained from the 17th round of the HSS and that of milk is estimated from 16 to 20th rounds. The estimated expenditure elasticity of demand for milk is 1.6, that of fish is 1.3 and that of meat and egg is 2.2.
32. For a detailed discussion of the trend in supply and consumption of fish and the functioning of the fish economy of Kerala, see John Kurion: Towards an Understanding of the Fish Economy of Kerala: A preliminary study of the Current Situation and Trends in Organisation of Technology Production and Distribution of Income, Working Paper No.66, Centre for Development Studies Trivandrum.
33. Ibid
34. Op.cit. Economics of cross-bred cattle.
35. For a detailed discussion of the size and utilisation of draught animals and the factors responsible for the substitution of draught animals by milch animals, see K.N.Hair, Size and Utilization of Draught Animals in Kerala, Indian Journal of Agricultural Economics, No.4, October-December 1977.
36. The Overall breeding efficiency (defined as the percentage of cows in milk to total milch stock used for breeding and milk production) of cows in Kerala increased from 45 per cent in 1965 to 55 per cent in 1975.

37. Out of the total concentrate feed used in milk production in 1975-76, about 30 per cent was in the form of compounded feed. The break of the composition of the concentrate feed in milk production are given below:

Source of concentrate feed	Quantity used (000 t)	As % of total
1. Compounded feed	62.00	29.5
2. Oilcake	43.00	22.8
3. Coconut Oilcake	8.00	3.9
4. Rice bran, husk and other items	39.00	20.5
t. Total	210.00	100.00

Source: National Sample Survey, 50th round (1975-76).
The data is obtained from the State tabulation.

38. There is evidence which suggests a decline in birth rate in Kerala during the last decade. See for Details, T.N.Krishna Demographic Transition in Kerala, EPI, Annual Number 1976.
39. Op.cit. 30.
40. Op.cit. 31
41. The annual growth rate in the population of milch animals as estimated from the Livestock census data is about 0.4 per cent.
42. There were no attempts so far to improve the genetic characteristics of the buffaloes in India.
43. Op.cit. Economics of Cross-bred cattle.
44. Op.cit. 37
45. Government of Kerala, report of the Committee on Commodity Taxation, May 1966, p.19.
46. The estimate of rubber seed cake is taken from the Report of the Working Group on Feeds and Fodder, appointed by the work-force on Livestock Development, State Planning Board, Trivandrum.
47. The estimate of concentrate requirements for the bovinstock (other than animals in milk) are obtained by standardising the youngstock into adult units and then assuming that the quantity of DCP required for the growing youngstock and dry animals will be 150 grams per day and that of work animals will be 200 gram per day (assuming 90 working days in a year).
48. Op.cit. NSS Draft Report 301/3.
49. The import estimate of 1.5 lakh tonnes is based on the total consumption of concentrate in milk production (1975-76) as obtained from the NSS data.
50. The second phase of the operation flood which is the largest effort to be made in the country for increasing milk production is launched in 1st July 1976 by the Govt. of India. This scheme covers all the States in the country and involves an investment of the order of 500 crores. The scheme is expected to benefit 10 million rural households to augment their milk production.

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