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SIZE AND UTILIZATION OF DRAUGHT ANIMALS IN KERALA*

Recent studies on the size, age and sex composition of bovine population in India show that the Kerala pattern in all respects is remarkably different from the rest of India.[1] Given the general indices of the bovine density, one would expect Kerala which is the most densely populated State in the country to have a relatively high bovine density. But in fact the bovine density of Kerala is the lowest in the country. Moreover, the bovine population in Kerala has been growing at a much slower rate than in the rest of the country in the past decade; the adult male bovine population, which is mostly used for draught purposes has in fact been steadily declining.[2]

This paper attempts to explain some of the factors responsible for the exceptionally small number of draught animals per hectare of cropped area in Kerala and for its decline over time. Section I describes the salient features of the present pattern of draught animal utilization in Kerala and section II discusses some of the factors governing the demand and supply of draught animals which seem to be peculiar in Kerala. Some concluding remarks are presented in section III.

I

PATTERN OF HOLDING AND UTILIZATION OF DRAUGHT ANIMALS

On an average, Kerala has 0.20 draught animal per hectare of cropped area compared to 0.58 per hectare for all-India (Table I). Within the State there are considerable variations between districts. Alleppey has 7

TABLE I—PERCENTAGE CHANGE IN BOVINE POPULATION (1961-72) AND ITS DENSITY PER HECTARE OF CROPPED AREA IN KERALA AND ALL-INDIA

	Human density per hectare of cropped area (number of persons)	Bovine density per hectare of cropped area (1972)			Percentage change in bovine population		
		Adult male	Adult female	Total	Adult male	Adult female	Total
Kerala	5.92	0.20	0.48	1.10	—41.50	12.72	2.80
India	3.91	0.58	0.61	1.61	2.72	5.55	4.00

Source: Rural population, Census of India, 1971; Bovine population, Livestock Census, 1972; Cropped area: three-year average for 1970-71, 1971-72 and 1972-73.

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1. A. Vaidyanathan, "Aspects of India's Bovine Economy: Some Preliminary Results," Working Paper No. 51, Centre for Development Studies, 1977; Marvin Harris, "Determinants of Bovine Sex and Age Species Ratios in Kerala and All India," Centre for Development Studies, Trivandrum (unpublished).

2. Since the practice of using adult female bovines for land preparation is not prevalent in Kerala unlike in other parts of India, the draught animal population here comprises only adult bovine male used for work.

draught animals per 100 hectares of cropped area while Palghat has nearly 60. There is apparently no systemtic relation between the number of draught animals per hectare of cropped area with human density across the districts.

The distribution of draught animals across land holding classes in Kerala is given in Table II. The data show a positive relation between the size of land holding and the number of draught animals per holding as well as between the size of holding and the proportion of households owning draught animals in Kerala as in the rest of the country. But there is no systematic relation between the density of human population and the density of draught animals across land holding classes.

TABLE II—PATTERN OF HOLDING OF DRAUGHT ANIMALS IN KERALA

Size of holding (acres)	Density of human population (number of persons per acre)	Number of draught animals		Percentage of rural households owning draught animals
		Per rural household	Per acre	
Less than 0.49	68.6	0.02	0.13	0.5
0.50-0.99	21.6	0.18	0.26	1.9
1.00-2.49	12.7	0.56	0.05	9.9
2.50-4.99	8.9	0.20	0.12	13.2
5.0-7.49	4.5	0.70	0.20	11.5
7.50-9.99	2.8	1.29	0.22	35.2
10.0 and above	1.9	1.58	0.20	53.4
All sizes	5.6	0.19	0.17	8.8

Source: Government of India: National Sample Survey: Number 215—Twentysixth Round—July, 1971-September, 1972, Tables on Land Holdings, State: Kerala, National Sample Survey Organisation, Department of Statistics, Ministry of Planning, New Delhi, July, 1975.

The relationship between the size of land holding and the pattern of holding of draught animals obtained from the Farm Management Survey is somewhat different from the above results.[3] While the number of draught animals per holding and the proportion of households owning draught animals shows the same relationship as obtained from the National Sample Survey (NSS) data with the size of land holding, the number of draught animals per acre is found to decline with a rise in farm size. The difference is explained in part by the fact that the Farm Management Survey relates only to districts where the crop pattern is distinctly different from the State average.

3. The farm management surveys were conducted in Quilon and Alleppey districts during 1962-63, 1963-64 and 1964-65.

Data pertaining to the utilization of draught animals are available from the Farm Management Survey. On an average, in the farms surveyed the draught animals are employed for 69 days in a year (Table III). In other words, the draught animals are employed for 81 per cent of the days in a year. The degree of unemployment of draught animals is higher in the smaller size-group of farms.

TABLE III—EMPLOYMENT OF DRAUGHT ANIMALS BY SIZE-GROUPS OF FARMS

Size-group (acres)	Employment of draught animals								Total days unemployed	Percentage of annual unemployment
	In crop production	Percentage	Other than crop production	Percentage	Exchange or gift	Percentage	Hired out	Percentage		
0-1·0	13.3	27.6	—	—	—	—	46.1	72.6	49.4	81.4
1.0-2.5	23.9	48.2	—	—	—	—	19.7	39.7	49.6	86.4
2.5-5.0	37.7	52.3	5.4	7.6	6.0	12.1	25.9	36.4	71.2	80.4
5.0-10.0	50.4	59.5	23.4	26.7	2.2	3.1	8.1	9.2	87.9	75.9
10 and above	68.6	78.0	3.2	4.0	5.8	7.6	2.9	3.6	81.4	77.6
All sizes	43.5	63.0	7.6	11.0	4.0	5.8	20.1	20.1	69.0	81.0

Note:—The normal working day for draught animals in the regions surveyed is four hours.
Source: Government of India: Economics of Farm Management, Kerala, 1962-63, Directorate of Economics and Statistics, Ministry of Food and Agriculture, New Delhi.

Out of the total number of days employed, the draught animals are used in crop production for 63 per cent of the days and hired out accounted for another 20 per cent. The number of days employed in crop production is found to be higher in the smaller size-groups. An important difference in the employment pattern of draught animals between Kerala and other States is the very high proportion of bullock days hired out in all size-groups of farms (Table IV). This proportion is found to be higher in Kerala than in all other regions for which farm management data are available.[4] This in turn indicates the existence of a well developed bullock rental market in the rural economy of Kerala.

Since draught animals are mainly used in crop production high seasonality in their use may be expected. While data pertaining to the seasonal patterns

4. Unlike in other parts of India, the number of bullock days given in exchange or gift is little in Kerala.

TABLE IV—PERCENTAGE OF DRAUGHT ANIMAL DAYS HIRED OUT AND DEGREE OF UNEMPLOYMENT OF DRAUGHT ANIMALS PER ANNUM IN A FEW SELECTED DISTRICTS IN INDIA

District	Number of days unemployed	Degree of annual unemployment	Percentage of bullock days hired out to total number of days employed	Ratio of bullock to human labour
Pali	284	77	6.8	0.44
Hooghly and 24 Parganas	307	85	15.3	0.25
Sambalpur	260	71	2.9	0.55
Cuttack	246	67	12.9	0.28
Salem and Coimbatore ..	246	67	12.6	0.18
West Godavari	252	69	7.9	0.21
Ahmednagar	197	54	2.3	0.32
Muzaffarnagar	268	73	3.4	0.23
Quilon and Alleppey ..	296	81	20.1	0.14

Source: Studies in the Economics of Farm Management: (1) Pali District, Rajasthan (1963-64); (2) Hooghly and 24 Parganas, West Bengal (1956-57); (3) Sambalpur District, Orissa (1963-64); (4) Cuttack District, Orissa (1967-68); (5) West Godavari, Andhra Pradesh, 1967-68; (6) Ahmednagar, Bombay (1955-56); (7) Muzaffarnagar, Uttar Pradesh (1967-68); (8) Quilon and Alleppey District, Kerala (1963-64); Directorate of Economics and Statistics, Ministry of Agriculture, Government of India, New Delhi.

do show variations in the degree of utilization (Table V), it is significant to note that even in the months of July-August and November-December which are the peak sowing seasons in the regions surveyed, there is high degree of unemployment of draught animals which implies the existence of surplus draught animals in the State.

TABLE V—SEASONAL UNEMPLOYMENT OF DRAUGHT ANIMALS IN KERALA (1962-63)

Month	April	May	June	July	August	September	October	November	December	January	February	March
Degree of unemployment ..	72.7	93.4	92.3	74.1	60.1	83.4	94.4	78.6	77.5	91.2	89.6	74.5

Source: Economics of Farm Management, Kerala, 1962-63, *op. cit.*

Kerala also presents a sharp contrast with the rest of the country in terms of the trend in the size and composition of bovine stock within the last decade or more. Particularly striking is the decline in the total adult male bovine population by 40 per cent compared to a slight increase in the rest of India. The number of draught animals per holding and per acre and the proportion of draught animals in the total bovine population in all size-groups of farms have declined in the State within the last one decade (Table VI).

TABLE VI—TREND IN DRAUGHT ANIMAL POPULATION (1961-62 TO 1971-72)

Size of holding (acres)	Number of draught animals per acre		Number of draught animals per holding		Draught animals as percentage of total bovine population	
	1961-62	1971-72	1961-62	1971-72	1961-62	1971-72
Less than 0.49	0.21	0.12	0.04	0.02	12.9	6.0
0.50-0.99	0.43	0.26	0.23	0.16	26.1	18.0
1.00-2.49	0.08	0.05	0.27	1.20	19.0	15.0
2.50-4.99	0.16	0.12	0.88	0.26	35.0	32.0
5.00-7.49	0.25	0.20	1.18	1.36	61.0	42.0
7.50-9.99	0.28	0.22	1.55	1.53	44.0	41.0
10.0 and above	0.28	0.20	2.86	2.18	71.0	40.0
All sizes	0.22	0.17	0.29	0.13	32.5	15.0

Source: (1) Government of India: National Sample Survey—Twentysixth Round: Tables on Land Holdings, State: Kerala, *op. cit.*

(2) Government of Kerala: National Sample Survey Report No. 10—Report on the Operational Holdings in Kerala, Rural, 16th Round (1960-61), Bureau of Economics and Statistics, Trivandrum.

II

DEMAND AND SUPPLY OF DRAUGHT ANIMALS

The causes leading to very low density of draught animals and the sharp decline in draught animal population during the past one decade seem to be due in large part to a number of special factors which depress the demand for draught animals. These factors include cropping pattern, increasing cost of maintenance of draught animals and the technology of paddy cultivation. These seem to be reinforced by the relatively greater preference for milch animals.

Cropping Pattern

Unlike in the rest of India, Kerala's cropping pattern is dominated by perennial crops (including plantations and tree crops) and crops like tapioca which require little animal power.[5] Draught animals in Kerala are mainly

5. The striking difference in the cropping pattern between Kerala and all-India is evident from the following table. Since the crop production in Kerala is dominated by smaller size of farms, the very low proportion of area under foodgrains in these size-groups of holdings will result in the lower density of draught animals per hectare of cropped area.

PERCENTAGE OF AREA UNDER FOODGRAINS AND NON-FOODGRAINS IN HOLDINGS OF DIFFERENT SIZES (ALL-INDIA AND KERALA, 1971-72)

Size of operational holding (hectares)	All-India			Kerala		
	Foodgrains	Non-food-grains	Total	Foodgrains	Non-food-grains	Total
0-0.5	82.8	17.2	100.0	15.8	74.8	100.0
0.5-1.0	83.2	16.8	100.0	36.8	65.2	100.0
1.0-2.0	81.5	18.5	100.0	43.3	56.7	100.0
2.0-3.0	80.0	20.0	100.0	46.2	55.8	100.0
3.0 and above	75.6	24.4	100.0	47.7	52.3	100.0
All holdings	76.8	23.2	100.0	34.9	65.1	100.0

Source: I. J. Naidu: All-India Report on Agricultural Census, 1970-71, Ministry of Agriculture and Irrigation (Department of Agriculture), Government of India, New Delhi, 1975.

used for the cultivation of paddy which accounts for only 36 per cent of the total cropped area.[6] The number of draught animals per holding and per acre and the percentage of households owning draught animals across districts in the State are found to increase with a rise in the percentage of area under paddy (Table VII). The same relation is found to be true with the average size of wet land holdings. Thus it seems that the low density of draught animals and the smaller proportion of households owning draught animals in Kerala are due to the small portion of area under paddy and the low average size of wet land holdings.

TABLE VII—PERCENTAGE OF AREA UNDER PADDY AND OF HOUSEHOLDS OWNING DRAUGHT ANIMALS, AVERAGE SIZE OF PADDY LAND HOLDING AND NUMBER OF DRAUGHT ANIMALS IN DIFFERENT DISTRICTS OF KERALA

District	Human density per hectare of cropped area	Percentage of area under rice	Average size of holding under rice (hectares)	Number of draught animals		Proportion of households owning draught animals
				Per holding	Per hectare	
Palghat	6.2	76.2	1.20	0.82	0.61	34.2
Malappuram	5.9	53.2	0.36	0.68	0.52	28.4
Trichur	8.6	46.8	0.32	0.61	0.38	18.5
Ernakulam	8.4	42.8	0.28	0.56	0.36	17.2
Cannanore	6.2	35.0	0.18	0.41	0.24	12.6
Calicut	7.6	29.6	0.18	0.38	0.22	11.2
Idikki	4.8	18.5	0.16	0.28	0.16	10.4
Alleppey	9.1	39.0	0.16	0.18	0.07	3.8
Kottayam	5.6	18.4	0.11	0.19	0.11	5.4
Quilon	6.7	18.2	0.09	0.22	0.18	5.2
Trivandrum	5.6	16.0	0.09	0.11	0.12	4.8

Source: Government of Kerala: Decennial Census of World Agriculture, Kerala (1970-71), Bureau of Economics and Statistics, Trivandrum.

During the past decade the draught animal population in all the districts declined sharply. The rate of decline in draught animal population was at a faster rate in the southern districts of Kottayam, Quilon, Alleppey and Trivandrum than in the other districts. But since the area under paddy increased in all the districts, the decline in draught animals cannot be due to the reduction in aggregate demand for draught power.[7]

One possible explanation for the decline in draught animal population within districts would be due to the reduction in the average size of wet land

6. This figure is computed from the Kerala Economic Review, 1976.
7. During the past decade the area under paddy in Kerala increased at a rate of 0.9 per cent per annum.

holdings. In the absence of comparable districtwise data on wet land holdings, it is not possible to bring out the extent to which distribution of wet land holdings in the past decade might have led to a reduction in wet land holdings. But it is possible to get some rough idea of these changes at the State level from the data on the distribution of total holdings by size classes between 1967 and 1975. These data which are available from two separate sources are not strictly comparable. Subject to these limitations, the data (Table VIII) show a 30 per cent increase in the total number of wet land holdings and a more than 20 per cent decline in the average size of holding. All the increase in the number of holdings has occurred in the size category below 2 acres. The number of holdings above 2 acres has in fact declined. This proliferation of very small holdings on which the cost of maintaining draught animal is relatively high and on which the return to rearing milch animal may be much more attractive, may have lead to the substitution of the draught animal by the milch animal.

TABLE VIII—PERCENTAGE DISTRIBUTION OF WET LAND HOLDINGS IN KERALA

Size-group (acres)	1967-68					1975-76				
	Number of holdings	Percentage	Area (acres)	Percentage	Average size of holding	Number of holdings	Percentage	Area (acres)	Percentage	Average size of holding
Less than 2.0 ..	5,23,431	89.0	4,18,278	61.2	0.80	7,24,335	93.74	5,44,033	77.6	0.75
2.0-5.0	52,772	8.9	1,62,297	23.8	3.07	43,953	5.69	1,27,172	18.1	2.89
5.0-10.0	10,270	1.7	69,013	10.1	6.72	4,120	0.53	26,345	3.8	6.39
10 and above ..	2,375	0.4	33,274	4.9	14.00	287	0.04	3,562	0.5	12.41
All sizes	5,88,848	100.0	6,82,862	100.0	1.16	7,72,695	100.00	7,01,112	100.0	0.91

Sources: (1) Government of Kerala: Survey of Land Holdings in Kerala (1967-68), Bureau of Economics and Statistics, Trivandrum.
(2) Revenue Division, Civil Supplies Department, Government of Kerala, Trivandrum.

Cost of Maintenance

The rise in human population density in the State over the years has resulted in the expansion of area under cultivation for growing crops for human consumption thereby reducing the availability of permanent pastures and grazing land.[8] In this situation, the rearing of livestock has to be met mostly from roughages and concentrates either from own farms or by purchase leading to an increase in the cost of livestock rearing. The main source of roughage in Kerala is from paddy straw and most of the concentrates for animal consumption are imported from outside. Any rise in the density of bovine population in this situation would require an increase in demand for paddy

8. At present around one per cent of the total geographical area is under permanent pastures and grazing land.

straw and import of concentrates from outside. The increase in supply of paddy straw is hindered (*a*) by slow rate of growth of area under paddy and (*b*) by the expansion of area under high-yielding variety (HVY) of paddy whose yield of straw is less than that of other traditional varieties.[9] The estimate of the rate of growth in output of paddy straw taking into account the effect of HYV is only 0.2 per cent per annum.[10] During this period (1956-72) the bovine population increased at a rate of 0.7 per cent per annum. This in turn might have aggravated the scarcity of feed and resulted in the rationalisation of the livestock economy by eliminating the surplus draught animals so as to maximize the output from available feed resources.

The elimination of draught animals might have taken place at a faster rate in the smaller size of holding. This is because of the (1) high cost of maintenance of draught animals in this size-group of farms caused by the larger dependence on purchased feed and (2) the smaller operational area leading to limited utilization of draught animals for own cultivation. The reason for the smaller proportion of households owning draught animals in the smaller size of holding and its higher level of hiring out is due to the high cost of draught power in this size-group of holdings.

Because of the higher cost of maintenance, ownership of draught animals is more uneconomical to the smaller farmers (Table IX). Information regarding the economy of draught animals of the weaker sections of the rural population is available from the 25th Round of the National Sample Survey. Rural households owning one pair or more of draught animals reported that the holding of these animals was uneconomical and that they were making it economical by hiring out. Sixty per cent of the households owning one draught animal reported its holding uneconomical. The remaining 37.5 per cent of this group were desirous of buying one more draught animal if credit facilities were available. Out of the households owning no draught animals, 66 per cent reported hiring of draught animals more economical than owning. Six per cent of the households in this group were however

9. The straw-grain ratio for traditional and high-yielding variety of paddy in Kerala is given below:

Plant type	Variety group	Straw-grain ratio		
		Virippu	*Mundakan*	*Punja*
Dwarf (HYV)	Medium duration	0.46	0.47	—
	Early duration	0.54	0.67	0.90
Tall (local)	Medium duration	1.07	1.36	—
	Early duration	1.28	—	1.24

e.g., Medium duration (HYV): Jaya, IR8, Bhavathi, Aswathi; Early duration: Annapurna, Jyothi, Triveni, Rohini, Supriya; Medium duration (Tall): Ptb. 1,2,9,26 (First crop); Early duration: Ptb. 10.

Source: Rice Research Station, Patambi, Kerala.

10. The output of paddy straw is estimated by using the following formula: $Q = Pr$, where Q = quantity of paddy straw produced; P = quantity of paddy produced; r = straw-grain ratio.

TABLE IX—COMPOSITION OF FEED AND COST OF MAINTENANCE PER DRAUGHT ANIMAL IN DIFFERENT SIZE-GROUPS OF FARMS (1962-63)

(*Rs.*)

Size-group (acres)	Value of fodder consumed	Value of concentrates consumed	Value of items other than feed	Total cost of maintenance per annum	Maintenance cost per working day	Average annual maintenance cost per day	Percentage of purchased feed consumed
0-1.0	106.45	72.94	89.72	269.15	3.51	0.64	68.6
1.0-2.5	116.88	26.04	103.08	246.00	2.28	0.58	56.2
2.5-5.0	96.59	51.86	55.54	243.69	2.41	0.53	48.4
5.0-10.0.. ..	113.63	56.56	47.23	217.15	2.91	0.44	46.3
10.0 and above ..	102.29	86.79	12.05	201.13	3.41	0.42	32.7
All sizes	102.38	53.28	71.51	227.10	2.68	0.51	39.1

Source: Government of India: Economics of Farm Management, Kerala, (1962-63), *op.cit.*

willing to buy them if credit facilities were available. About 21 per cent of the households reported both hiring and owning draught animals uneconomical. Thus it seems that the development of bullock rental market and the owning of draught animals by a very small proportion of households in Kerala are due to the high cost of maintenance of these animals, thereby making it uneconomical to keep them on small farms.

Technology of Paddy Cultivation

(*a*) *Degree of agricultural mechanization:* Preparation of land for paddy cultivation can be done by draught animals and mechanical power and in some conditions, even by human labour. There are two types of mechanical equipments: those which reduce the demand for draught power and others which accentuate it. Tractors, for example, belong to the first category. Oil engines and electric pumpsets, on the other hand, may lead to either an increase or a decrease in the use of bullock labour. In areas where the bullocks are used for irrigation, an increase in the number of oil engines and electric pumpsets would lead to a displacement of bullock labour while irrigation equipment is likely to lead to more intensive cropping policies and thus to increasing demand for bullock labour.

The number of tractors and power tillers in Kerala by 1972 was 2,154.[11] Out of this, 40 per cent was owned by the Government agencies like panchayats and co-operative societies which hired them out to farmers. The distribution of tractors across land holding classes shows that the farms below 5 hectares own 50 per cent of the tractors in the State. The holding of tractors

11. Livestock Census, 1972.

in the relatively small size of farms may be due to (1) the existence of rental market for tractors (especially in transportation), and (2) to the fact that even though the ownership holding is small in this group, the operational holding may be much higher than the ownership holding. The reason for the purchase of tractors by the large farmers is due to the substantial savings rendered possible by tractor ploughing as compared to traditional ploughing. Another reason may be the provision of cheap credit to the farmers by the State owned Agro-industries Corporation.

The number of tractors per 100 rural households in Kerala is around 0.02.[12] The average area operated by tractors is 9.85 hectares.[13] If we take this figure of average area operated by a tractor or power tiller, the total area operated by these machines would work out to nearly 27 thousand hectares or 3 per cent of the area under paddy. This, in turn, indicates that the effect of tractors on bullock labour displacement is only negligible.

In 1961 the number of oil engines and electric pumpsets in Kerala was 2.3 thousand and it increased to 28.6 thousand by 1972.[14] In terms of horse power the availability of these equipments increased from 0.04 HP in 1961 to 0.15 HP in 1972. Since draught animals are not used in irrigation, the increase in the number of pumpsets and oil engines and its horse power availability, in so far as they increased the intensity of cultivation, must have actually generated additional demand for draught power.

(*b*) *Substitution of human labour for animal power:* There is evidence to suggest that paddy cultivation in Kerala uses on an average more human labour than animal power; according to Farm Management Surveys conducted in early 'sixties the ratio of bullock labour to human labour was roughly 1: 7, which is much lower than the comparable rates for other districts. The Farm Management Survey data also show that there is a tendency for this ratio to increase with the size of land holding. A more recent survey[15] shows (*a*) a decline in the average ratio of bullock to human labour; (*b*) a steep decline in this ratio in the smaller sized holdings (below 2 acres) (Table X).

While the data in these two surveys may not be strictly comparable, they do seem to suggest a tendency to substitute human labour for bullock labour in the small size of holding. This would reflect the increasing economic cost of holding them. These factors might have induced a shift from oxen to hand

12. Government of India: National Sample Survey: Number 215—Twentysixth Round—Tables on Land Holdings, State: Kerala, *op. cit.*
13. *ibid.*
14. Livestock Census, 1972.
15. This survey was conducted by the State Planning Board of Kerala for evaluating the performance of high-yielding varieties of paddy in 1973-74 covering a sample of 562 households from 56 blocks spread over ten districts in the State.

TABLE X—HUMAN AND BULLOCK LABOUR INPUT PER HECTARE IN PADDY CULTIVATION BY SIZE-GROUPS OF FARMS

Size of holding (acres)	Input of bullock labour per acre		Input of human labour per acre		Ratio of bullock labour to human labour	
	FMS (1962-63)	SPB (1973-74)	FMS (1962-63)	SPB (1973-74)	FMS (1962-63)	SPB (1973-74)
0-1.0	19.30	8.52	122.28	136.40	0.16	0.08
1.0-2.5	18.32	10.20	108.41	109.30	0.17	0.07
2.5-5.0	17.61	14.65	75.93	83.10	0.23	0.17
5.0-10.0	19.45	14.08	72.75	80.10	0.27	0.17
10.0 and above	12.44	12.32	61.33	79.50	0.20	0.15
All sizes	11.38	11.45	54.48	69.09	0.20	0.16

FMS: Farm Management Survey.
SPB: State Planning Board.
Source: (1) Government of India: Economics of Farm Management, Kerala (1962-63), *op. cit.*
(2) Government of Kerala: Evaluation of High-Yielding Variety of Paddy, 1973-74, Evaluation Series No. 26, State Planning Board, Trivandrum.

cultivation on the small farms.[16] Such a shift is more possible in Kerala than in other parts of the country because the relatively high rainfall during the main crop season makes it possible to prepare and till land by human labour without the use of animal power.

Preference for Milch Animals

The economic factors militating against the use of animal power are reinforced by the possibility of getting high returns from rearing milch animal. Very small farmers faced with limited income potential from land may find dairying an attractive supplementary occupation. And given the limited availability of resources to grow or purchase feed, the return per unit of feed may be higher in milk production than in other livestock enterprise. The relative attraction of milk production has actually increased over time.

The increased real cost of draught animal is reflected not only in rising feed costs, but also in a rise in price of draught animals both in nominal terms and relative to general price level. This can be seen from Table XI. The price of milch cattle has gone up at a faster rate than that of draught cattle.[17]

16. The tendency to substitute human labour for bullock labour will be more evident under conditions in which the cost of hiring draught animals exceeds the expected relative rate at which cultivation with oxen and plough and cultivation with handhoe by tilling can complete the ploughing operations in a plot. This, in turn, is related to the size of the plot. For instance, in Indonesia it is reported that in larger size plots two buffaloes with plough were found to operate three times faster than in smaller plots. See Ester Boserup: Conditions of Agricultural Growth: Economics of Agrarian Change under Population Pressure, George Allen and Unwin Ltd., London, 1965.

17. The price of milch cattle and draught cattle are collected by the Statistical Unit of the Animal Husbandry Department and published in the *Bulletin of Animal Husbandry Statistics.*

TABLE XI—RELATIVE PRICE RATIO

Year	Price of draught cattle	Index	Price of milch cattle	Index	Cow milk / Paddy straw	Cow milk / Oilcake	Cow milk / Cotton seed	Beef / Paddy straw	Beef / Oilcake	Beef / Cotton seed	Milch cattle / Draught cattle	Cow milk / Beef
1962-63 ..	286.0	100.0	186.0	100.0	0.0094	2.1322	1.3966	0.0162	3.6630	2.3921	0.650	0.580
1963-64 ..	290.8	101.7	191.2	102.8	0.0095	2.1505	1.3942	0.0162	3.6364	2.3953	0.659	0.590
1964-65 ..	290.1	101.8	193.9	104.3	0.0095	2.1277	1.3942	0.0160	3.5971	2.3585	0.866	0.592
1965-66 ..	292.0	102.1	197.5	106.2	0.0095	2.1552	1.4104	0.0159	3.6232	2.3697	0.676	0.595
1966-67 ..	294.0	102.8	201.8	108.5	0.0896	2.1098	1.4184	0.0158	3.5791	2.3641	0.686	0.599
1967-68 ..	295.1	103.2	216.8	111.2	0.0096	2.1552	1.4368	0.0159	3.6101	2.3692	0.701	0.597
1968-69 ..	296.8	103.1	211.2	113.6	0.0096	2.1834	1.4368	0.0159	3.6101	2.3692	0.701	0.597
1969-70 ..	294.8	104.1	216.3	116.3	0.0097	2.0226	1.4514	0.0158	3.5714	2.3474	0.734	0.617
1970-71 ..	297.7	103.6	221.7	119.2	0.0097	2.1978	1.4535	0.0156	3.6104	2.3364	0.748	0.618
1971-72 ..	296.2	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	1.4793	0.0157	3.5842	2.3310	0.803	0.633
1973-74 ..	294.8	103.8	239.9	129.0	0.0099	2.2727	1.4801	0.0160	3.5336	2.5336	0.808	0.642

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

Note:—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 cottonseed are reported for one kg.

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

This may reflect in part the depressing effect of large scale and growing import of cattle (mainly adult male cattle) on the price of draught cattle; in part it would seem to reflect the greater economic value of milch cattle.[18] A comparison of the relative movement of milk and beef prices suggests that the profitability of milk production has increased over the last decade. Also this period was marked by a rapid spread of artificial insemination as part of the State's programme for breed improvement. The main thrust of the programme was to improve milch breeds.[19] Available data point to a substantial increase in the breeding and lactating efficiency of milch cattle as a result of cross breeding. To the extent that productive efficiency of milch animal increased as a result of these programmes—and there is no basis yet to quantify this—the tendencies shown by movement of relative prices of milk and feed must have been reinforced. The fact that milk price rose relative to beef price may not have been an important factor because (*a*) cattle are not reared with a view to producing meat and (*b*) in any case the price of beef is significantly affected by the volume of imported animals.

The factors tending to increase the return on milk production must have been reinforced by the reduction in the average size of holdings and the large increase in the number of small holdings where, for reasons mentioned earlier, there are strong tendencies to keep the number of draught animals to the minimum and to increase the number of milch cattle. The rise in the profitability of milk production in the State might have led to a large number of rural households taking up dairying as a source of supplementary income. Since the availability of feed resources is limited, the increase in the 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 tendency toward the substitution of milch animals for draught animals in the smaller farms.

III

CONCLUSION

In this paper an attempt is made to examine the size and utilization of draught animals in Kerala. The main results emerging out of this study are (*a*) the existence of a bullock rental market in the rural economy of Kerala and (*b*) the decline in the demand for draught animals caused by the increase in the number of smaller farms and the rise in the profitability of milk production leading to substitution of draught animals by milch animals. The impact of mechanical equipment like tractors and oil engines on the demand for animal power is found to be negligible.

18. At present, around 30 per cent of the bovine population in Kerala is imported from outside.
19. Around 40 per cent of the breedable female bovine population is covered by this programme.

The development of bullock rental market is due to the very low proportion of households owning draught animals resulting in their lower availability per household and their higher rate of utilization by hiring. Since the utilization of draught animals is highly seasonal, their non-availability at the proper time of cultivation has resulted in the substitution of human labour for bullock labour at least in the smaller size of farms.

Consolidation of land holdings or effective redistribution of land are the oft-advocated solutions for the reduction in draught animals in agrarian economies. Studies relating to the impact of redistribution of land in Kerala do not show any significant change in the structural distribution of land.[20] It is also argued in some of the recent studies that the growth in the number of smaller farms in Kerala is because of the increase in the rate of partitioning of households due to rapid population growth.[21] The growth in the number of smaller farms clinging to land as their main source of subsistence resulted in the substitution of draft animals by milch animals and the development of dairying as a source of supplementary income for rural households. Thus it seems that the main cause underlying the reduction in draft animal population in Kerala is the rise in demographic pressure on land,[22] and the growing economic attraction of milk production.

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20. See for details, Poverty, Unemployment and Development Policy: A Case Study of Selected Issues with Reference to Kerala, Department of Social and Economic Affairs, United Nations, 1975, Chapter VI. This study was undertaken by the Centre for Development Studies, Trivandrum.

21. For a detailed account of the impact of population growth on the rate of partitioning of households, see P. G. K. Panikar, *et al.*: Population Growth and Agricultural Development: A Case Study of Kerala, Centre for Development Studies, Trivandrum, 1977. This study was sponsored by the Food and Agriculture Organization of the United Nations.

22. The impact of demographic pressure on the size and composition of bovine holdings in Kerala is analysed in detail in a forthcoming paper by the author.

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