

FOREWORD

The urgent need of Kerala in the field of agricultural development is evolution of an agricultural technology suitable for the small holdings. Mechanisation in such a technology has necessarily to be one using small and simple machines. Power tiller is one such machine which can fit into a small-holding-oriented technology.

The Government of Kerala has rightly initiated a programme for the assemblage and distribution of power tillers to cultivators through the Agro-Industries Corporation. The success of such a programme will depend upon convincing the farmers about the advantage of using the power tillers in place of the conventional methods. It has to be ascertained how far the use of power tillers will displace labour which is a burning socio-economic problem of the State. The difficulties faced by the farmers while taking up the use of power tillers have to be identified and promptly remedied so that the use of this machine can become popular and universal fast.

In view of the facts mentioned above a study on the use of power tillers was undertaken by the Kerala Agricultural University at the instance of Kerala Agro-Industries Corporation. The Corporation contributed Rs. 12,500 being 50 per cent of the expenditure involved for the study. This contribution of the Corporation is gratefully acknowledged.

The study was undertaken guided and supervised by Sri. K. S. Karayalar, Junior Professor of Agricultural Economics, College of Agriculture, Vellayani. The team who undertook the study consisted of the following officers:

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The present study is only of a preliminary nature and the findings are significant to that extent. A perusal of the findings indicates that there is need to undertake more objective studies on the impact of the use of power tillers on the productivity of the land. The possibility of diversifying the use of power tillers also needs further pointed studies. There is no doubt that the power tiller can be moulded into a versatile machine of the small farmer helping him in ensuring economic returns from his holding.

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Dated: 12-9-1973)

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A Study on the use of Power Tiller and its Impact on the Farm Economy of Kerala

1. INTRODUCTION :

For developing countries like India, mechanisation of agriculture is important for improving agricultural productivity.

Fundamentally, the major aims of agricultural mechanisation in a country should be to economically increase the food resources, to reduce drudgery in farming and to assist in creating a gross national product. A technically efficient agriculture would increase agricultural productivity most rapidly. To achieve agricultural efficiency a minimum power range of 0.5 to 0.8 horse power per hectare mechanical power is necessary. While in Japan a mechanical power of 2.664 horse power per hectare is available, in India it is only 0.008 per hectare. The horse power available per agricultural worker in Japan is 1.388 per hectare as against 0.335 in India. Research indicates that atleast 0.50 horse power per hectare of cropped area should be available if some productivity increase is expected. This amount of power will shorten the work day reduce human muscle use and drudgery in farming (Agricultural mechanisation in South East Asia, 1971-Farm Machinery Industrial Research Corporation, Tokyo, Japan.)

Until the advent of planning, Indian agriculture had to depend mainly on animal power and traditional agricultural implements for the various agricultural operations. With the implementation of Five Year Plans, the agricultural outlook of our country has improved substantially. During the past ten years there has been an unprecedented rise in the demand for all types of farm machineries and equipments. Farmers more than ever before, are eager to buy well designed tools and equipment for maximising production from land. With the rise in wages of manual labour and cost of maintenance of bullocks, use of labour saving machineries is gaining popularity among the farmers.

Mechanisation of agriculture as is practiced in advanced countries, cannot be transplanted to the developing countries where unemployment and under employment in rural areas is the rule. The problem must therefore be approached by adopting a suitable technology, giving due consideration for the probable labour displacement. In terms of agricultural mechanisation, this means using machines of small capacity so that a large number of machines can be operated thereby minimising the displacement of labour.

The two wheeled power tiller has proved to be the suitable machine for this purpose for many reasons, chiefly that it can be utilised to the maximum under the prevailing conditions of small holdings. The power tiller is quite versatile and can be readily adapted to operate systems of multiple cropping that are being introduced

at present. The multipurpose use of power tillers for such purposes as tilling, harrowing, threshing, pumping water and transportation is helpful for small farmers. Technically, small tillers are more efficient than animal drawn implements.

2. SOURCE OF SUPPLY AND AGENCIES OF DISTRIBUTION:

A large number of power tillers have been imported into the country for studies and several makes such as Akitu, Yanmar, Mitsubishi, Satoh, Kubota, Hako and Agria have undergone studies at various research centres. A few machines like Kubota, Krishi and Mitsubishi have come under indigenous production. Since production is far below the requirement, the gap between indigenous availability and demand, is partially met out of imports of Yanmar, Kubota, Mitsubishi, Iseki and Satoh power tillers from Japan. The working group on Agricultural machinery and implements has estimated the demand of power tillers in India during 1973-74 at 80,000 numbers.

The following firms have been licenced for manufacture of power tillers in the country. *

Sl. No.	Name of firm	Brand Name	Sanctioned capacity per year.
1.	Krishi Engines	KRISHI	3,000
2.	VST Tractors and Tillers	MISTUBISHI	5,000
3.	JK Cotton Mills	SATO	6,000
4.	Indequip Engg. Co.	ISEKI	10,000
5.	Beegee Corporation	HAKO	15,000
6.	Maharashtra Engineering Co-operative Society	YANMAR	4,000
7.	Southern India Corporation	LANDMASTER	10,000
8.	Kerala Agro Industries Corporation	KUBOTA	2,0001

(* Source-Kerala Agro-Industries Corporation)

Of the above only firm Nos. 1, 2, 3, 4, 6 and 8 have commenced either assembly or manufacture so far.

The acquisition and distribution of power tillers is at present entrusted with the Agro-Industries Corporations, set up in the various States in the contry. In Kerala, the Agro-Industries Corporation was established in November 1968. The corporation is now supplying power tillers to the cultivators on hire purchase basis.

3. THE STUDY :

With the introduction of high yielding varieties and multiple cropping programmes in Kerala, time becomes critical to the farmer. Farming operations which could be done in the past at a more leisurely pace, has now to be carried out under a very tight schedule. As a result the demand for power tillers, is increasing steadily. Nothing is however known about the implications of the use of power tillers on the farm economy of Kerala. Hence the Kerala Agricultural University in collaboration with the Kerala Agro-Industries Corporation decided to take up a study covering the following main objects.

- i. To make a comparative study of the preparatory cost of cultivation (Tillage operations) for paddy crop using the power tiller and the conventional implements.
- ii. To estimate the possible displacement of labour by the use of power tiller.
- iii. To investigate the measures considered necessary for providing alternate employment to the displaced agricultural labour.

4. METHOD OF STUDY :

4. 1. Period and Coverage :-

The study was conducted during June 1973 with 1972-73 as reference period. It covered the Districts of Trichur and Palghat, which are the major rice producing Districts in the State and which offer greater scope for mechanisation.

The relevant details required for the study were collected by interviewing selected farmers coming under the category of those who were using power tillers and those who used conventional implements for their cultivation. The collection of the data was done by four Research Assistants under the direct supervision of a Research Officer. The overall technical control of the study was with the Division of Agricultural Economics, College of Agriculture, Vellayani. The total duration of the scheme was for a period of six months with effect from 26-2-1973.

4. 2. Sampling design and samples selected :

The selection of cultivators using power tillers was made on the basis of the list furnished by the Managing Director, Kerala Agro-Industries Corporation, Trivandrum. The entire sample of 32 cultivators of Trichur District and 6 of Palghat District using power tillers were selected for the study.

Cultivators using traditional implements were selected by random sampling methods. Cultivators residing in the same locality of the power tiller users and

possessing more or less the same area were considered for the selection of the samples. A total number of 28 traditional cultivators selected at random were interviewed.

A Service Co-operative Society possessing a Power tiller was also covered for the study.

5. RESULTS OF THE STUDY:

5. 1. Area operated by Power Tiller:

The analysis of power tiller efficiency was mainly made in respect of ploughing of paddy fields. Paddy is the principal crop for which power tiller is now being largely used. Thirtyeight cultivators possessing power tillers, were interviewed. The net area under cultivation was 226.9 hectares and the gross area was 403.2 hectares. The details of area are provided in Appendix I A. The crops cultivated were mainly paddy, coconut, arecanut, tapioca and others like pulses. The net area under paddy was 141.4 hectares, the gross area being 317.7 hectares. The viruppu crop covered 98.9 hectares, mundakan 132.4 hectares and punja 86.4 hectares. Of the total cropped area ploughing with power tillers accounted for 99.1 percent. The data on paddy cultivation using power tillers are presented in Table 1.

It may be seen that 37 out of 38 cultivators have ploughed all their fields with power tillers. Cultivator No. 13 has ploughed only 75 percent of his total area using power tiller, as the rest of the area was marshy, where power tiller could not be worked.

On the basis of the size of the gross cropped area under paddy, the 38 cultivators can be grouped as follows.

i.	Those cultivating below 2 hectares	...	2 Nos.
ii.	„ between 2 to 5 hectares	...	12 „
iii.	„ between 5 to 10 hectares	...	19 „
iv.	„ above 10 hectares	...	5 „

While cultivator No. 30 had a cropped area of one hectare only, cultivator No. 36 had the largest cropped area of 48 hectares.

5. 2. Cost of ploughing by power tiller:

The cost of operations by power tiller includes both fixed charges and operational costs. The fixed charges are the depreciation, insurance, interest and annual repair and maintenance charges. The operational costs for ploughing include the cost of fuel and lubricants and wages to driver.

5. 2. 1. Operational costs:

The operational costs for ploughing one hectare of paddy field is worked out in Table 2.

TABLE I

Area operated by power tiller for puddling operation during the different cropping seasons.

Cultivator No.	VIRIPPU			MUNDAKAN			PUNJA			TOTAL AREA			
	Total area (hect)	Operated by power tiller (hect)	Duration of operation (in days)	Total area (hect)	Operated by power tiller (hect)	Duration of operation (in days)	Total area (hect)	Operated by power tiller (hect)	Duration of operation (in days)	Total area (hect)	Operated by power tiller (hect)	Duration of operation	(in days) Percentage under power tiller to total area under paddy
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	1.6	2.6	6	3.2	3.2	8	1.8	1.8	5	7.6	7.6	19	100
2	2	2	5	2	2	5	2	2	5	6	6	15	100
3	2	2	6	2	2	5	2	2	5	6	6	16	100
4	3	3	8	3	3	8	3	3	7	9	9	23	100
5	0.8	0.8	2	0.8	0.8	2	0.8	0.8	2	2.4	2.4	6	100
6	1	1	2	1.5	1.5	4	1	1	2	3.5	3.5	9	100
7	3	3	8	3	3	8	3	3	7	9	9	23	100
8	...	...	...	4.8	4.8	12	...	...	...	4.8	4.8	12	100
9	1	1	3	1	1	3	1	1	2	3	3	8	100
10	2	2	6	3.2	3.2	10	2.8	2.8	5	8	8	21	100
11	3.2	3.2	10	3.2	3.2	10	...	...	...	6.4	6.4	20	100
12	3	3	8	3	3	7	...	...	...	6	6	15	100
13	2	1	4	2	1.5	4	...	...	...	3	3	8	100
14	3.2	3.2	10	3.2	3.2	10	...	...	...	6.4	6.4	20	100
15	...	...	...	1.6	1.6	3	1.6	1.6	3	3.2	3.2	6	100
16	0.8	0.8	2	0.8	0.8	2	0.8	0.8	2	2.4	2.4	6	100
17	2.8	2.8	8	2.8	0.8	6	...	...	...	5.6	5.6	14	100
18	1	1	3	1	1	3	1	1	3	3	3	9	100
19	2	2	5	2	2	4	2	2	6	6	6	15	100
20	1	1	3	1	1	3	1	1	5	3	3	8	100
21	2.8	2.8	8	2.8	2.8	6	...	...	...	5.6	5.6	14	100

TABLE 1 (contd)

Cultivator No.	VIRIPPU			MUNDAKAN			PUNJA			TOTAL AREA			
	Total area (hect)	Operated by power tiller (hect)	Duration of operation (in days)	Total area (hect)	Operated by power tiller (hect)	Duration of operation (in days)	Total area (hect)	Operated by power tiller (hect)	Duration of operation (in days)	Total area (hect)	Operated by power tiller (hect)	Duration of operation (in days)	Percentage under power tiller to total area under paddy
1	2	3	4	5	6	7	8	9	10	11	12	13	14
22	...	...	...	4.8	4.8	13	4.8	4.8	13	9.6	9.6	26	100
23	4	4	8	4	4	9	4	4	9	12	12	26	100
24	...	...	...	1.6	1.6	2	...	...	...	1.6	1.6	2	100
25	2	2	10	2	2	9	2	2	11	6	6	30	100
26	4.8	4.8	8	4.8	4.8	6	...	...	...	9.6	9.6	14	100
27	1.8	1.8	5	13.6	13.6	35	13.6	13.6	35	29	29	75	100
28	4	4	18	4	4	10	1	1	3	9	9	23	100
29	8	8	20	10	10	25	2	2	5	20	20	50	100
30	1	1	3	...	...	...	...	...	...	1	1	3	100
31	1.3	1.3	3	1.3	1.3	3	...	...	...	2.6	2.6	6	100
32	6	6	15	10	10	25	12	12	30	28	28	70	100
33	4	4	10	4	4	10	1.6	1.6	3	9.6	9.6	23	100
34	2.8	2.8	7	2.8	2.8	7	...	...	...	5.6	5.6	14	100
35	4	4	10	2	2	5	2	2	5	8	8	20	100
36	16	16	40	16	16	40	16	16	30	48	48	110	100
37	...	...	...	1.6	1.6	4	1.6	1.6	4	3.2	3.2	8	100
38	...	..	...	2	2	5	2	2	5	4	4	10	100
Total	98.9	98.4	257	132.4	131.9	331	86.4	86.4	209	317.7	316.7	797	99.1

TABLE 2

Cost of operation per hectare with power tiller of puddling in paddy fields

Cultivator No.	Area covered (Hect)	Total days operated	Cost of fuel and lubricants Rs.	Wage of driver Rs.	Total operational cost Rs.	Cost per Hectare Rs.
1	2	3	4	5	6	7
1	2.6	19	285	152	437	57.50
2	6	15	210	120	330	55.00
3	6	16	240	128	368	61.30
4	9	23	322	184	506	56.22
5	2.4	6	84	48	132	55.00
6	3.5	9	126	72	198	56.60
7	9	23	299	184	483	53.67
8	4.8	12	180	96	276	57.50
9	3	8	112	64	176	58.67
10	8	21	296	168	464	58.00
11	6.4	20	360	100	460	71.87
12	6	15	150	120	270	45.00
13	6	8	80	64	144	36.00
14	6.8	20	200	200	400	58.50
15	3.2	6	75	72	147	45.93
16	2.4	6	90	48	138	57.50
17	5.6	14	210	112	322	57.50
18	3	9	120	180	300	100.00
19	6	15	180	150	330	55.00
20	3	8	104	80	184	61.33
21	5.6	14	182	140	322	57.14
22	9.6	26	400	260	660	68.75
23	12	26	260	260	520	43.33
24	1.6	2	25	16	41	25.86

TABLE 2 (contd.)

Cost of operation per hectare with power tiller for puddling in paddy fields

Cultivator No.	Area covered (Hect)	Total days operated	Cost of fuel and lubricants	Wage of driver	Total operational cost	Cost per Hectare
			Rs.	Rs.	Rs.	Rs.
1	2	3	4	5	6	7
25	6	30	240	360	600	100 00
26	9.6	14	224	210	434	45.20
27	29	75	850	750	1600	55.10
28	9	23	250	230	488	53.30
29	20	50	600	500	1100	55 00
30	1	3	30	30	60	60 00
31	2.6	6	70	60	130	50.00
32	28	70	800	700	1500	53.50
33	9.6	23	250	230	480	50 00
34	5.6	14	180	140	320	57 10
35	8	20	200	200	400	50 00
36	48	110	1300	1100	2400	50 00
37	3.2	8	100	80	180	50 62
38	4	10	120	100	220	55 00
Average	8.4	19.3	258	202.70	460 80	54 80

TABLE 3

Operational cost for traditional ploughing of one hectare of paddy crop

Cultivator No.	Cost of maintenance per pair per day	Plough man cost per day	Total cost per pair per day	Pair of animals used for ploughing	Area covered (Hect)	Cost of ploughing per hectare
	Rs.	Rs.	Rs.			Rs.
1	2	3	4	5	6	7
1	2.50	5.00	7.50	90	3	225.00
2	4.30	5.00	9.30	180	6	279.00
3	4.15	5.00	9.15	192	6.4	274.50
4	6.36	5.00	11.36	121	4.2	322.69
5	4.30	5.00	9.30	93	3	288.30
6	4.40	5.00	9.40	60	2	282.00
7	3.50	4.00	7.50	168	5	225.00
8	4.00	4.00	8.00	70	2.4	233.33
9	4.00	4.00	8.00	330	11	240.00
10	4.00	4.00	8.00	180	6	240.00
11	—	—	16.00	90	3	480.00
12	3.25	5.00	8.25	468	15.6	247.50
13	4.72	4.50	9.22	90	3	276.60
14	4.50	5.00	9.50	72	2.2	285.00
15	—	—	15.00	42	1.4	450.00
16	2.75	5.00	7.75	15	0.5	232.50
17	3.78	4.00	7.88	264	8.8	236.40
18	8.00	5.00	13.00	72	2.4	390.00
19	6.00	5.00	11.00	84	2.8	330.00
20	6.00	6.00	12.00	126	4.2	360.00
21	6.00	6.00	12.00	120	4	360.00
22	5.00	5.00	10.00	240	8	300.00
23	6.00	6.00	12.00	42	1.4	360.00
24	—	—	— hiring @ Rs. 10.00 days	60	2	300.00
25	6.00	6.00	12.00	90	3	360.00
26	6.00	6.00	12.00	120	4	360.00
27	5.00	6.00	11.00	180	6	330.00
28	5.00	6.00	11.00	600	20	330.00
Average	4.30	4.50	8.80	152	5	307

The cultivators usually give two ploughings for the proper preparation of the field before planting. On an average 2.3 days are required for preparing one hectare of wet land. Taking a working day as 8 hours it takes about 18 hours for preparing one hectare. The cost of fuel and lubricants and the wages for the driver for preparing one hectare of paddy land works out to Rs. 30.70 and Rs. 24.10 respectively. The total operational cost thus works out to Rs. 54.80 per hectare. In other words the cultivator on an average spends Rs. 1.70 towards cost of fuel and lubricants and Rs. 1.35 towards labour charges per hour of operation of the power tiller. The operational cost thus works out to Rs. 3.05 per hour.

5. 2. 2. Fixed charges :

The fixed charges for Kubota power tiller as per the calculations of the Kerala Agro-Industries Corporation works out to Rs. 2.95 per hour. In view of the fact that all the 38 cultivators are using only Kubota power tiller, the fixed charges have been uniformly taken as Rs. 2.95 per hour, which works out to Rs. 53.10 per hectare.

5. 2. 3. Total cost of ploughing :

The total cost of ploughing per hectare by power tiller is furnished below:

i. Operational cost per hectare	Rs.	54.80
ii. Fixed charges per hectare	Rs.	53.10
Total cost per hectare	Rs.	107.90

5. 3. Traditional ploughing :

As part of the enquiry, 28 cultivators, who were entirely dependent on animal power for preparation of their lands for paddy cultivation, were interviewed for collecting data on cost of traditional ploughing.

The total cropped area under paddy by these cultivators was 141.3 hectares and the net area 63 hectares. The details of area under paddy and other crops cultivated by the 28 traditional cultivators are furnished in Appendix 1. B.

A total number of 52 pairs of work animals are owned and maintained by 25 traditional cultivators while the other 3 cultivators (Nos. 11, 15 and 24) carry out the fixed operations by hiring out pairs from outside. The details of pairs maintained by each cultivator and the cost of maintenance of pairs are shown in Appendix II.

5. 3. 1. Cost of traditional ploughing :

The cost of traditional ploughing includes operational cost as well as overhead cost. The operational costs comprise cost of maintenance of animals and wages for the ploughmen. The overhead costs consist of depreciation towards the cost of the animals and the interest which accrued on the capital invested.

The operational cost and the overhead cost of ploughing per hectare of paddy crop are worked out in Tables 3 and 4.

TABLE 4

Over head cost of traditional ploughing per hectare of paddy field

Cultivator No.	Cost of work animals Rs.	Depreciation per annum @ 5% Rs.	Interest per annum @ 5% Rs.	Total over head cost Rs.	Over-head cost per day	Over-head cost per hectare
1	2	3	4	5	6	7
1	600	60	30	90	0.24	7.20
2	1000	100	50	150	0.41	12.30
3	1000	100	50	150	0.41	12.30
4	1000	100	50	150	0.41	11.48
5	1000	100	50	150	0.41	12.70
6	2200	220	100	330	0.90	27.00
7	1800	180	90	270	0.74	22.20
8	800	80	40	120	0.33	9.57
9	3300	330	195	495	1.38	41.40
10	2400	240	120	360	0.98	29.40
11	—	—	—	—	—	—
12	1000	100	50	150	0.41	12.30
13	600	60	30	90	0.24	7.20
14	400	40	20	60	0.16	4.80
15	—	—	—	—	—	—
16	600	60	30	90	0.24	7.20
17	1900	190	95	285	0.26	7.80
18	1000	100	50	150	0.41	62.50
19	1000	100	50	150	0.41	44.10
20	1000	100	50	150	0.41	35.70
21	1000	100	50	150	0.41	37.50
22	1000	100	50	150	0.41	11.30
23	1000	100	50	150	0.41	107.10
24	—	—	—	—	—	—
25	1000	100	50	150	0.41	50.00
26	1000	100	50	150	0.41	37.50
27	1000	100	50	150	0.41	13.60
28	1000	100	05	150	0.41	7.50
Average	1138.40	113.84	56.92	170.75	0.44	24.30

Most of the cultivators maintain the work animals throughout the year for the reason that during busy seasons there was heavy pressure of demand for work animals as a result of which the animals were not available for field operations in time. Another advantage of maintaining animals was the availability of dung and urine, which were preserved and applied as manure to the field.

The annual cost of maintenance per pair varied from Rs. 912.50 to Rs. 2317.15 depending on the quantity and type of feed fed to the animals. The average cost of maintenance per day worked out to Rs. 4.30.

The average total cost per pair per day including the ploughman cost was Rs. 8.80. Usually 30 pairs were required for ploughing one hectare of paddy land. The average cost of ploughing per hectare of land for the 28 traditional cultivators was Rs. 307.00.

The average overhead cost per day worked out to 44 paise. The overhead cost per hectare was Rs. 24.30.

5. 3. 2. Total of ploughing

The total cost of ploughing per hectare in the traditional way furnished below:

i. Operational cost per hectare	...	Rs. 307.00
ii. Overhead cost ,,	...	Rs. 24.30
Total cost per hectare	...	<u>Rs. 321.30</u>

6. TOTAL COST OF PLOUGHING - A COMPARISON:

A comparative statement of total cost of ploughing using power tiller and animal power is given in Table 5.

TABLE 5

Total of ploughing (Average) per hectare of paddy field

Nature of Power used	Operational Cost Rs.	Fixed Cost Rs.	Total Rs.
1. Power Tiller	54.80	53.10	107.90
2. Animal Power	307.00	24.30	331.30

For the cultivators using power tillers the total cost involved was Rs. 107.90 per hectare as against Rs. 331.30 per hectare for the traditional type of cultivators.

Thus the power tiller user could reduce the total cost of ploughing by Rs. 223.40 per hectare. This naturally reduces the overall cost of cultivation thereby increasing the net return per unit area.

7. UTILISATION OF HOWER TILLER:

7. 1. By Service Co-operative Society:

The data collected from the records of the Co-operative Society, Cherplachery, in Palghat District, regarding the utilisation of the Kubota power tiller possessed by them are presented in Table 6. This Society is hiring the power tiller to cultivators for ploughing only.

TABLE 6

Utilisation of power tiller by the Cherplachery Co-operative Society during 1972

Month	No. of hours hired	Income	Remarks
January	nil	nil	
February	60	403	Rate of hire at Rs. 8 per hour
March	74	592	
April	51	403	
May	57	456	
June	48	384	
July	51	403	
August	19	152	
September	77	770	Rate of hire enhanced to Rs. 10 per hour
October	40	400	
November	33	330	
December	19	190	
Total	529	4570	

Expense towards oil, servicing, repairs and wages, to driver	2050
Profit:	2520

7. 2. By Power Tiller Owners:

Some of the cultivators owning power tillers also hire out their machines to other cultivators for ploughing purpose. The details of hire are given in Table 7.

Utilisation of power tiller by some cultivators during 1972

Cultive- tor No.	No. of hours hired	Rate of hire per bour Rs.	Gross income Rs.	Net income Rs.
29	250	15	3750	2500
30	150	15	2250	1250
32	300	15	4500	3000
33	150	15	2250	1250
34	250	15	3750	2000
35	200	15	3000	2000
36	300	15	4500	3000
37	200	15	3000	2000

Such practice of hiring out the power tillers results in quicker additional returns to the owners thereby reducing the financial strains caused to them due to initial capital investments for the purchase of power tillers and also due to frequent repairs to the machine.

8. COMPARISON OF COST OF TILLAGE BEFORE AND AFTER PURCHASE OF POWER TILLER:

During the course of study, a comparison was also made on the labour engaged and cost of tillage operations for paddy crop before and after purchase of power tiller.

The details gathered from the 38 power tiller owners are presented in Table 8.

On an average a cultivator engaged 20 pairs and 20 men per hectare before the purchase of the power tiller involving a cost of Rs. 275-60. But after the purchase of the power tiller the labour engaged was reduced to 2 pairs and 4 men including 2 power tiller operators per hectare involving a cost of Rs. 35-30. Thus there is a difference of cost of Rs. 240-30 which is a saving to the cultivator after the purchase of the power tiller.

8. 1. Labour displacement:

From the details presented in Table 8, it may be seen that on an average 18 pairs of animals and 16 men are displaced per hectare of paddy area as a result of introduction of power tillers.

The above figures apparently give an alarming picture of the labour force that may be displaced from the agricultural sector of our State as a result of the

TABLE 8

Comparison of labour engaged and cost of tillage operations in paddy before and after purchase of power tiller.

Cultivator No	Labour engaged and cost						Difference of cost Rs.
	Before purchase of tiller			After purchase of tiller			
	Pairs	Men	Cost	Pairs	Men	Cost	
1	228	228	3420	19	19	152	3268
2	186	186	2790	15	15	120	2670
3	180	180	2700	16	16	128	2572
4	279	279	3906	23	23	184	3722
5	72	72	1152	6	6	48	1104
6	105	105	1680	9	9	72	1608
7	270	270	4050	23	23	184	3866
8	144	144	2304	12	12	96	2208
9	93	93	1395	8	8	64	1331
10	240	240	3600	21	21	168	3432
11	200	200	2000	—	20	80	1920
12	225	225	2250	—	30	120	2130
13	120	120	1200	—	16	64	1136
14	192	192	1920	—	40	160	1760
15	95	95	760	—	6	72	688
16	72	72	1152	6	12	144	1008
17	168	168	2688	—	14	112	2576
18	90	90	720	—	18	180	540
19	180	180	1440	—	15	150	1290
20	90	90	720	—	8	80	640
21	158	158	1264	—	14	140	1124
22	300	300	2400	—	26	260	2140
23	300	300	2400	—	26	260	2140

TABLE 8 (contd.)

Comparison of labour engaged and cost of tillage operations in paddy before and after purchase of power tiller

Cultivator No.	Labour engaged and cost						Difference of cost Rs.
	Before purchase of tiller			After purchase of tiller			
	Pairs	Men	Cost	Pairs	Men	Cost	
24	45	45	360	—	2	16	344
25	180	180	1140	—	30	360	1080
26	278	278	4170	—	14	210	3960
27	580	580	4640	75	150	1500	3140
28	270	270	2160	27	150	500	1660
29	600	600	4800	50	100	1000	3800
30	30	30	240	3	6	60	180
31	80	80	640	10	16	160	480
32	840	840	6720	70	140	1400	5320
33	290	290	2320	55	78	780	1540
34	170	170	1190	30	44	440	750
35	240	240	1680	20	40	400	1280
36	1120	1120	7840	—	110	1100	6740
37	100	100	700	8	16	144	556
38	120	120	840	10	20	180	660
Average	235	235	2306.60	13.5	45.5	297.10	2009.50
Average per Hectare	20	20	275.60	2	4	35.30	240.30

introduction of power tillers and like machineries. But it can be said from our experience during the past ten years of introduction of tractors that mechanisation of farm operations, especially the ploughing operations will not be a serious threat to the interest of the agricultural labour of our State. Such shortrun dislocation of labour is bound to occur in the initial phases of mechanisation of agricultural operations. But in the long run, mechanisation will ensure greater employment opportunities by intensification of agriculture.

A study carried out by the Punjab Agricultural University has shown that the pattern of mechanisation which has been followed in Punjab has resulted in increased employment of human labour, due to increase in crop intensity and increased crop production per unit by time and area. It has shown that labour and machinery are essentially complimentary and when they combine they can tackle increased volume of work. There is more demand for human labour and less for bullock power. Due to increased intensity of cropping, Punjab has experienced a labour shortage at peak periods. (Intensive Agricultural Independence Silver Jubilee Number, November 1972)

The experience of Punjab can be of Kerala also in due course. With the introduction of free education and agrarian reforms in Kerala and the changing sociological factors there is a growing tendency among the labour class, especially agricultural labour, to leave their traditional occupations and seek new gainful employment opportunities, which may give them a steady income. Under such conditions the possible displacement of labour by the introduction of power tillers may not be a serious problem in the immediate future.

8. 2. Alternate employment to displaced labour:

As mechanisation expands, the overall agricultural labour demand will decrease and the labour then seeks other gainful employment. Some of the displaced farm labour can be properly trained to find opportunities in agriculturally related occupations. The expansion of agricultural mechanisation is intertwined with industrial and commercial development and the absorption of displaced labour by industries creates a sound economic development which increases agricultural productivity. More industries should be started to manufacture domestically fertilizers, agricultural chemicals, farm machinery and other agricultural inputs. Such industries will provide ample scope of employment for the displaced labour. Starting of industries being a slow process, other ways also should be thought of to provide immediate employment to displaced labour. Schemes like cattle and poultry improvement programmes recently launched by the State Government will go a long way to solve this problem.

9. IMPACT ON PRODUCTIVITY:

Agricultural productivity is controlled by factors like soil conditions, climate, inputs like seed fertilizers and pesticides and above all availability of irrigation

facilities. The success of the intensive agricultural development programmes launched by the State depend on the timely availability and application of the above mentioned inputs.

During the Third and Fourth Five Year Plans special emphasis was given to the agricultural development programmes on more scientific and modern lines. The farmer now is quite different from the farmer ten years ago. The present day farmers have become fully conscious of the use of improved seeds, fertilizers, pesticides and other inputs in raising the crop yields. During the last five years mechanisation in agriculture is slowly gaining momentum and there is increasing demand for tractors and power tillers.

The first basic need for good crop growth is a good seed bed having adequate depth and free from weeds for good germination and root development. This operation is being done with wooden ploughs by a series of repetitive operations. Lack of penetration and narrow working width are some of the deficiencies of this implement, resulting in poor quality work and low turn over. A good combination of improved tillage implements worked by machineries like tractor or power tiller can complete the operation saving considerably both time and cost as compared to traditional ploughing. There is therefore greater scope for achieving timeliness in operation which is necessary to raise the yield. Another distinct advantage is the enormous reduction in the strain on the man and animals involved in walking long distances during ploughing.

The use of the above machineries makes it possible to the farmer to go in for multiple cropping where the limited time available between the crops calls for the use of faster working implements having greater outturn. With good soil preparation, timely sowing or planting and adoption of multiple cropping, productivity can be raised to a considerable extent.

Thus the impact of the use of power tillers for ploughing operations in our paddy lands consists not only in a rise in the per acre productivity but also in an appreciable increase in the overall production of paddy in our State.

10. IMPACT ON AGRICULTURAL ECONOMY OF THE STATE

It can be surmised from the foregoing analysis that the Agricultural economy of our State can be considerably improved by the introduction of machineries like tractors and power tillers which can help our farmers to conduct their agricultural operations in time and resort to multiple cropping methods. Timely cultivation and multiple cropping can contribute to the increase in the overall production of rice in our State.

According to 1972 statistics, the total area under rice in Kerala was 875157 hectares made up of 395298 hectares under viruppu, 381971 hectares under mundakan,

and 97888 hectares under punja. The total production of rice was 1351733 tons made up of 552246 tons during viruppu, 596808 tons during mundakan and 203834 tons during punja seasons. About 80 percent of the land holders consists of small and medium land holders owning areas between 0.15 and 7.0 hectares. These small and medium farmers, who form the majority have to be enabled in modernising their farm operations by providing power tillers on hire basis at reasonable rates. This can be done by the Agro-Industries Corporation by setting up machinery hiring units at suitable centers all over the paddy growing areas of the State.

There is no experimental data to estimate the actual extent of increase in production of rice by adopting timely agricultural operations including proper preparation of land etc. It could be roughly ascertained from the cultivators using power tiller that upto 10 percent increase in yield could be obtained by using machineries like power tillers. Thus by popularising the use of power tillers alone among the small and medium land holders in paddy, an overall increase of 10 percent in the present rice production in the State can be expected.

Mechanisation of tillage operations coupled with multiple cropping will definitely contribute increased production of rice and stabilise to some extent the agricultural economy of the State and also ensure greater employment opportunities to the agricultural labour.

11. DIFFICULTIES OF POWER TILLER USERS AND RECOMMENDATIONS THEREON:

During the course of the enquiry the power tiller owners expressed the following difficulties now experienced by them.

1. Lack of spare parts for power tiller in the local markets.
2. High cost and poor quality of the spare parts supplied to them.
3. High cost of repairing and servicing charges of the Agro-Industries Corporation.
4. High cost of plough sets.
5. Absence of facilities and arrangements for repairing the power tillers at the owners site especially during busy seasons.
6. Acute shortage of technicians and farm mechanics for timely repairing and servicing of the machine.

It is felt that the foregoing difficulties expressed by the present owners of power tillers are genuine. Unless immediate steps are taken to solve these difficulties it is likely that the farmers may lose confidence in the efficiency of power tillers.

The following recommendations are therefore made to gain the confidence of power tiller users and avoid future difficulties in the introduction of power tillers in the State.

1. The first and foremost need is to stock adequate quantity of spare parts for supply to the power tiller users through local agents if necessary as and when needed at comparatively cheaper rates.
2. The quality of materials used for assembling the equipment needs more attention to guarantee a longer life time with a minimum consumption of replacement parts. Our small holders cannot afford to lose their investment in equipment in 3 or 4 years because this may cause a serious financial disaster. They should be provided with equipment that can be operated simply and safely and will still last for atleast 6 or 7 years.
3. It must be clearly understood at the very outset that being a machine the power tiller urgently calls for a proper servicing system for its proper handling and maintenance. The Agro-Industries Corporation has to provide facilities for training farmers on the proper handling and maintenance of the machine including minor repair works. The Corporation may also have a mobile workshop to cater to the needs of the farmers in interior parts.
4. The lack of small, power driven equipment that could economically mechanise the small farms is serious problem. Our farmer has to pay about 3 to 6 times as much as a farmer in the industrialised regions pay for the same piece of equipment. An agricultural machine that is well accepted in an industrialised country often is not efficient or effective under our conditions. The main reason for this is the difference in the natural environmental conditions such as soil and water and socio-economic conditions prevailing in Kerala. Another reason is the inaction in the improvement and consolidation of land.

A correct approach therefore appears to be to develop agricultural machinery, which can fully display its efficiency under the existing conditions in our country.

5. At present there is a wide gap between research and manufacturer on one hand and the manufacturer and the farmer on the other hand. There should be applied and adaptive research on available equipments and efforts should be made to develop new agricultural equipment for indigenous production. The equipment designed should be for easing the drudgery of farming operations and they should be hand operated or partially mechanical. They should be of good quality, durable and within the purchasing capacity of a small farmer.

6. Educated unemployed youth in rural parts can be selected and provided with necessary training in operation and maintenance of power tillers.

12. SUMMARY AND CONCLUSIONS:

Kerala being a deficit State in rice production all efforts have to be concentrated on evolving intensive land utilisation farming methods to enhance production and reduce the food deficit. This methods will involve use of increased fertilizer inputs and adoption of multiplierropping practices coupled with the introduction of new high yielding strains. Farming operations using the right kind of machinery at the right time is a sure way of upgrading grain production. In that respect agricultural mechanisation is the most important and indispensable component among the various essentials stated above.

In Kerala, where unemployment and underemployment are the acute problems in rural areas, a new technology of agricultural mechanisation has to be evolved without the displacement of the available labour force adversely. This means using machines of small capacity so that a large number of machines can be operated and displacement of labour can be minimised. The power tiller appears to be the suitable machine for this purpose for many reasons and chiefly because it can be utilised to the maximum by the small and medium land holders of our State, who form nearly 80 percent of the total land holders.

The demand for tractors and power tillers is steadily increasing in the State every year. As against 650 tractors and 250 power tillers during 1970, their numbers have increased to 1110 and 465 respectively during 1970.

The power tiller is mainly used for ploughing operations for paddy under wet conditions. On an average, the power tiller takes 18 hours to plough two rounds and prepare one hectare of wet land for planting as against 30 pairs of bullocks normally required to plough 4 to 5 rounds to prepare the same area.

The total cost of ploughing using power tiller and the bullocks differ widely. For the power tiller user, the total cost of ploughing one hectare of paddy land costs Rs. 10790 as against Rs. 331.30 per hectare for traditional cultivator using bullocks. Thus a power tiller user would be making a saving of Rs. 223.40 per hectare in the preparatory cultivation expenses.

By introducing power tillers for tillage operations it is estimated that about 18 pairs of bullocks and 16 men per hectare may be displaced. Ordinarily even in places where traditional ploughing is practiced, the ploughmen are employed during the seasons only and they are not full time employees. Depending on the cropping intensity they get 3 or 4 months work in a year and during the rest of the period they have to seek other means of employment. Hence such a displacement of the underemployed labour like the ploughmen is not likely to create a serious problem of

labour displacement in the long run by the introduction of power tillers. With a phased programme of mechanisation of agriculture and gradual absorption of the displaced labour in agriculturally related occupations and industries, the problem of labour displacement now apprehended and feared may not pose any serious challenge or threat. The adoption of mechanisation of agriculture under Kerala conditions should be in terms of increasing labour efficiency and creating more job opportunities for them.

Out of a total State income of Rs. 1059 crores during 1968-69 in Kerala, a sum of Rs. 577 crores was from Agriculture (proper) alone. This accounts for about 55 per cent of the total income. Hence all measures to boost up agricultural income will naturally have their impact on the economy of our State. The need therefore is for increasing farm productivity. Increase in productivity is achieved by planned activation of the factors of production with the help of modern devices and an adequate farm power for successfully running the wheels of those devices. Use of machineries improves agricultural operations, enables timely operations and paves way for multiple cropping. We are in the era of "Green Revolution" and greater stress is made on the application of inputs like seeds, fertilisers, pesticides and irrigation water. To have the best from the above factors of production, use of modern technology like the use of machineries in agriculture is an immediate need. It is gratifying that the Kerala farmers are realising this fact of late and more than ever before the use of power tillers in our Agriculture is becoming popular. Against this changing background there is no doubt that mechanisation of agriculture to suit the need and conditions of Kerala would contribute for the further improvement in the agricultural economy of our State.

In the implementation of the programme, however, there are many technical and socio-economic problems, such as insufficient number of qualified technical personnel for timely repairing and servicing of the machines, high cost of spares and accessories, low purchasing power of average individual farmer and lack of mechanical sense on the part of farmers. All these problems have to be dealt with successfully before great strides can be made in mechanising farming operations in our State.

APPENDIX I

CLASSIFICATION OF AREA UNDER DIFFERENT CROPS (Hectares)

A. Power Tiller users

Cultivator No.	Paddy			Other crops						Total	
	Virippu	Mundakan	Punja	Gross area	Net area	Coconut	Arecanut	Tapioca,	Others	Gross area	Net area
1	2	3	4	5	6	7	8	9	10	11	12
1	2.6	3.2	1.8	7.6	3.2	2.4	0.4	1	...	11.4	7
2	2.0	2.0	2.0	6	2	0.4	0.6	1.6	...	8.6	7.6
3	2	2	2	6	2	1	...	...	...	7.0	3
4	3	3	3	9	3	2	1	...	...	12	6
5	0.8	0.8	0.8	2.4	0.8	1.0	...	...	...	3.4	1.8
6	1.0	1.5	1	3.5	1.5	1.5	1.5	0.5	...	7.0	5.0
7	3	3	3	9	3	1	...	...	...	10	4
8	...	4.8	...	4.8	4.8	...	...	...	...	4.8	4.8
9	1	1	1	3	1	1	0.5	...	...	4.5	2.5
10	2	3.2	2.8	8	3.2	0.6	0.1	...	...	8.7	3.9
11	3.2	3.2	...	6.4	3.2	...	0.8	...	...	7.2	4
12	3	3	...	6	3	0.5	0.5	...	...	7	4
13	2	2	...	4	2	...	...	...	...	4	2
14	3.2	3.2	...	6.4	3.2	0.4	...	...	...	6.8	3.6
15	...	1.6	1.6	3.2	1.6	0.6	...	...	...	3.8	2.2
16	0.8	0.6	0.8	2.4	0.8	...	...	0.2	...	2.6	1
17	2.8	2.8	...	5.6	2.8	...	...	...	...	5.6	2.8
18	1	1	1	3	1	3	...	...	...	6	4
19	2	2	2	6	2	...	...	...	...	6	2
20	1	1	1	3	1	0.5	...	...	...	3.5	1.5
21	2.8	2.8	...	5.6	2.8	0.4	...	...	...	6	3.2
22	...	4.8	4.8	9.6	4.8	...	...	...	...	9.6	4.8

APPENDIX I (contd)

CLASSIFICATION OF AREA UNDER DIFFERENT CRCPS (Hectares)

A. Power Tiller users

Cultivator No	Paddy			Other crops						Total	
	Viruppu	Mundakan	Punja	Gross area	Net area	Coconut	Areccanut	Tapioca,	Others	Gross area	Net area
1	2	3	4	5	6	7	8	9	10	11	12
23	4	4	4	12	4	0.4	...	...	...	12.8	4.8
24	...	1.6	...	1.6	1.6	4.2	...	...	...	5.8	5.8
25	2	2	2	6	2	0.8	0.8	...	...	7.6	3.6
26	4.8	4.8	...	9.6	4.8	0.2	...	...	...	9.8	5
27	1.8	13.6	13.6	29	13.6	2.4	0.2	...	0.4	31.6	16.6
28	4	4	1	9	4	0.5	2	0.5	...	12.6	7
29	8	10	2	20	10	1.2	0.8	2	1.6	25.6	15.6
30	1	...	...	1	1	3	6	2	2	14	14
31	1.3	1.3	...	2.6	1.3	3	3.1	...	1.3	10	8.7
32	6	10	12	28	16	4	...	...	...	32	20
33	4	4	1.6	9.6	4	1	0.4	2	...	13	6.5
34	2.8	2.8	...	5.6	2.8	4	0.4	...	0.8	10.8	8
35	4	2	2	8	4	0.4	0.8	1.4	0.4	11	7
36	16	16	16	48	16	...	...	...	...	48	16
37	...	1.6	1.6	3.2	1.6	1	...	...	...	42	2.6
38	...	2	2	4	2	6	...	...	...	10	8
Total	98.9	132.4	86.4	317.4	141.4	47.5	20.3	11.2	6.5	403.2	226.9

APPENDIX I

CLASSIFICATION OF AREA UNDER DIFFERENT CROPS (Hectares)

B Traditional Cultivations

Cultivator No.	Paddy			Gross area	Net area	Other crops				Total	
	Viruppu	Mundakan	Punja			Coconut	Arecanut	Tapioca,	Others	Gross area	Net area
1	2	3	4	5	6	7	8	9	10	11	12
1	1	1	1	3	1	0.6	...	...	...	3.6	1.5
2	2	2	2	6	2	1	...	...	...	7	3
3	3.2	3.2	...	6.4	3.2	0.1	...	...	...	6.5	3.3
4	1.4	1.4	1.4	4.2	1.4	0.6	...	...	...	4.87	2
5	1	1	1	3	1	...	...	...	...	3	1
6	1	1	...	2	1	1.6	...	...	...	3.6	2.6
7	2.8	2.8	...	5.6	2.8	0.2	0.2	...	...	6	3.2
8	1.2	1.2	...	2.4	1.2	0.4	...	...	...	2.8	1.6
9	5.5	5.5	...	11	5.5	0.5	...	...	...	11.5	6
10	3	3	...	6	3	0.2	...	...	...	6.2	3.2
11	...	1	2	3	2.8	2	...	...	...	5	4.8
12	5.2	5.2	5.2	15.6	5.2	...	...	...	...	15.6	5.2
13	1	1	1	3	1	...	...	...	...	3	1
14	0.6	1	...	1.6	1.6	...	...	...	...	1.6	1.6
15	...	...	1.4	1.4	1.4	...	...	...	...	1.4	1.4
16	...	0.5	...	0.5	0.5	...	...	0.5	...	1	1
17	3.2	3.2	2.4	8.8	5.6	...	...	...	...	8.8	5.6
18	0.8	0.8	0.8	2.4	0.8	0.4	0.4	...	...	3.2	1.6
19	...	2.8	...	2.8	2.8	0.4	0.4	0.4	...	4	4
20	1.6	1.6	1	4.2	1.6	1	1	0.8	...	7	4.4

APPENDIX 1. B

Cultivator No.	Paddy			Other crops						Total	
	Viruppu	Mundakan	Punja	Gross area	Net area	Coconut	Arecanut	Tapioca,	others	Gross area	Net area
1	2	3	4	5	6	7	8	9	10	11	12
21	...	2	2	4	2	0.4	0.4	...	...	4.8	2.8
22	...	4	4	8	4	4	4	...	...	16	12
23	...	1.4	...	1.4	1.4	0.8	0.6	1.4	...	4.2	4.2
24	...	1	1	2	1	0.6	...	...	...	2.6	1.6
25	1.2	1.2	0.6	3	1.2	0.8	0.6	0.6	...	5	3.2
26	...	2	2	4	2	...	...	...	...	4	2
27	2	4	...	6	4	3.2	2.8	...	2	14	12
28	8	8	4	20	8	3.5	1.5	1	2	28	16
Total	45.7	62.8	32.8	141.3	63	22.3	11.9	4.7	4	184.2	111.9

APPENDIX II

STATEMENT SHOWING COST OF FEEDING OF WORK ANIMALS

Cultivator No. No. of Pairs	...	1 one Pair	2 one Pair	3 one Pair	4 one Pair	5 one Pair
Items		Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual
(a) Items of Cattle feeds						
1. Strew		1.50 547.50	2 730	2 730	3 1095	2 730
2. Green grass					1 365	1 365
3. Rice bran		0.50 182.50	1 335		1 365	
4. Oil Cakes						
5. Cotton Seed		0.50 182.50	1 365	1.0 365	1 365	2 730
6. Mixed feed		0.50 182.50	1 365	1.50 547.50	0.50 182.50	
7. Others			1		0.50 182.50	
(b) Remuneration of cattle attendant						
Gross Annual Cost		3.00 1095	5 1825	4.50 1642.50	7.00 2555	5 1825
(c) 1. Income from dung		0.50 182.50	0.70 255.50	0.65 237.25	0.65 237.75	0.70 255.50
2. Income from other sources						
Total Annual Income		182.50	255.50	237.25	237.75	255.50
(d) Net Annual Cost		912.50	1569.50	1405.25	2317.25	1569.50
(e) Annual cost of maintenance per pair		912.50	1569.50	1405.25	2317.25	1569.50

APPENDIX II (contd)

Cultivator No. No. of Pairs	6 Two Pairs		7 Three Pairs		8 Two Pairs		9 Five Pairs		10 Three Pairs	
	Cost of feeding Per day Annual		Cost of feeding Per day Annual		Cost of feeding Per day Annual		Cost of feeding Per day Annual		Cost of feeding Per day Annual	
(a) Items of Cattle feeds										
1. Straw	4	1460	6	2190	3	1095	5	1800	6	2190
2. Green grass										
3. Rice bran	2	730	1.50	547.50	1	365	5	1800	1.50	547.50
4. Oil Cakes										
5. Cotton Seed	1	365	3	1095	2	730	5	1800	1.50	547.50
6. Mixed feed	3	1095	1.50	547.50	1	365	1.25	450	3	1095
7. Others					1	365	1.25	450		
(b) Remuneration of cattle attendant										
							5	1800	1.50	547.50
Gross Annual Cost	10	3650	12	4380	8	2920	22.50	8100	13.50	4927.50
(c) 1. Income from dung	1.20	438	1.50							
2. Income from other sources										
Total Annual Income		438	547.50		360		900		547.50	
(d) Net Annual Cost		3212	3832.50		2560		7200		4380	
(e) Annual cost of maintenance per pair		1606	1277.50		1280		1440		1460	

Cultivator No. ... No. of Pairs ...	11 Hiresout Pair	12 To Pairs	13 One Pair	14 One Pair	15 Hiresout Pair
Items	Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual
(a) Items of Cattle feeds					
1. Straw		4 1460	2.50 812.50	2 730	
2. Green grass					
3. Rice bran		1 365	2 730		
4. Oil Cakes		1 365	2 730	1 365	
5. Cotton Seed					
6. Mixed feed					
7. Others					
(b) Remuneration of cattle attendant		2 730		3 1095	
Gross Annual Cost		8 2930	6.50 2272.50	6 2190	
(c) 1. Income from dung		547.5	547.5	547.5	
2. Income from other sources					
Total Annual Income		547.5	547.5	547.5	
(d) Net Annual Cost		2372.50	1725	1643.50	
(e) Annual cost of maintenance per pair		1186.25	1725	1643.50	

APPENDIX II (contd.)

Cultivator No. No. of Pairs	16 one Pair	17 Three Pairs	18 one Pair	19 Two Pairs	20 one Pair
Items	Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual	Cost of feeding Per day Annual
(a) Items of Cattle feeds					
1. Strew	2 730	4 1460	4 143	2 730	2 730
2. Green grass		1 365	1 365	2 730	1 365
3. Rice bran	1 365	3 1095	1 365	1 530	
4. Oil Cakes	1 365	3 1095	3 1095	3 1095	2 730
5. Cotton Seed		2			
6. Mixed feed					
7. Others			1 365	2 730	
(b) Remuneration of cattle attendant		1.66 600		4 1460	2 730
Gross Annual Cost	4 1460	14.66 5345	10 3650	14 5110	7 2555
(c) 1. Income from dung	455	1095	2 730	2 730	2 365
2. Income from other sources					
Total Annual Income	455	1095	730	730	365
d) Net Annual Cost	1005	4250	2920	4380	2190
(e) Annual cost of maintenance per pair	1005	1416	2920	2190	2190

APPENDIX II (contd)

Cultivator No	...	21	22	23	24	25	
No. of pair	...	One pair	Five pairs	Two pairs	Hiresout pairs	One pair	
Items		Cost of feeding		Cost of feeding		Cost of feeding	
		Per day	Annual	Per day	Annual	Per day	Annual
(a)	Items of cattle feeds						
	1. Straw	2	730	5	1825	2	730
	1. Green grass	1	365	5	1825	2	730
	3. Rice bran						
	4. Oil Cakes						
	5. Cotton Seed	2	730	2	730	1	365
	6. Mixed feed			10	3650	3	1095
	7. Others			3	1095	2	730
(b)	Remuneration of	2	730	5	1825	4	1460
	Gross Annual Cost	7	2555	30	1095	14	5110
(c)	1. Income from during	1	365	5	1825	2	730
	2. Income from other sources						
	Total Annual Income		365		1825		730
(d)	Net Annual Cost		2190		9125		4380
(e)	Annual cost of maintenance per pair		2190		1825		2190

APPENDIX II (contd.)

Cultivator No	...	26	27	28		
No. of pair	...	One pair	Five pairs	Five pairs		
Items	Cost of feeding		Cost of feeding		Cost of feeding	
	Per day	Annual	Per day	Annual	Per day	Annual
(a) Items of cattle feeds						
1. Straw	2	730	5	1825	5	1825
2. Green grass	1	365	5	1825	5	1825
3. Rice bran	2	730	2	730	2	730
4. Oil Cakes						
5. Cotton Seed			10	3630	10	3650
6. Mixed feed				1095	3	1095
7. Others	3					1825
(b) Remuneration of cattle attendant	2	730	5	1825		
Gross Annual Cost	7	2555	30	10950	30	10950
(c) 1. Income from during	1	365	5	1825	5	1895
2. Income from other sources.						
Total Annual Income		365		1825		1895
(d) Net Annual Cost		2190		9125		9125
(e) Annual cost of maintenance per pair		2190		1825		1825