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INVESTMENT IN DRAUGHT ANIMALS IN AGRARIAN
ECONOMIES – A CASE STUDY OF KERALA

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INVESTMENT IN DRAUGHT ANIMALS IN AGRARIAN ECONOMIES — A CASE STUDY OF KERALA

1. Introduction

In this paper an attempt is made to (1) examine whether the draught animal population shows a surplus in relation to land and land distribution; (2) to trace the developments that have taken place in the State in the direction of bringing the supply of draught animals in line with its demand. We shall also look into the factors that influenced the changes in draught animal population and the development of a bullock rental market in the rural economy of Kerala. Then in the light of the case studies of two villages which we have undertaken we shall examine the extent to which human and bullock labour power is used in different size group of farms in order to bring out the impact of tractorisation on the demand for draught animal population.

This paper is divided into four sections. Section I contains an analysis of the pattern of holding of draught animals and its level of utilisation across different size group of farms. Section II deals with the factors which affects the supply of and the demand for draught animal. Section III presents the results of the case studies of the two villages and the final Section gives the conclusion.

Pattern of Holding and Utilisation of Draught Animals

2. The data on the pattern of holding of draught animals collected during the 26th round of the National Sample Survey show sharp difference between Kerala and other States. The number of draught animals per holding and per hectare and the percentage of households reporting holding of draught animals is the lowest in Kerala as will be evident from Table I.

Table 1:   Number of draught animals per holding and per hectare
          and the percentage of households reporting holding
                      of draught animals

State	Average Number of draught animals/holding	Average Number of draught animals/hectares	Percentage of households reporting holding of draught animals
Andhra Pradesh	0.82	0.68	39.02
Rajasthan	1.27	0.79	56.31
Uttar Pradesh	1.21	1.08	61.44
Madhya Pradesh	1.88	0.73	68.94
Jammu & Kashmir	1.14	1.01	63.65
Punjab	0.72	0.64	35.79
West Bengal	1.14	1.32	44.79
Assam	1.46	1.56	53.78
Orissa	1.21	1.18	53.46
Karnataka	1.23	0.49	41.81
Haryana	0.63	0.42	31.73
Maharashtra	1.13	0.43	45.07
Bihar	0.96	0.98	47.17
Kerala	0.21	0.41	8.68
Tamil Nadu	1.21	0.98	36.8
All India	0.89	0.69	38.21

3.   Analysis of the relationship between the cropping pattern and the pattern of holding of bovine population in the State shows that in regions where the proportion of area under foodgrains to total cropped area are higher, the proportion of households reporting holding of draught animals and the number of draught animals per holding and per hectare are also higher.[1/] The proportion of households reporting holding of draught animals and their smaller number per holding and per hectare are partly due to the low proportion (around 34 per cent of the total cropped area) of area under foodgrains whose cultivation requires intensive land preparations and partly to the dominance of perennial crops (like coconut and rubber) in the cropping pattern (this account for about 54 per cent of the total cropped area) which do not need animal power.

Micro level data on the pattern of holding of draught animals are available from the Farm Management Surveys conducted in the Quilon and Alleppey districts during 1962-63, 1963-64, 1964-65. The number of draught animals per holding and per acre and frequently distribution of farms according to the number of draught animals are given in Table 2.

Out of the 196 households surveyed 35 percent reported holding of draught animals. This is much higher than the State average because the sample is selected from areas and from farms where the proportion of area under paddy is higher than the State average. In the villages surveyed taken together, 50 per cent of total cropped area was under paddy, and around 62 per cent of the households reported holding of draught animals is found to decline with the increase in size of land holding. This is due to (1) the high cost of maintenance of draught animals per unit of work done; and (2) the higher dependence on purchased feed to total feed consumed (in terms of value). The cost of maintenance per

working day for draught animals is found to decline with the rise in
size of land holdings.

Table 2: Holding of Draught Animals in Kerala by Size Group of Farms
(1962-63)

Size Groups (Acres)	Number of draught animals		Frequency distribution of farms by number of draught animals				Percentage of hh reporting holding of draught animals
	Average no. per total farm	Average No. per acre	0	1	2	3	
0 - 1.0	0.08	0.52	35	3	–	–	8.0
1.0 - 2.5	0.32	0.32	42	5	3	–	19.0
2.5 - 5.0	0.41	0.18	31	11	4	–	33.0
5.0 - 10.0	0.78	0.14	12	9	6	–	56.0
10.0 - 15.0	1.85	0.07	2	–	9	2	85.0
15.0 - 25.0	1.65	0.04	4	–	11	2	76.0
Above 25	2.50	0.05	–	–	2	1	100.0
Average number of draught animals and total number of farms	0.58	0.09	126	30	35	5	35.0

Table 3: Composition of Feed and Cost of Maintenance per Draught animal In Different Size Group of Farms (1962-63)

Size group of farms (acres)	Value of fodder consumed	Value of concentrate consumed	Value of items other than feed	Total cost of maint-enance per annum	Mainte-nance cost per working day	Average annual mainte-nance cost per day (Rs.)	% of purcha-sed feed consumed
0 - 1.0	106.45	72.94	89.76	269.15	3.51	0.64	68.6
1.0 - 2.5	116.88	26.04	103.08	246.0	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
10.0-15.0	102.29	86.79	12.05	201.13	3.41	0.42	32.7
15.0-25.0	76.85	41.51	74.48	194.89	3.43	0.46	24.2
All	102.38	53.28	71.51	227.10	2.68	0.51	39.1

Source: Government of India, Directorate of Economics and Statistics, Ministry of Food and Agriculture, Community Development and Cooperation, Economics of Farm Management, Kerala (1962-63)

The average number of draught animals, per holding and per acre in the villages surveyed comes about 0.58 and 0.09 respectively. The number of draught animals per acre is found to decrease as size of holding becomes larger. The higher intensity of draught animals per acre in smaller size is due to their indivisibility as an asset. The larger of holdings/are in a position to use bullocks more fully with the result that the area operated per draught animal is higher in them. Thus the apparently higher availability of draught animal per acre in smaller size group of farms conceals the disadvantages/which individual small holdings from suffer; possessing no draught cattle or possessing inadequate numbers or being not able to use them economically.

5.   Draught animals are mainly used in crop production. Out of the 69 days employed on an average in the farms surveyed during 1962-63 around 63 per cent of the days, they are used in crop production. Hired out accounts for another 20 per cent of the employment. The number of days employed in crop production is found to be higher in the larger size group of farms whereas the number of days hired in is found to be higher in the larger size group of farms whereas the number of days hired out is found to be higher in the smaller size groups (See Table 4).

A significant feature of the employment of draught animals is the enormous wastage of animal labour power. The annual rate of unemployment of draught animals comes about 81 per cent. The degree of unemployment of draught animals is found to be more   in the smaller size group of farms.

The degree of unemployment of draught animals is higher in Kerala than in many other States. In the West Godavari district of Andhra Pradesh it is around 69 per cent, in Cuttack district of Orissa it comes about 67 per cent, in the Muzzafar Nagar district of UP 79 per cent and in the Ahmednagar District of Maharashtra 57 per cent. Table 6 provides data on the degree of unemployment of draught animals in a few States.

Since draught animals are mainly used in crop-production, high seasonality in their use may be expected. While data pertaining to the seasonal patterns of employment of draught animals do show variations in the degree of utilization, it is significant that even in the months of July-August and November-December which are the peak sowing seasons in the regions where F.M.S. are conducted, the high degree of

unemployment of draught animals implies the existence of surplus draught animals. The higher level of unemployment of draught animals in smaller holdings shows that this surplus is higher in these size groups.

Table 4: Employment of Draught Animals by Size Group of Farms

Size Group (acres)	Employment of Draught Animals						Hired out	Per-centage	Total days unemployed	Percentage of annual unemployment
	In Crop production	Per-centage	Other than crop prodn.	Per-centage	Exchange or gift	Per-centage				
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
10.0 - 15.0	68.6	78.0	3.2	4.0	5.8	7.6	2.9	3.6	81.4	77.6
15.0 - 25.0	78.2	82.0	7.4	7.7	11.7	14.4	-	-	95.4	73.8
Above 25	96.4	-	-	-	-	-	-	-	94.4	73.1
All	43.5	63.0	7.6	11.0	4.0	5.2	20.1	20.1	69.0	81.0

Source: Government of India, Directorate of Economics and Statistics, Ministry of Food& Agriculture, Economics of C Farm Management, Kerala, 1962-63

Note:- The normal working day for draught animals in the regions surveyed is four hours.

Table 5: Seasonal Employment of Draught Animals in Kerala (1962-63)

Month	April	May	June	July	August	Sept.	Octo.	Nove.	Dec.	Jan.	Feb.	Ma
No. of days draught animals are employed	3.18	2.02	2.29	8.60	12.36	4.96	2.68	6.41	7.73	3.01	3.50	
Degree of unemployment	72.7	93.44	92.3	74.1	60.1	83.4	94.4	78.6	77.5	91.2	89.6	74

Source: Government of India, Directorate of Economics and Statistics, Ministry of Food and Agriculture, Economics of Farm Management, Kerala (1962-63)

6.   An important difference in the employment pattern of draught animals between Kerala and the other States is the very high proportion of bullock days hired in all size group of farms. As is evident from Table 4, in the size group (0-1) acre, around 95 per cent of the bullock days are hired out. As size of holding increases the proportion of bullock days hired out is found to decline. When holdings of all sizes are considered around 20 per cent of the bullock days are hired out. This proportion is found to be the highest in Kerala among all the States in the country where F.M.S. are conducted (See Table 6). For instance, in the West Godavari District of Andhra Pradesh only around 8 per cent of the bullock days are hired out; in the Muzzafar Nagar district of Uttar Pradesh it was around 3.4 and in the district of Hoogly and 24 Parganas of W.Bengal it works out to be around 12 and 15 per cent; in Sambalpur dist. of Orissa it comes about 8 per cent and in the Vidharbha region of Maharashtra about 5 per cent and in the Pali

Table 6: Percentage of draught animal days hired out and degree of unemployment of draught animals per annum in a few selected districts in India

Districts	Number of days unemployed	Degree of animal un-employment	Percentage of bullock days hired out to total number of days unemp-loyed
Pali (Rajasthan 1963-69)	284	77	6.81
Hoogly and 24 Phar-ganas (West Bengal 1956-57)	307	85	15.39
Sambalpur (Orissa, 1961-62)	260	71	2.95
Cuttack (Orissa, 1967-68)	246	67	12.9
Salem and Coimbatore (Tamil Nadu 1955-56)	246	67	12.6
West Godavari (Andhra Pradesh 1967-68)	252	69	7.9
Ahmed Nagar (Bombay, 1955-56)	197	54	2.3
Muzzafar Nagar (Uttarpradesh 1966-67)	268	73	3.4
Quilon and Alleppey (Kerala 1963-64)	296	81	20.1

Source: Directorate of Economics and Statistics, Ministry of Agriculture, Economics of Farm Management;

(1) Pali District, Rajasthan (1963-64)
(2) Hoogly and 24 Parganas, W.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) Muzzafar Nagar, Uttarpradesh (1967-68).
(8) Quilon and Alleppey District, Kerala (1963-64).

district of Rajasthan around 6.8 per cent. The high proportion of bullock
days hired out in Kerala compared with other regions in the country refle-
cts the existence here of well-developed bullock rental market in the
village economy.

Around 64 per cent of the farms surveyed did not possess any draught
animals at all. They therefore completely depended on hired bullock labour
for their ploughing operation. The small sized farms which owned bullocks,
because of their small size attempted to maximise the employment of their
draught animals by hiring them out. Since the percentage of households hir-
                  in   is
ing/animals/higher than those owning draught animals, hiring-in of bullock
labour is found in all size groups of farms. Data pertaining to the
number of owned and hired draught animal days in different size group of
farms are given in Table 7.

Table 7: Number of owned and hired bullock labour days employed in different
                           size group of farms

Size of farm (acres)	Number of owned draught animal days per holding	Number of hired bullock days per holding	Total	Hired as per- centage of total
0 - 1.0	68	28	91	29.2
1.0 - 2.5	85	46	131	35.2
2.5 - 5.0	720	456	1176	38.8
5.0 - 10.0	3737	988	4725	21.0
10.0-15.0	2091	1588	3682	43.3
15.0-25.0	1572	1071	2643	40.6
25.0 +	3538	1821	5359	33.9
All	1651	637	2289	27.9

Source: Government of India, Directorate of Economics and Statistics,
   Ministry of Food and Agriculture, Community Development and
   Cooperation, Economics of Farm Management, Kerala (1962-63).

The proportion of bullock days hired in is found to be higher than the proportion of bullock days hired out. This is reported to be due to the hiring in of draught animals from other regions into the villages surveyed during the peak sowing seasons.

7. The main findings of this section are summarised ' as follows: (1) Examination of the pattern of holding and level of utilisation of draught animals in Kerala showed the existence of surplus draught animals in all size group of farms. It also revealed a high level of hiring out of bullock labour in smaller size group of farms and hiring in larger size groups; (2) Insterstate comparison of the pattern and level of draught animals shows that their number per holding and per hectare as well as the level of utilisation is lower in Kerala than in other regions in the country. The proportion of bullock days hired out is also found to be higher in Kerala. All this indicates that in Kerala there is (1) enormous wastage of animal labour power and (2) the existence of a rental market for draught animals.

II

Demand and Supply of Draught Animals

8. According to the 1956 livestock Census, the population of draught animals in the State was around 8.59 lakhs and it declined to 6.2 lakhs by 1972. During 1956 the number of draught animals used in transportation alone was around 44 thousand and by 1972 the corresponding number was only 22 thousand. This suggests that the reduction a was mainly in the number of those used in crop production. The average rate of decline

in draught animal population during this period was around 2 per cent per annum. It may be noted that this happened during a period when the cropped area was increasing at a rate of 3.1 per cent per annum. The area under paddy was increasing at a rate of 0.9 per cent per annum, during this period. A sharp decline in draught animal at a time when cropped area was increasing was observed only in Kerala among the different States in India.[2/] To understand the factors which led to the decline in draught animal population it is essential to look into the factors which affects their supply and the demand for draught animals. The main factors which affects their supply are the price of cattle, cattlefeeds, milk and beef. On the demand side the main factors are: (1) Size and distribution of land holdings; (2) availability of mechanised power in agriculture; (3) intensity of human and bullock labour input in agriculture.

9. Price of Cattle, Cattle Feeds, Milk and Beef

One could possibly expect some relation between prices of cattle and cattle feeds on the one hand and the prices of foodgrains, beef and milk on the other. If the price of foodgrain increases the price of draught cattle would also increase under situations in which there is keen competition for the same agricultural resources (like land and water) by alternative uses (- say growing fodder for animal consumption and cultivation of crops for human consumption) particularly in the context of rapid population growth.[3/] Since there has been no diversion of land and other resources in Kerala from alternative uses to the cultivation of fodder it is not possible to expect any relation between rise in foodgrain price and price of draught cattle.

Table 8: Straw grain ratio for traditional and high-yielding variety of paddy in Kerala

Plant Type	Variety Group	Mean Grain Yield (Kg/ha)			Mean straw yield (kg./ha)		
		Virrippu	Mundakan	Punja	Virrippu	Mundakan	Punja
Dwarf (HYV)	Medium duration	3700	3500	--	1700 (.46)	1450 (.47)	
-do-	Early duration (95-110 days)	3160	2750	2800	1700 (.54)	1850 (.67)	1650 (.90)
Tall (local)	Medium duration	2343	2300	--	2500 (1.07)	3800 (1.36)	--
-do-	Early duration	1800		1100	1810 (1.28)		2250 (1.24)
Tall	HY Mashoori (125-135 days)	1980	2400	-	3100 (1.59)	2800 (1.55)	

Eg: Medium duration: Jaya, IR8, Sabari, Bhavathi, Aswathi,

Short Duration :   Annapurna, Jyothi, Thriveni, Rohini, Supriya,

Medium Duration
        tall   Ptb. 1,2,9,26 (first crop)
                    Ptb., 4,12,20;
Early duration :   Ptb. 10.

Note: Figures in brackets in the mean straw yield column gives the straw/grain ratio.

Source: Rice research Station, Patambi, Kerala

10. Data on the price of draught bullocks and milch cows are available from 1962 onwards at current prices. In order to find out the change in their constant prices over the years the current cattle prices are deflated with consumer price index to net out the effect of changes in general prices. The resultant price of draught cattle and milch cow are given in Table 10. In general an increase can be observed in the real value of cattle over the years.

11. One possible reason for the increase in real value of cattle in the State may be the increase in real price of paddy straw and concentrates. The rise in the price of paddy straw may be due to the decline in its production caused by the introduction in the State in the mid-sixties, of high yeilding varieties of paddy whose yield of paddy straw is lower than that of traditional varieties. This is evident from Table 8 which gives the straw grain ratio for traditional and high yielding varieties.

However the rate of adoption of high yielding variety of paddy has been slow in the State. The per centage of area under H.Y.V. in 1972-73 was only around 24 per cent of the total area under paddy.

Yet this might have led to some extent to a decline in the rate of increase in the output of paddy straw in the State and would be one of the reasons for the increase in its price. The more important reason may be the increase in the bovine population at a rate faster than that of the output of paddy straw. The rate of growth in output of paddy straw during the last 15 years was 0.2 per cent per annum while the annual rate of growth of bovine population was around 0.7 per cent. [4]

Table – 6

Price of draught cattle, milch Bovines, cattle feeds, milk and beef in Kerala

Year	Draught Cattle	Index	Milch cattle	Index	Milch buffalo	Index	He buffalo	Index	Cow milk	Index	beef	Index
1962-63	286.0	100.0	186.0	100.0	158.0	100.0	339.0	100.0	0.810	100.0	1.390	100.0
1963-64	290.8	101.7	191.2	102.8	159.7	101.1	341.7	100.8	0.830	102.4	1.406	101.2
1964-65	290.1	101.8	193.9	104.3	102.4	102.8	347.1	102.4	0.840	103.6	1.419	102.1
1965-66	292.0	102.1	197.5	106.2	162.5	103.7	349.5	103.1	0.852	105.2	1.433	103.1
1966-67	294.0	102.8	201.8	108.5	163.8	104.6	351.8	103.8	0.865	106.8	1.445	104.0
1967-68	295.1	103.2	216.8	111.2	165.2	104.9	353.5	104.3	0.870	107.4	1.458	104.9
1968-69	296.8	103.1	211.2	113.6	165.7	105.8	356.6	105.1	0.895	108.4	1.462	105.2
1969.70	294.8	104.1	216.3	116.3	167.1	105.6	355.6	104.9	0.897	109.7	1.456	104.8
1970-71	297.7	103.6	221.7	119.2	166.8	105.2	354.5	104.6	0.890	110.2	1.462	105.2
1971-72	296.2	102.9	227.1	122.1	166.2	106.1	357.3	105.4	0.910	110.5	1.472	105.9
1972-73	294.2	103.1	236.9	127.3	167.6	106.3	362.0	106.8	0.920	113.8	1.477	106.5
1973-74	294.8	103.8	239.9	129.0	167.9	107.1	360.6	106.4	0.940	116.0	1.484	106.8

Price of draught cattle, milch bovines, cattle feeds, milk and beef in Kerala

Contd.....

Year	Buffalo milk	Index	Buffalo meat	Index	Paddy straw	Index	Oilcake	Index	Cotton seed	Index
1962-63	0.920	100.0	0.985	100.0	86.0	100	0.380	100.0	0.580	100.0
1963-64	0.982	100.0	1.000	101.5	87.0	101.2	0.386	101.6	0.595	101.8
1964-65	0.939	102.1	1.020	103.6	88.9	103.4	0.395	102.2	0.602	102.8
1965-66	0.940	102.2	1.120	103.6	89.9	104.6	0.395	104.1	0.604	104.2
1966-67	0.950	103.3	1.010	102.5	90.9	105.8	0.401	104.9	0.610	105.2
1967-68	0.954	103.7	1.020	103.6	91.3	106.2	0.404	104.9	0.613	105.8
1968-69	0.987	107.3	1.009	102.4	92.5	107.6	0.403	105.8	0.616	106.3
1969-70	0.964	104.8	0.979	98.4	92.9	108.2	0.407	106.2	0.622	107.4
1970-71	0.970	105.4	0.987	99.8	93.0	108.8	0.405	107.2	0.625	107.8
1971-72	0.971	105.5	0.978	99.0	93.9	109.2	0.408	108.2	0.627	108.1
1971-72	0.971	105.5	0.962	97.7	94.4	109.8	0.418	107.5	0.633	109.1
1973-74	0.966	105.0	0.958	97.0	94.9	111.4	0.414	108.4	0.639	110.2

Source: The data is computed from the Bulletin of Animal Husbandry Statistics.

Note : The price of draught animal is for draught animals whose physical conditions is good. The price of milch animal is reported for one litre of morning milk-yield in (1-3) months of lactation.

The price of milk, beef, straw, oilcake, and cottonseed are reported for one kg.

Table 10

Relative Price Ratios

Year	Price of straw / price of cow milk	Oil-cake / milk	Cotton seed / milk	Straw / Beef	Oilcake / Beef	Cotton-seed / Beef	Straw / Buffalo milk	Oilcake / B.milk	Cotton-seed / B.Milk	Straw / Buffalo meat	Oilcake / B.meat	Cotton-seed / B.Meat	Milch cattle / Draught cattle	milk / Beef	B.milk / B.meat	Milch buffaloe / draught buffaloe
1962-63	106.1	0.469	0.716	61.9	0.273	0.417	93.47	0.413	0.630	0.873	0.386	0.589	0.650	0.580	0.934	0.466
1963-64	104.8	0.455	0.717	61.7	0.275	0.421	94.41	0.419	0.645	0.868	0.388	0.595	0.659	0.590	0.922	0.467
1964-65	105.8	0.470	0.717	62.6	0.278	0.424	91.82	0.421	0.642	0.872	0.387	0.590	0.666	0.592	0.921	0.468
1965-66	105.5	0.464	0.709	62.8	0.276	0.422	95.05	0.420	0.643	0.883	0.387	0.592	0.676	0.595	0.927	0.465
1966-67	105.1	0.474	0.705	63.12	0.278	0.423	95.70	0.422	0.642	0.894	0.397	0.604	0.686	0.599	0.941	0.466
1967-68	104.9	0.464	0.696	62.9	0.277	0.422	96.12	0.423	0.643	0.891	0.396	0.601	0.701	0.597	0.935	0.467
1968-69	104.5	0.453	0.698	63.2	0.276	0.422	96.32	0.428	0.634	0.913	0.399	0.610	0.712	0.605	0.977	0.465
1969-70	103.3	0.454	0.695	64.0	0.280	0.426	95.92	0.422	0.645	0.948	0.456	0.629	0.734	0.617	0.985	0.470
1970-71	104.4	0.455	0.689	63.6	0.277	0.428	96.68	0.420	0.644	0.951	0.418	0.643	0.748	0.618	0.984	0.471
1971-72	103.1	0.448	0.688	63.8	0.278	0.429	97.19	0.420	0.646	0.966	0.418	0.649	0.772	0.623	0.991	0.465
1972-73	102.6	0.443	0.680	64.1	0.279	0.429	98.23	0.429	0.652	1.100	0.480	0.746	0.803	0.633	1.010	0.463
1973-74	100.9	0.440	0.676	65.4	0.283	0.434	99.05	0.430	0.661	1.120	0.487	0.748	0.808	0.642	0.997	0.466

12.   The fact that the price of milch cattle has increased at a faster rate than the price of draught cattle is reflected in the ratio of the price of milch cattle to price of draught cattle. The price of milch cattle is found to move at a faster rate than the price of beef. The ratio of the price of milk to important items of feeds like paddy straw and concentrates was also increasing over the years. On the other hand the ratio of the price of beef to prices of feed was decreasing over the years. All this is evident from Tables 9 and 10. The price of milch and draught buffaloe shows a fluctuating trend over the years. The ratio of the price of input to price of buffalo milk and buffalo meat showed an increasing trend over the years.

The increase in output price relative to feed price noticed in the case of cow milk indicates that the profitability of cow milk production has gone up. The decrease in output price relative to feed price observed in the case of beef indicates that the profitability of beef production has come down. In this situation in order to meet the rising demand for milk increase in the number of female cattle and improvement in their quality might have taken place. The rising demand for beef might have net by increasing the rat of slaughter of adult and young stock male cattle. The faster movement of beef price relative to draught cattle price indicates that this is what in fact did take place. The increasing trend in the ratio of input to output prices in the case of buffalo milk and buffalo meat shows that the ffitability of rearing buffaloes for milk and meat are on the decline in the State. Because of this inorder to meet the replacement demand for milch and draught buffaloes and also to meet the demand for buffalo meat import from neighbouring States might have taken place, rather than rearing them here.

Because of the increase in real price of feeds, the cost of cattle rearing
has gone up and resulted in the import of slaughter animals and of draught
cattle for meeting part of the rising demand for beef and the replacement
demand for draught animals. Draught and slaughter animals are imported from
the neighbouring States of Tamil Nadu and Karnataka where cattle prices are
generally found to be lower than in Kerala. Analysis of the data on the
pattern and magnitude of the movement of bovine population shows that
around 30 per cent of the draught animal population in the State is imported
from outside. The differential price movement observed between draught and
milch cattle is due to the interaction of these factors. The effect of
this price movements is also reflected clearly in the changes in the size
and composition cattle population in the State.

Change in Size and Distribution of Land Holding

13.   Data on the proportion of households owning draught animals and the
number of draught and milch animals per acre and per holding are available
from the survey of land holdings 1961-1962 and 1971-72. Examination of
this data gives useful clue to the change in the number of draught and
milch animals in holding belonging to different size holdings. The number
of draught and milch animals per acre in different size of holdings are
given in Table 11.

It is observed that/all the size group of holdings recorded decline
in the number of draught animals; the decline is however sharper in the
lower size groups. Even though considerable increase is observed in the
number of milch cattle per acre in all the size of holdings, it is much
higher in the smaller size of holdings. This may be due to the higher
opportunity cost of livestock feeds in the smaller holdings. Probably it
is due also to the expansion of the village market for milk resulting in

Table: 11   Change in Number of Milch and Draught Animals in difference size group of farms (1961-62 to 1971-72)

Size of land-holdings(Acres)	Number of draught animals (per ha.)		Percentage	Number of milk animals(per.ha)		Percentage
	1961-62	1971-72		1961-62	1971-72	
0.49	0.52	0.32	-38	1.28	1.89	+49
0.50-0.95	1.03	0.64	-38	1.03	1.94	+88
1.0 -2.45	0.19	0.12	-32	0.97	1.52	+57
2.45-4.99	0.39	0.28	-28	1.16	1.61	+39
5.00-7.49	0.61	0.49	-20	0.95	1.17	+25
7.50-9.99	0.68	0.52	-26	0.65	0.83	+28
10.0-12.45	0.54	0.42	-22	0.50	0.67	+34
12.50-14.99	0.59	0.47	-20	0.57	0.64	+12
15.0-19.99	0.57	0.38	-33	0.57	0.66	+16
20.0-24.99	0.56	0.42	-25	0.51	0.60	+13
25.0-29.99	0.43	0.36	-16	0.52	0.61	+17
30.0-49.99	0.17	0.14	-18	0.37	0.48	+20
50.0 and above	0.22	0.72	-14	0.30	0.28	+26
All	0.53	0.42	-21	0.62	0.84	+35

Sources 1. Government of Kerala, Bureau of Economics and statistics, Report on the National SampleSurvey, 16th Round, Kerala, Tables with Notes on Land Holdings.
2. Government of India, Department of Statistics, National Sample Survey 26th Round, Tables on Land Holdings, Kerala.

Table: 12 : Change in estimated number of Rural Households, Estimated Area operated and Average Area of operational holdings.

Size Group of Holdings (Acres)	Estimated No. of operational hold- ings (00)		Per- cen- tage	Estimated Area (00)acres)		Per- cen- tage	Average Size Operational Holdings (acres)	
	1971-72	1961-62		1971-72	1961-62		1971-72	1961-62
0.49	11600	12800	-9.4	2249	1870	20.3	0.19	0.15
0.50-0.99	3643	2860	+27.4	2609	1830	52.1	0.71	0.66
1.0 -2.49	4138	3610	+14.6	6362	5630	13.0	1.53	1.56
2.50-4.99	1990	1870	+ 1.0	6933	6490	6.4	3.45	3.47
5.00-7.49	534	630	-15.2	3207	3810	-15.3	6.06	6.05
7.50-9.99	283	240	+17.0	2423 ·	2040	18.8	8.56	8.50
10.0 and above	277	490	-39.4	4233	11190	- 62.2	15.28	22.83
All	22465	22500	0.2	28018	32000	-12.4	1.24	1.46

Source: 1. Government of Kerala, Bureau of Economics and Statistics, Report on the Operational Land Holdings, National Sample Survey, 16th Round (Kerala)

2. Government of India, Department of Statistics, National Sample Survey, 26th Round, Tables on Land Holdings Kerala.

a large number of rural households taking up dairying as a subsidiary occupation.

14. An explanation for the decline in draught animals in different size groups of farms can be offered by looking into the changes in the distribution of land holdings in recent years. Analysis of the data on operational landholdings available from the 16th and 26th rounds of the National Sample Survey shows change in the total number of operational land holdings belonging to different size group of farms. The total operational area of rural households shows significant decline in this period. The operational area of the top size group of farms (above 10 acres) has rapidly declined while those of the lower size group shows a marginal increase (See table 12).

The percentage distribution of operational holdings and operational area of different size group of farms is given in Table 21. Though the percentage share of operational holding of medium size group of farms (between 1 to 4.99 acres) has come down, their share of operational area shows significant increase. The share of operational holdings and the area operated by lower size groups (≼0.99 acres) also shows significant increase. Further the area of the top size group of farms (i.e. above 10 acres) has come down. All this evidence for the re-distribution of land which has taken place among different size group of holdings. Since the reduction in operational area has taken place only in the top size group of farms, it is not possible however to infer that this has led to reduction in draught animal population.

15. Since draught animals are mainly used in the cultivation of wet land, more insight into the impact of land distribution on draught animal population can be obtained by looking into some of the more recent data on wet land holdings in Kerala. These data available from two separate sources

and strictly not comparable are given in Table 14.

The data shows a significant decline in the wet land area operated by size holding above 2 acres. Significant increase is observed also in the number of wet land holdings in the lower size groups; the total area operated by them has also gone up. This in turn indiciates a reduction in the demand for draught animals in the size of holding above 2 acres and might have been a positive cause for the elimination of draught animals from these size group of holdings.

Degree of Agricultural Mechanization

16. There are two types of mechanical equipments; those which reduce the need for bullock labour and other which augment it. Tractors for example belong to the first group. They can lead to displacement of bullock labour. Oil engines and electric pumpsets on the other hand may lead either to an increase or to a decrease in the use of bullock labour. In areas where bullocks are used in irrigation, increase in number of oil engines and electric pumpsets would lead to displacement of bullock labour, while an increase in irrigation equipment is likely to lead to more intensive cropping policies and thus to increasing demand for bullock labour. Since in Kerala draught animals are not used in irrigation purposes, unlike in other parts of India, we treat tractors as bullock-labour displacing while irrigation equipments are treated as bullock labour absorbing.

17. Date on the number of tractors and power tillers in the State are available from the quinquennial livestock Census eports and also in the Decennial World Census of Agriculture (1970-71). According to 1961 Livestock Census, the number of tractors in use was 276 which increased to 2154 by 1972. Out of the total number of tractors and power tillers in use in 1972, around 40 percent was owned by Government agencies like

Table 13: Percentage distribution of operational holding and operational are (Kerala – Rural – 1961-62 to 1971-72)

Size of holding	Percentage distribution of operational households		Percentage distribution of operational area	
	1961-62	1971-72	1961-62	1971-72
0-40	56.9	57.7	5.7	8.0
0.50-0.99	12.7	18.1	5.7	9.3
1.0 -2.49	16.0	6.7	17.1	22.7
2.50-4.99	8.3	2.2	19.7	24.7
5.0 -7.49	2.8	9.9	11.6	11.4
7.50-9.99	1.1	2. 7	6.2	8.6
Above 10.0				
All	100.	100.0	100.0	100.0

Source: (1) Government of Kerala, Bureau of Economics and Statistics, Report on the Operational Land H ldings (Rural) National Sample Survey 16th Round (Kerala.

(2) Government of India, Department of Statistics, National Sample Survey 26th Round, Tables on Land Holdings, Kerala

Percentage Distribution of Net Land Holdings in Kerala:

Size group (acres)	1967-68					1975-76				
	Number of holding	Percen- tage	Area (acres)	Percen- tage	Average size of holding	Number of holding	Percen- tage	Area in acres	Percen- tage	Average size of holding
2.0	523431	89.0	418278	61.2	0.80	724335	93.7	544033	77.6	0.75
2.5 - 5.0	522772	8.0	102297	28.8	3.07	43953	5.7	127172	18.1	2.89
5.0 - 10.0	10270	1.7	69013	10.1	6.72	4120	0.5	26345	3.8	6.39
10.0 and above	2375	0.4	33274	4.9	14.0	287	0.04	3562	0.5	12.41
All	588848	100	682862	100	1.16	772695	100	701112	100	0.91

Sources: (1) Government of Kerala, Bureau of Economics and Statistics, Survey of Landholdings in Kerala (1967-68)

(2) Revenue Division, Civil Supplies Department, Government of Kerala.

Panchayats and co-operative societies which hired them out to farmers. The number of power tillers in 1972 was 627. The increase in number of tractors and power tillers is given in table 15.

Distribution of tractors across different size group of farms are available from the Report of the Census of World Agriculture (1970-71). It shows that around 50 percent of the tractors are concentrated in size group of farms below 5 hectares. The holding of tractors in relatively small size group of farms may be due to (1) the existence of rental market for tractors (specifically in transportation) (2) the fact that even though the ownership holding is small in this group, the operational holding may be much higher than ownership holding.

One reason for the purchase of tractors by large farmers is due to substantial savings rendered possible by tractor ploughing than by traditional ploughing. A recent study on the economies of tractor cultivation in the State showed that the cost of ploughing by tractors is much less than that of traditional ploughing[5]. The reason is the provision of cheap credit to the farmers by the State owned Agro-Industries Corporation.

18. Information on the average annual area operated by tractors with different horsepower and its availability across different size group of farms are available from the 26th round of the National Sample Survey. The number of tractors available per 100 rural households as per this Survey is 0.02. The average area operated by tractor for the State as a whole works out to be 9.55. There are only marginal variations observed in the area operated by tractors with smaller and larger horsepower. comparison of the average area operated by tractors in other States shows that its rate of utilisation is low in Kerala (See Table 16). The average area operated by tractors in Bihar is 15.22 hectares and in Uttar Pradesh about 63.78 hectares. The main reasons for the under utilisation of

tractors in the State may be the predominance of perennial crops and plantations in the cropping pattern and some of the institutional factors like the size and number of fragments per holding and their location.

The availability of tractors in terms of horse power per hectare of cropped area in the State works out to be around 0.012. There are only marginal variations in the availability of tractors among different regions in the State.

During 1971-72 the total area under paddy was around 8.75 lakh hectares. If we take 9.85 hectare as the average area operated by a tractor or a power tiller, the total area operated by tractors or power tillers would work out nearly 27 thousand hectares or about 3 per cent of the area under paddy. This indicates only negligible effects of tractors on bullock labour displacement.

19. The number of electric pumps and oil engines in use in the different districts are given in Table 18. During 1961 the number of oil engines and electrical pumpsets was 2.3 thousand and it increased to 28.6 thousand by 1972. But in terms of horsepower the increase in the number of oil-engines and electric pumpsets is very low. Since draught animals are not generally used in irrigation in the State the increase in the number of oil engines and electric pumpsets and horsepower availability, in so far as they increased the intensity of cultivation, actually generated additional demand for draught power.

20. The increase in the number of households reporting wet land cultivation (of paddy) and the decline in the number of households owning draught animals, at a time when cropped area was increasing and the availability of tractor power was insignificant might have led large numbers of households, to greater dependence on hired bullock labour. This

Table: 15 Number of Tractors and Power Tillers in Kerala

District/State	1961 Tractors	Power Tillers	1966 Tractors	Power Tillers	1972 Tracts	Power Tillers
Trivandrum	3	–	7	7	59	40
Quilon	4	–	23	31	122	61
Alleppey	73	–	57	67	312	107
Kottayam	87	–	61	16	286	74
Ernakulam	22	–	35	23	328	105
Trichur	26	–	75	20	229	63
Palghat	23	–	108	16	445	81
Kozhikode	26	–	26	8	163	30
Cannanore	12	–	26	9	171	60
STATE	276	–	418	191	2145	627

Table 16:   Average Annual Area Ploughed by
Tractors in few States

State	Average Area ploughed by tractor (ha.)
Bihar	15.72
Andhra Pradesh	63.78
Hariyana	10.88
Gujarat	13.45
Maharashtra	25.58
Punjab	9.95
Kerala	9.85

Source: Government of India, Department of Statistics, National
Sample Survey, 26th Round, Tables on Land Holdings
(Respective State Volumes).

Table 17: Horse Power Availability of Tractors per Hectare of Cropped Area

District/State	1961	1966	1972
Trivandrum	0.0002	0.0010	0.0063
Quilon	0.0002	0.0028	0.0086
Alleppey	0.0049	0.0083	0.0211
Kottayam	0.0042	0.0034	0.0399
Trichur	0.0026	0.0094	0.0256
Palghat	0.0010	0.0055	0.0202
Kozhikode	0.0010	0.0017	0.0067
Cannanore	0.0006	0.0016	0.0094
Kerala	0.0017	0.0037	0.0120

Note: The Horse Power Availability is estimated by assuming on an average 15 h.p. per Tractor.

might have led in turn to the expansion of the bullock rental market and to the emergence of a group of farmers who own draught animals and hire them out to others in order to maximise the employment of their draught animals.

The twentyfifth round of the National Sample Survey provides information on the economy of draught animals of the weaker sections of the rural population. Sample Households possessing one pair or more of draught animals reported that the holding of draught animals for own use alone was uneconomical and that they were making it economical by hiring out. Sixty percent of the households possessing one draught animal reported its holding uneconomical; they were making it economical by hiring in one animal. 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 animal 66 per cent reported the hiring of draught animals more economical than owning. Six per cent of the households in this group were however willing to buy them if credit facilities were available. About 21 percent of the households reported both hiring and owning draught animals uneconomical.

Intensity of human and bullock labour use

21. Data from the farm management surveys show that the intensity of human and bullock labour input per acre of area under paddy is higher in smaller size holdings and that it declines as the size of holding increases. (See 19). In contrast to the above findings, yielded by the F.M.S. data, a more recent survey shows that in the smaller size of holdings the number of bullock days is low and the input of human labour days is high. This study was conducted by the State Planning Board of Kerala for evaluating the performance of H.Y.V. of paddy in the Virippu season 1973-74 covering a sample of 562 households selected from 56 blocks spread over 10 districts in the State (See Table 20). According to this study the number of human

Table: 18 :   Number of Oilengines and electric Pumpsets in different
districts and its availability in terms of horsepower
per 100 hectare of area under paddy.

District/State	1961	1966	1972
Trivandrum	19 (ng)	14 (ng)	297 (0.(
Quilon	50 (.001)	47 (0.001)	534 (0.(
Alleppey	765(.005)	806 (.005)	2014 (.0(
Kottayam	507(.007)	382 (.005)	898 (0.(
Ernakulam	521(.006)	1922 (.011)	6770 (.3(
Trichur	1306(.007)	3056 (.140)	1263 (.1(
Palghat	1198(.003)	2220 (.057)	6892 (.10
Kozhikode	436(.021)	1260 (.078)	2810 (.10
Cannanore	735(.040)	1946 (0.10)	5339 (.2(
Kerala	5937 (0.038)	1693 (.073)	28626 (.15(

Source: Livestock Census, 1961, 1966, 1972

Note: The total H.P. Availability is estimated by assuming on
an average 5 H.P. per electric pumpset and oil engine.

Figures in bracket gives the H.P. availability.

Table 19: Distribution of Human and Bullock Labour input per acre in Paddy cultivation (Virippu Season)

Size of holdings	Distribution of human labour days			Distribution of bullock labour days		
	Ploughing	Other operations	Total	Ploughing	Other operations	Total
0-1.0	15.82	106.46	122.28	17.49	0.81	19.30
1.0-2.5	16.11	92.30	108.41	17.51	0.87	18.32
2.5-5.0	10.51	65.42	75.93	16.01	1.60	17.61
5.0-10.0	9.04	63.71	72.75	13.18	1.45	19.45
10.0-15.0	6.84	54.49	61.33	11.31	1.13	12.44
15.0-25.0	2.84	20.65	23.49	5.63	1.47	7.10
All	6.32	48.16	54.48	10.15	1.23	11.38

Source: Government of India, Ministry of Food and Agriculture, Economics of Farm Management, Kerala, 1962-63.

Note: In the regions where Farm Management Surveys were conducted the normal working day for draught animals was 4 hours.

Table 20: Input of Human Labour and Bullock Labour in Different size of holdings during Virrippu Season, 1973-74

Size of holdings	Distribution of bullock labour days			Distribution of human labour days			
	Ploughing	Other operations	Total	Ploughing	Tilling	Other operations	Total
0-1	7.50	1.02	8.52	9.80	7.80	11.8	134
1.0-2.5	8.80	1.40	10.20	7.80	6.60	92.5	109
2.5-5.0	12.58	2.10	14.65	13.79	2.90	66.30	83
5.0-10.0	12.18	1.90	14.08	14.70	1.20	64.2	80.
10.0-15.0	10.12	2.20	12.32	11.60	1.80	66.1	79.
15.0-25.0	9.18	1.80	10.95	10.80	2.10	59.3	72.
Above 25.0	9.89	1.60	11.49	11.30	1.70	56.7	69.
All	9.75	1.70	11.45	11.60	1.19	56.3	69.0

Source: High Yielding Varieties Programme in Kerala
(Virrippu Paddy 1973-74), An Evaluation Study,
Evaluation Division, State Planning Board,
(Data Unpublished).

labour days employed for ploughing is lower and that employed for filling higher in the size groups (0-1) hectare and (1-2.5) hectare. This suggests that in the smaller size groups there is a tendency to increase the input of human labour and reduce bullock labour. The reduction in bullock use in the smaller size holdings may be due to the following reasons; The ploughing operations for paddy cultivation is highly seasonal and the time span of cultivation basically depends on the availability of water and duration of the crop, the number of crops to be raised etc. The rapid decline in number of draught animals in the State might have created conditions of scarcity of bullocks or tractors at the proper time of cultivation. In areas where supply of labour is abundant there would consequently be a tendency to increase the input of human labour and reduce the output of bullock labour especially 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 extent of area to be ploughed. For instance in Indonesia, it was observed that in larger size plots two buffaloes with plough were found to operate three times faster than in smaller plots. Hand cultivation is therefore more likely to be preferred in smaller plots.$^{6/}$ The predominance of small farms in paddy cultivation in the State may be one of the reasons for the use of handhoe for tilling. The case studies of the two villages we are presenting in the next section will give more supporting evidence.

22. To sum up the expansion of the size of the market for beef and milk when the profitability of milk production has gone up and that of beef production has come down resulted in the improvement in quality and the increase in the number of female cattle population and the reduction in the supply of male cattle population. The re-distribution of wet land holdings

has resulted in the reduction in demand for draught animals. Since the availability of tractor power for ploughing is only marginal in the State, it has led to the expansion of the bullock-rental market and also to the increase in the intensity of human labour input and reduction of bullock labour input in smaller size group of farms.

III
CASE STUDY

23.   Inorder to bring out the changes occuring in the village economy of Kerala consequent on the decline in the number of draught animal and the impact of tractorization we have done case studies of two villages selected from Trivandrum and Palghat districts in the State. The study centres are selected from Trivandrum and Palghat districts for the following reasons: (1) in the Trivandrum district the rate of decline in number of draught animals has been higher and the rate of growth of dairying faster than in other districts; (2) Palghat is one of the main paddy growing belts in the State where the pace of technological change in agriculture has been rapid.

The Hamu Village located at a distance of 8 km. from Trivandrum city is selected from the Trivandrum district. One important feature of this village is the high level development of dairying. There are two diary co-operatives functioning in the village who supply milk to the Central dairy in Trivandrum city. The Erumayoor village selected from Alathur Taluk in Palghat has been getting irrigation water from the Inla puzha project since 1970 when high-yielding paddy were introduced for cul tivation. Irrigation pumps and tractors and electricity began to be used in this village since 1970, while in the neighbouring village similar developments had taken place at an earlier period.

Hundred and fifty households were selected at random from Nonon and hundred and twenty from Erumayoor for the Survey. Data on the pattern of holding of draught animals, on mortality and birth rates, on the types of feed given and production and marketing of milk were collected. The survey was carried out in the first village in December, 1975 and the second Village in January 1976.

24. On the selected housholds in the first village (Nonon) around 31 percent of the area was under paddy cultivation whereas in the second village (Erumayoor) around 82 percent of the area was under foodgrains. Sixtysix out of the 152 households in Village 1 and 92 out of the 120 households in Village II reported paddy cultivation. The distribution of draught animals in the selected households, the number per acre and per holding and the average area under paddy are given in Table 31.

In Village I a large number of small cultivators reported paddy cultivation. Because of the differences in cropping pattern, the average area under paddy is found to be significantly different in the two villages.

15 out of the 66 households in Village I and 72 out of 92 households in Village II which reported paddy-cultivation possessed draught animals. It can be seen that the availability of draught animals per holding and per acre is significantly lower in Village I than in Village II.

One household in Village I and 9 households in Village II owned tractors. The one tractor in Village I is mainly used in transportation. The operational holding of the different household in Village I owning tractors was 13.4 acres. Out of the 9 households in village II possessing tractors 6 households had an average ownership holding of around 22 acres; but the average operational holding was 33.7 acres. Probing questions into the possible under reporting of ownership holding revealed

that benami division of land among members of the same family had been
effected in order to evade land ceiling laws and agricultural taxation.
was also seen that out of the 9 households possessing tractors four house
holds are still tenents and were involved in cases pending decision with
tribunal for obtaining rights from the former jenmies.

25. In Village I tractor is used for transporting coconut and coconut
husks on five days in a week. Probing questions into the non-hiring of
tractors for ploughing revealed the following facts. (1) the size of the
plot under paddy is small; (2) deep ploughing for paddy cultivation is no
existent in this area.

Out of the 92 paddy cultivating households in Village I, 62 reported
hiring of tractors. The use of tractor cultivation was confined to ini-
tial ploughing. The farmers reported three main reasons for this: (1)
tilling operation for virippu start before the beginning the Monsoon when
soil will be hard and initial ploughing with bullock is difficult both fo
and for bullocks; (2) with the introduction of short duration H.Y.V. of
paddy strains the period of ploughing also shortened because of the possi
lity of taking three crops with the available irrigation water; (3) durin
the peak season of cultivation there is shortage of labour. It is also s
that in household hiring tractors they were not needed for ploughing be-
cause the plots are small and scattered over large area. Some households
reported that that tractors were not available during sowing seasons.

The owners of tractors in this village reported on an average 10 days
(8 hours a day) of use   in the season for own cultivation and
for hiring out together. Tractors are occasionally used also in transport
ing manure and fertilisers. One reason given by the farmers for the
underutilisation of tractors is its high horse power and the big size of t
machines which make their use difficult, in smaller plots. The use of

tractors in transportation is limited because of the dominance of peren-
nial crops and plantations in the cropping pattern which does not re-
quire frequent transport of inputs from and output to the market. The
cost per acre of ploughing by using big tractors is also reported to be
higher for large tractors than for hand tractors or power tillers.

Out of the 51 households in village I owning draught animals, 26
households reported hiring of draught animals for ploughing and the re-
maining households did their tilling operations by human labour alone.
The main reason reported for hand cultivation was the scarcity of draught
animals at the proper time of cultivation and the high cost of hiring them.
The cultivators in the intermediate size group also reported saving of
bullock labour by using handhoe for one round of tilling and thus reducing
the number of rounds of draught animal days used. But in the higher size
groups no such saving on bullock labour was reported. The number of days
of draught animal labour per acre is significantly high in the larger hold-
ings as is evident from Table 22. On the other hand in village II the
number of rounds ploughed per acre was high in the smaller holdings and
low in larger holdings. The smaller cultivators in the lower ranges were also
found to hire out bullocks to households owning no draught animals. These
households hired in tractors also whenever available.

The group of households owning tractors also possessed draught animals.
The explanation given for the holding of draught animals along with tract-
ors was partly sociological and partly economic. This group of cultivators
considered the holdings of good quality draught animals socially presti-
gious. All such households cultivated paddy in different plots scattered
over different places and they could not use their tractors for ploughing
in some plots because of their small size and difficulty in moving tractor
from one plot to another due to lack of roads.

The average cost of hiring per pair of draught animals in Village
was 22 whereas in Village II it was around Rs.18. The cost of ploughing
with hired bullock labour in Village I comes to about Rs.223 whereas in
Village II it is about Rs.174.

The functioning of the bullock rental market is found to be linked
to the economic status of cultivators who hire in an hireout bullocks.
For instance the cultivators who advanced money to persons who hire out
bullocks charged no rate of interest on such advances, the only conditio
is that the farmer should see to it that their ploughing operations are
completed in time. The economically better off cultivator who hired out
bullocks realised besides hiring charges, special rights like the right
provide the paddy straw at a pre-determined price and to harvest the cro
in such a way as to maximise his income from harvest wages.

The households hiring in tractors reported that the number of work
animals was not declining due to the hiring of tractors. They also chose
to keep draught animals due to the undertainity of getting tractors at t
proper time of ploughing. The households possessing draught animals but
having no land for cultivation were hiring out bullocks and were thus
earning an additional income. No additional area was however reported to
have been brought under cultivation as a result of the introduction of
tractors.

26. One of the reasons mentioned in the previous section for the decline
in number of draught animals and the increase in number of milch animals
in holding belonging to different size groups was the expansion of the
village market for milk which led to an increase in the number of farmers
taking up dairying as a subsidiary occupation. This hypothesis is further
strengthened by the evidence of the distribution of milch animals in the
different size group of holding and the marketed surplus of milk in the

Table 21: Number of Cultivators reporting paddy cultivation according to size of land holding, the average area under paddy, the number of draught animals for per acre and per holding and its distribution

Size of holding (acres)	Number of cultivators		Average area under paddy (acres)		Distribution of draught animals		Number of households reporting holding of draught animals		Number per acre of area under paddy		Number per household	
	Village I	Village II	Village I	Village II	Village I	Village II	Village I	Village II	Village I	Village II	Village I	Village II
0-1.0	25	11	0.28	0.79	-	12	-	11	-	0.73	-	0.57
1.0-2.5	21	19	0.69	1.72	4	28	3	14	0.27	0.85	-	1.47
2.5-5.0	9	18	0.98	3.71	3	39	3	18	0.34	0.58	0.12	2.17
5.0-10.0	7	16	3.24	8.18	2	57	2	16	0.08	0.39	0.38	3.56
10.0-15.0	3	9	9.32	13.12	4	22	4	9	0.22	0.19	0.38	2.44
15.0-25.0	1	6	13.40	19.17	3	23	3	6	0.22	0.20	1.33	.83
25.0 and above	-	3	-	32.56	-	13	-	3	-	0.13	3.00	4.33
all	66	92	1.40	4.85	16	199	15	77	1.17	0.33	0.24	2.11

Village I: Nemon in Trivandrum District

Village II: Erumyoor in Palghat District.

two villages. The number of households which reported holding of milch animals the average yield per animal and the marketed surplus of milk in the two villages are given in Table 23 and 24.

It is observed that the number of households reporting holding of milch animals is higher in Village I than Village II. The number of milch animals per acre and per holding and the quantity of milk marketed is also higher in this village. The variations observed between the two villages are due to the differences in the size of the market for milk. The milk produced in Village I is marketed through two dairy co-operatives who supply milk to the Central dairy in the Trivandrum city. In Village II there is no organised agency for collection of milk and its distribution outside the Village. Production of milk here is therefore limited by the demand within in the Village.

The marketed surplus of milk in both the villages is found to follow the same trend. As the size of the holding increases the marketed surplus of milk is found to decline. It is also seen that eventhough dairying has developed as a subsidiary occupation in both the villages, development has been higher in Village I which might have contributed to a large extent to the reduction in the number of draught animals.

27. The main findings emerging out of our case study are the following: (1) In village I where the area under paddy per holding is low and the size of the market for milk is higher dairying has developed as a subsidiary occupation at a faster rate than in Village I. The reduction in use of bullock labour and increase in input of human labour is also reported to be taking place in the village. In village II where area under paddy per holding is larger and the size of the market for milk is limited the number of draught animals and the number of tractors available for cultivation is higher. There is considerable under-utilisation of tractors in this village and its

Table 22: Number of rounds ploughed per acre in different size group of Farms

Size of holdings (acres)	Virrippu		Mundakan		Punja	
	Village I	Village II	Village I	Village II	Village I	Village II
0-1.0	1.6	6.2	1.8	8.6	1.8	7.4
1.0-2.5	2.4	7.8	3.4	9.4	2.9	8.6
2.5-5.0	4.2	5.6	4.8	6.2	4.2	5.3
5.0-10.0	4.8	4.8	5.4	4.9	5.1	4.7
10.0-15.0	4.6	4.3	6.3	6.2	5.9	5.8
15.0-25.0	4.1	5.1	4.8	4.8	4.6	4.3
Above 25	-	4.2	-	4.6	..	4.8
All	39	6.3	4.2	7.3	4.2	4.6

Table 23: Number of milch animals per acre and per holding and number of cultivators reporting holding of milch animals

Size of holding (acres)	Number of House-holds		No. of milch animals		No. per acre		No. per household	
	Village I	Village II	Village I	Village II	Village I	Village II	Village I	Village II
0-1.0	57	12	221	16	5.60	1.69	3.88	1.33
1.0-2.5	35	14	145	22	2.55	0.91	6.14	1.57
2.5-5.0	16	18	61	34	1.10	0.54	3.81	1.89
5.0-10.0	7	16	33	46	0.65	0.35	4.71	2.56
10.0-15.0	3	9	19	34	0.48	0.29	6.33	3.78
15.0-25.0	1	6	9	29	3.57	0.25	9	4.63
Above 25	-	3	-	16		0.16	-	5.33
All	119	78	488	197	1.74	0.35	4.07	2.53

Table 24: Average number of animals in milk at the date of survey and the marketed surplus of milk among different size of producers

Size of holding	Number of animals in milk		Average No. per holding		Average yield per animal in milk (litres)		Total production of milk for 90 days per household (litres)		Marketed Surplus of milk (as % of total)	
	Village I	Village II	Village I	Village II	Village I	Village II	Village I	Village II	Village I	Village II
0-1.0	149	7	2.61	0.58	3.21	1.84	754	95	91.6	48.2
1.0-2.5	84	9	2.40	0.64	2.92	1.68	631	97	87.4	44.2
2.5-5.0	29	14	1.81	0.78	3.17	1.98	516	139	73.3	44.3
5.0-10.0	14	26	2.00	1.63	2.89	2.16	520	316	69.5	38.3
10.0-15.0	8	16	2.16	1.78	2.54	1.92	610	306	67.2	26.1
15.0-25.0	4	13	4	2.17	2.40	1.86	864	362	63.4	23.4
25 and above	-	6	-	1.00	-	1.92	-	330	-	19.6
All	229	94	2.40	1.31	2.53	2.07	3895	164	74.1	32.4

use has not led to any significant reduction in draught animal population.

CONCLUSION

28.   The reduction in draught animal population in Kerala has taken place mainly through the price mechanism from the supply side and changes in the distribution of land holdings from the demand side. Since the availability of tractor power in the State is negligible it resulted in the intensive use of bullocks/buffaloes and also in the reduction in use of animal power and increase in input of human labour in small size of farms. In the absence of reliable and sufficient data on the input of human and bullock labour in different size group of farms it is not possible to say whether the relation between them is one of substitutability/of complimentarity.

Even in regions where the intensity of tractorization is higher in the State, its utilisation rate is reported to be low and has not led to any significant reduction in the number of draught animals. In this situation the increase in tractorisation in the State can only lead to unproductive investment because it is not associated with any substantial reduction in draught animal population and will only aggrevate the rural unemployment.

NOTES AND REFERENCES

1. See K.Narayanan Nair, Size and Pattern of Bovine holdings in Kerala, (unpublished), Centre for Development Studies, Trivandrum.

2. The other States which recorded decline in draught animal population in India are Maharashtra and Gujarat. In these States it is found to be due to the reduction in cropped area.

3. A positive relation between price of draught cattle and price of food-grain was observed in the case of Andhra Pradesh and Punjab. See C.H.Hanumantha Rao, Technological Change and Distribution of Grains in Indian Agriculture, Mac Millan, New Delhi.

4. The outturn of paddy is estimated by using the following formula:

$$S = 2 \ P \cdot r \quad \text{where}$$

S = quantity of straw produced per annum

P = quantity of Paddy produced per annum

r = straw grain ratio

5. A study on the economics of tractor cultivation in Kerala shows that the cost of traditional ploughing by bullocks is significantly higher than tractor ploughing. See, Government of Kerala, State Planning Board, Evaluation Series, No.13, Impact of Tractor use on the Farm Economy of Kerala.

6. See Ester Bosrup, Conditions of Agricultural Growth, Economics of Agrarian Change under Population Pressure. Goorge Allen and Unwin L.T.D.