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THE CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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THE IMPACT OF MECHANIZATION ON RURAL INCOME AND INCOME DISTRIBUTION IN SUPHANBURI, THAILAND

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THE IMPACT OF MECHANIZATION ON RURAL INCOME AND INCOME DISTRIBUTION: THE CASE OF SUPHANBURI PROVINCE

Somporn Saitan*

INTRODUCTION, SCOPE AND OBJECTIVES

Two of the most important sources of agricultural growth in Thailand are expansion in the area adopting the new rice production technology and continued development of irrigation systems (Hayami, Barker and Bannagen, 1976). Irrigation comes in many forms, ranging from hand lifted buckets to the massive reservoir systems. The new rice technology, includes improved crop varieties, chemical inputs and farm mechanization. Under present circumstances, it appears difficult to further expand the area under cultivation. The only possible way of increasing crop production is to improve the productivity of the existing cultivated area. Farm mechanization plays an important role in this strategy. It affects the extent of employment, makes possible double cropping, improves cropping yields and can increase farm income. Mechanization saves time in land preparation, harvesting and threshing and, thus allows the farmer to utilize time in supplemental employment opportunities. These jobs in turn increase the income of the farmer. Furthermore, farmers who own machines can earn additional income by rendering custom services to farmers who do not own machines or do not have sufficient machine capacity to meet their requirements.

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Since mechanization affects the allocation of inputs in crop production, it is believed to induce the redistribution of income. Whether this redistribution increases the welfare of farmers or the income of other factor owners must be determined empirically. In addition to the redistribution problem, mechanization is hypothesized to discriminate in favor of rich farmers to the detriment of small farmers.

This paper focuses attention only on irrigated farms and two-wheel and four-wheel tractors used for land preparation.

The purpose is threefold: 1) to trace the effects of tractor use on the structure of income; 2) to determine the impact of tractor use on income distribution among factors of production and earners and, 3) to examine the effect of tractor use on income inequalities.

METHODOLOGY

Information Gathered

Primary data were obtained from the farm survey of the Consequences of Farm Mechanization Project, involving one site in Thailand. The following data were obtained from a sample of 280 farmers: 1) a general socio-economic profile of the farmer and his family; 2) farm production and input use, including crop yields, fertilizers and chemical use, labor utilization and records of farm receipts and expenditures and, 3) an assessment of farm credit and product inventories.

Sampling Procedure

A proportionate number of samples were stratified into nine strata based on the type of irrigation and source of power used for primary tillage:

1. Rainfed and animal
2. Rainfed and animal + machine
3. Rainfed and 2-wheel tractor
4. Rainfed and 4-wheel tractor
5. Irrigation and animal
6. Irrigation and animal + machine
7. Irrigation and 2-wheel tractor
8. Irrigation and 4-wheel tractor
9. Field labor (the landless labor)

In this study, both wet and dry season data of 1981-82 crop year from strata 7 and 8 are used. All household samples in these strata were included. The distribution of household samples used in the study, by level of mechanization and type of operation, is shown in Table 1.

Analytical Framework

The investigation of the impact of tractor use on farm household income was undertaken using the Cobb-Douglas production function and the concept of factor shares using an accounting procedure. The method used in the analysis of income distribution were the share of total income in the sample, Gini ratios and the Lorenz curve.

FINDINGS

Socio-economic Characteristics of Farmers

Differences were observed in mean farm size, area planted and type of tenure among different tractor ownership classes (Table 2). These differences, in general, were higher on tractor owner farms than tractor hiring farms. However, the average age of the farmers, level of education and the potential family labor available, i.e. the dependency ratio, were almost identical for all classes.

Income Structure

The term income in this study refers to "family labor income", i.e. the gross value of total rice production and gross receipts from contract work with generated by their own equipment and labor. The term "farm household income" refers to income derived from farming plus off-farm and non-farm activities.

Data on farm income is presented in Tables 3 to 5. On average, the farm household income of owned tractor farms was higher than for tractor hiring households in both the wet and dry seasons (Tables 3,4). The major source of this income was from farm activities. The lower farm income of tractor hiring farms can be attributed to the direct outlay for renting tractor services.

The data in Table 5 compares different sources of total household farm income in the 1981-82 wet and dry seasons. Total farm household income in the wet season was higher than in the dry season, although the

contribution of on-farm, off-farm and other income to total farm household income was almost same in both seasons. The contribution of non-farm income was, however, greater in the dry than in the wet season, 13% and 9% of total farm household income, respectively. The differences in total household income between the two seasons was caused by the gap in yield and fluctuations in the prices of paddy.

Data on the comparative annual costs and returns show that net income per hectare by tractor ownership class varied by season (Table 6). In the wet season, net income was higher for tractor hiring farms than for tractor owning farms. In dry season however, the situation was reversed. Further, irrespective of tractor-ownership, use of 4-wheel tractors gave higher net incomes than 2-wheel tractors. On average, the net income resulting from use of 4-wheel tractors was 9% higher than 2-wheel tractors in wet season and 16% higher in the dry season. The average difference was 12% on an annual basis. In general, the net income per hectare in the wet season was 90% higher than in dry season.

Impact of Tractor Use on Income

(i) Impact on off-farm income. Regression analysis showed that use of tractors significantly affected off-farm income (Table 7). Of the various components of off-farm income, man-hours spent in off-farm activities, machine renting and land rental were significantly affected by tractor use. This analysis shows that, irrespective of tractor-ownership, use of tractors saved the time for farmers in farm

operations which they could utilize in off-farm income generating activities.

(ii) Impact on non-farm income. Like off-farm income, non-farm income was also affected significantly by tractor use (Table 8). However, only one component was affected significantly -- manhours spent on non-farm activities.

(iii) Impact on farm income. Factor share analysis was used to determine the impact of tractor use (based on type of tractor ownership) on rice production costs and returns (Table 9 and 10). Data on gross family factor income (GFFI) showed that the income of farmers was about 30% higher in the wet than in the dry season. In the wet season, the GFFI resulting from use of the 4-wheel tractor was about 10% higher than from use of 2-wheel machines. Tractor owning farmers had a 50% higher income than tractor hiring farms. But in the dry season, the GFFI for 4-wheel tractors was nearly the same as for 2-wheel tractors. However, owned-tractor farms showed over 30% greater GFFI than hired-tractor farms.

The residual in the factor share analysis, which refers to the farm's profit, was 80% higher in the wet than in the dry season. In the wet season, the residual for tractor owning farms was 50% lower than for tractor hiring farms. Profits were 40% higher using the 4-wheel tractor than with 2-wheel tractors. In the dry season the residual was higher by 90% for tractor owning farms than for tractor hiring farms. The residual for 4-wheel tractors was (100%) higher than for 2-wheel tractors.

Estimated total costs including the imputed cost of unpaid family labor, owned land and capital show that labor, land and current input costs represent the largest portion of total cost. When summed together, they constituted about 84% of the total cost, irrespective of tractor ownership and season. The imputed family labor cost on hired-tractor farms was much higher than on tractor owning farms. Conversely, the imputed cost for owned land was lower on tractor hiring farms than on tractor owning farms because the proportion of land owned was lower on the tractor hiring farms. The data show, however, that owned land constituted the major portion of total cultivated land on all farmers.

There were minor differences in total cost and total paid-out cost between hiring and tractor owning farms. In the wet season, higher capital costs on tractor owning farms was more than offset by a lower labor cost, so that total cost on tractor owning farms was slightly lower than on tractor hiring farms. Similarly, although the imputed value of family labor was much higher on tractor hiring farms, it was more than offset by a lower total labor cost on tractor owning farms. This finding together with the cost of rented land, which is highest on tractor hiring farms, means the total paid out cost on tractor hiring farms was slightly higher than on tractor owning farms.

Impact of tractor use on income distribution

Factor share analysis showed that among the factors of production, the share of labor and the residual were 5% and 6% lower on tractor hiring farms (Table 11 and 12). Conversely, the share of land and capital were 2% and 6% higher on tractor owning farms. The result indicates the capital share was relatively smaller than the labor share. This finding emphasizes that although investment in machinery is justified by its positive impact on all production factors, in the present case mechanization is more advantageous to the owners of labor resources than to the owner of capital.

Among earners, however, there were minor differences between the shares of hired labor, which was only 1% lower on tractor owning farms. Also the farmer's income was 6% higher on tractor owning farms than on tractor hiring farms. For income distribution effects, mechanized land preparation resulted in only a slight deterioration in the income distribution pattern. In the current environment, mechanization affected only family labor use while leaving hired labor earnings reasonably intact.

The relative shares of value added are shown in Tables 13 and 14. There were minor differences in the relative shares of land. This finding seems to result primarily from the lack of difference between the proportion of share cropped-in and rent-in land to total cultivated land. The proportion of owned land on tractor owning farms was higher

than on hired tractor farms resulting in a higher share for landlords on tractor hiring farms.

Income inequality. The data illustrating the effect of tractor use on income inequality is shown in Tables 15 and 16 and Figures 5 to 8. It is difficult to assess any significant degree of income inequality between tractor ownership groups. Using the Lorenz curves, no apparent conclusions relating to the spread in income inequality by tractor ownership class. The Gini coefficient illustrates that income inequality between classes was very low for different tractor-ownership groups during both seasons. The addition of total off-farm and non farm income to farm income further lowered the Gini's coefficient. This finding reveals that these income components play an important role in mitigating the problem of inequity in income distribution.

As more machinery is introduced, it is important that off-farm and non-farm job opportunities are created, although some of these will be reduced by mechanization itself.

SUMMARY AND CONCLUSIONS

The results of the study show that use of tractors for land preparation significatnly affected income from off-farm and non-farm sources. The findings further show that farmers incurred more expense for labor and current inputs than for tractor cost (capital). This result emerges because the tractor is used for only a short time during land preparation. The share of current inputs and labor is greater than

that of capital. for this reason, it is quite difficult to reach a firm conclusion about the impact of tractors used for land preparation on farm income.

The two methods to estimate the impact of tractor use on income inequality (Lorenz curve and Gini coefficient) provided similar results in terms of small differences in income inequality among tractor ownership groups.

The results of the evaluation of the impact of tractor use on income distribution must be interpreted with caution. It is insufficient to study data for only one crop year and reach any firm conclusions. The present analysis also could not consider tractor use over an extended period using time series data, which would have allowed a more rigorous appraisal of the effect of tractor use on income. Provided off and non farm job opportunities continue to exist, these income source will compensate for the reduced damand for own farm labor.

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Table 1. Distribution of household samples by the degree of mechanization and ownership class.

Level of mechanization	Type of tractor ownership					
	Owned		Hired		Total	
	Wet	Dry	Wet	Dry	Wet	Dry
4-wheel tractor	51	46	27	27	78	73
2-wheel tractor	94	92	51	51	145	143
Total	145	138	78	78	223	216

Table 2. Socio-economic characteristics of sample farms by type of tractor ownership, Suphanburi, 1981-82.

Item	Type of tractor ownership			
	4-T(O)[1]	2-T(O)[2]	4-T(H)[3]	2-T(H)[4]
Mean farm size (ha)				
Wet season	5.06	4.03	2.43	1.67
Dry season	5.42	4.16	2.75	1.89
Percent area planted				
Wet season	32.18	48.29	7.64	11.90
Dry season	29.79	47.87	8.80	13.55
Type of tenure (%)				
Farmer operator				
Wet season	28.15	39.25	9.63	22.96
Dry season	26.13	43.24	9.01	21.62
Share tenants				
Wet season	23.81	59.52	7.14	9.52
Dry season	25.00	55.76	9.62	9.62
Leaseholder				
Wet season	6.52	34.78	23.91	34.78
Dry season	7.55	28.30	22.64	41.51
Age of farmer	66	66	62	70
Education of farmer	Pranthom 4	Pranthom 4	Pranthom 4	Pranthom 4
Size of household	6	5	6	5
Dependency ratio	1.9	1.9	1.6	2.4

1. 4-wheel tractor owned.
2. 2-wheel tractor owned.
3. 4-wheel tractor hired.
4. 2-wheel tractor hired.

Table 3. Total farm household income, 1981-82 wet season, Suphanburi, Thailand.

	Tractor ownership									
	4T(O)		2T(O)		4T(H)		2T(H)		AVERAGE	
	Baht	%	Baht	%	Baht	%	Baht	%	Baht	%
Total household income - per household	26,748	100	19,530	100	14,940	100	12,682	100	18,493	100
Total farm income - per household	21,509	80	14,378	74	10,365	69	7,124	56	13,344	72
Total off-farm income - per household	3,898	14	3,780	16	2,869	19	2,877	22	2,701	15
1. Income from off-laboring	1,929	7	3,780	16	2,869	19	2,827	22	2,701	15
2. Income from hiring out farm machine	1,953	7	237	1	-	-	642	5	708	4
3. Income from land rent	16	-	45	-	-	-	-	-	15	-
Total non-farm income - per household	1,341	6	1,674	9	1,629	11	2,000	16	1,662	9
1. Income from handicraft	382	1	213	1	380	3	189	1	291	2
2. Income from service	421	2	860	4	341	2	209	2	458	2
3. Income from commerce	71	-	369	2	159	1	1,158	9	440	2
4. Income from other non-farm activities	467	2	232	1	749	5	444	4	473	3
Income from other source	-	-	16	-	78	1	94	1	63	-

Table 4. Total farm household income, 1982 dry season, Suphanburi, Thailand.

	Tractor ownership									
	AT(O)		2T(O)		4T(H)		2T(H)		AVERAGE	
	Baht	%	Baht	%	Baht	%	Baht	%	Baht	%
Total household income-per household	14,709	100	13,298	100	10,615	100	8,976	100	11,872	100
Total farm income - per household	13,030	89	10,231	77	5,285	49	4,164	47	8,177	69
Total off-farm income	629	4	1,852	13	1,301	12	3,256	37	1,760	15
1. Income from off-farm laboring	324	2	1,633	12	1,301	12	3,256	37	1,629	14
2. Income from hiring out farm machine	305	2	188	1	-	-	-	-	123	1
3. Income from land rent	-	-	31	0.3	-	-	-	-	8	-
Total non-farm income	1,049	7	1,215	9	4,064	38	1,376	16	1,926	16
1. Income from handicraft	167	1	235	1	675	6	670	8	437	3
2. Income from service	673	5	254	2	1,026	10	315	3	567	5
3. Income from commerce	209	1	258	2	725	7	177	2	342	3
4. Income from other activities	-	-	468	4	1,638	15	214	3	580	5
Income from other source	-	-	-	-	35	0.3	-	-	9	-

Table 5. Source of income, 1981-82 crop year, Suphanburi, Thailand.

	Tractor ownership				
	4T(O)	2T(O)	4T(H)	2T(H)	AVERAGE
Wet season					
On farm income	21,509	14,378	10,365	7,124	13,344
Off farm income	3,898	3,412	2,819	3,469	3,424
Non farm income	1,341	1,674	1,629	2,000	1,662
Other	-	16	78	94	63
Total farm household income	26,748	19,330	14,940	12,682	18,493
Dry season					
On farm income	13,030	10,231	5,285	4,164	8,177
Off farm income	629	1,852	1,301	3,256	1,760
Non farm income	1,049	1,215	4,064	1,376	1,926
Other	-	-	35	-	9
Total farm household income	14,708	13,298	10,685	8,796	11,872
Total income per year					
On farm income	33,539	24,609	15,650	11,288	21,521
Off farm income	4,527	5,314	4,170	6.725	5,184
Non farm income	2,390	2,889	5,693	3,376	3,588
Other	-	16	113	94	72
Total farm household income	40,456	32,828	25,620	21,483	30,365

Table 6. Comparative costs and returns per hectare by season and tractor ownership class 1981-82 crop year, Suphanburi, Thailand.

	Tractor ownership			
	4T(O)	2T(O)	4T(H)	2T(H)
Wet season				
Mean farm size (ha)	5.06	4.03	2.45	1.67
Percent area planted (%)	86	89	80	97
Total value of output	10,732	10,954	11,874	11,025
Total variable cost	4,896	6,256	6,450	5,760
Gross margin	4,836	4,697	5,425	4,710
Dry season				
Mean farm size (ha)	5.42	4.16	2.75	1.89
Percent area planted (%)	79	83	78	93
Total value of output	8,899	8,686	8,394	8,043
Total variable cost	5,800	5,900	5,940	6,060
Gross margin	3,099	2,787	2,454	1,983
TOTAL GROSS MARGIN PER YEAR	7,935	7,484	7,879	6,693

Table 7. Regression results of tractor use on off-farm income, 1981-82 crop year, Suphanburi, Thailand.

Variable	4T(O) Wet	4T(O) Dry	2T(O) Wet	2T(O) Dry	4T(H) Wet	4T(H) Dry	2T(H) Wet	2T(H) Dry
Constant (A)	3.9065** (6.93)	2.8808** (4.02)	4.5330** (8.12)	2.2475** (3.87)	0.9135^{ns} (0.89)	2.9739** (6.29)	2.8463** (3.07)	2.7730** (4.44)
X_1 (α_1)	-0.1077)^{ns} (-0.39)	-0.2801^{ns} (-0.69)	0.3808^{ns} (1.09)	-0.0599^{ns} (-0.16)	-0.1631^{ns} (-0.55)	-0.0334^{ns} (0.18)	-0.04953ns (-1.24)	-0.2481 (-0.77)
X_2 (α_2)	0.5817** (6.34)	0.7335** (6.01)	0.5443** (6.80)	0.8899** (10.44)	1.0977** (6.64)	0.7875** (5.54)	0.8432** (8.79)	
D_1 (β_1)	1.3572 (4.46)	2.7610** (2.54)	0.8307 (3.24)	0.9922* (2.65)	-	-	-	-
D_2 (β_2)	2.1275** (6.00)	-0.1459**^{ns} (-0.14)	0.9659** (2.80)	1.9186** (3.67)	1.0207* (2.47)	- -	-0.1939* (-1.50)	- -
R^2	0.6571	0.7698	0.6036	0.7412	0.8354	0.9107	0.6021	0.7008
F-value	18.20	13.37	18.66	20.28	56.08	12.61	39.82	
No. of samples	43	21	54	50	16	14	29	37

Notes: 1. The production functios is defined as:

$$\ln Y_i = A + \alpha_1 \ln X_1 + \alpha_2 \ln X_2 + \beta_1 D_2 + \beta_2 D_2$$

where: Y_i = off farm income
X_1 = proportion of man-hours of family labor to total labor
X_2 = man-hours spent on off-farm activities
D_1 = Dummy for machine hired out
D_1 = 1 if machine is hired, 0 otherwise
D_2 = Dummy for land in hectare rented out
D_2 = 1 if land is rented out, 0 otherwise
i = level of tractorization.

2. * = significant at 99 percent of tractorization
3. ** = significant at 90 percent level of confidence.
4. ns = non-significant
5. values in parentheses are "t" statistics.

Table 8. Regression result of tractor use on nonfarm income, 1981/82, Suphanburi, Thailand.

Variable	4T(O) Wet	4T(O) Dry	2T(O) Wet	2T(O) Dry	4T(H) Wet	4T(H) Dry	2T(H) Wet	2T(H) Dry
Constant (A)	2.6743* (3.23)	1.9951* (3.16)	3.3609** (4.85)	1.8933* (2.64)	8.0606* (4.21)	0.7614^{ns} (0.38)	1.5775^{ns} (1.25)	2.949* (2.32)
X_1 (α_1)	-0.1285^{ns}	-0.343^{ns}	0.2578^{ns}	-0.4821^{ns}	-0.1104^{ns}	-0.1721^{ns}	-0.7395*	-0.6057^{ns}
X_2 (β_1)	0.8727** (6.91)	0.9549** (6.94)	0.7411** (6.49)	0.9136** (7.77)	0.0653^{ns} (0.23)	1.1241* (3.90)	1.0039** (3.07)	0.8674* (3.72)
R^2	0.8726	0.9007	0.7124	0.8309	0.0336	0.7579	0.7128	0.6397
F-value	27.39	3.604	21.06	36.86	0.05	7.83	16.13	9.77
no. of samples	11	11	26	18	6	8	17	14

Notes: 1. The production function is defined as:

$$\ln Y_i = A\ \alpha \ln P_i + \beta \ln Q_i$$

where Y_i = non-farm income
X_1 = proportion of man-hours of family labor to total labor
X_2 = man-hours spent on non-farm activities
i = level of tractorization

2. * = significant at 99 percent level of confidence.
3. ** = significant at 90 percent level of confidence.
4. ns = nonsignificant
5. value in parentheses are "t" statistics.

Table 9. Rice production costs and returns per hectare, 1981-82 wet season, Suphanburi, Thailand.

Item	Tractor ownership				
	4T (O)	2T(O)	4T(H)	2T(H)	Average
A. Production cost					
1. Current inputs	2,598	2,917	2,625	2,468	2,722
2. Labor	2,527	2,570	2,538	2,820	2,605
a) Family labor	1,041	1,230	1,169	1,395	1,200
b) Hired labor	1,486	1,338	1,369	1,425	1,404
3. Land	2,688	2,837	2,823	2,768	2,773
a) Own land	2,274	1,855	1,626	1,768	1,978
b) Rent land	413	981	1,196	1,000	795
4. Capital	1,525	1,837	1,380	1,303	1,627
a) Own	1,351	1,554	418	323	1,243
b) Hire	174	282	962	980	384
5. Total cost	9,339	10,162	9,368	9,361	9,729
6. Total inputs paid out	2,074	2,602	3,528	3,405	2,583
B. Total output	10,732	10,954	11,874	11,025	10,893
C. Gross value added	8,134	8,036	9,249	8,557	8,171
D. Gross family factor income (GFFI)	6,060	5,433	5,720	5,151	5,587
E. Residual	1,393	790	2,505	1,664	1,164

Table 10. Rice production costs and returns per hectare, 1982 dry season, Suphanburi, Thailand.

Item	Tractor ownership				
	4T(0)	2T(0)			
A. Production cost					
1. Current cost	2,657	2,556	2,263	2,373	2,536
2. Labor	2,642	2,421	2,695	2,710	2,550
a. Family	1,110	1,106	1,067	1,531	2,550
b. Hire	1,531	1,314	1,628	1,178	1,388
3. Land	2,083	1,816	1,531	2,029	1,899
a. Own	1,909	1,387	630	1,452	1,485
b. Rent	174	428	901	576	415
4. Capital	1,441	1,446	1,325	1,441	1,433
a. Own	1,221	1,213	295	274	1,000
b. Hire	220	232	1,029	1,167	425
5. Total cost	8,825	8,240	7,815	8,554	8,419
6. Total input paid out	1,926	1,975	3,558	2,922	2,228
B. Total output	8,899	8,686	8,394	8,043	8,637
C. Gross value added	6,242	6,130	6,130	5,670	6,101
D. Gross family factor income (GFFI)	4,315	4,154	2,572	2,747	3,873
E. Residual	75	446	578	-510	217

Table 11. Factor and earners shares for rice production using four alternative methods of land preparation, 1981/82, Wet season, Suphanburi, Thailand.

ITEM	Tractor owner share 4T(O)	2T(O)	Average	Tractor hiring farm 4T(H)	2T(H)	Total average	
Factor shares							
1. Current inputs	24.21	26.64	25.64	22.11	22.59	22.39	24.98
2. Labor	23.55	23.47	23.50	21.38	28.69	25.58	23.92
3. Land	25.05	25.90	25.55	23.78	26.70	25.11	25.46
4. Capital	14.21	16.77	15.72	11.63	11.96	11.82	15.35
5. Residual	12.98	7.22	9.59	21.10	10.64	15.09	10.69
Total	100	100	100	100	100	100	
Earner Shares							
1. Current inputs	24.21	26.64	25.64	22.11	2.59	22.39	24.98
2. Hired labor	13.85	12.21	12.08	11.54	13.96	12.93	12.89
3. Landlord	3.80	8.96	6.86	10.08	8.33	9.07	7.30
4. Hired capital	7.63	2.58	2.19	8.10	9.48	8.29	3.53
5. Operator	56.47	49.61	52.43	48.17	45.64	46.72	57.29
Total 100	100	100	100	100	100		

Table 12. Factor and Earner shares for rice production using four assumptions methods methods of land preparation, 1981/82 Dry season, Suphanburi, Thailand.

ITEM	Tractor owner farm			Tractor hiring farm			Total Average
	4T(O)	2T(O)	Average	4T(H)	2T(H)	Average	
Factor shares							
1. Current input	29.86	29.43	29.60	26.96	29.50	28.47	29.36
2. Labor	29.67	27.87	28.58	32.12	33.70	33.06	29.53
3. Land	23.41	20.91	21.88	18.25	25.23	22.41	21.99
4. Capital	16.20	16.65	16.47	15.79	17.92	11.67	
5. Residual	0.84	5.14	3.45	6.89	-6.35	-1.00	2.52
Total	100	100	100	100	100	100	
Earner shares							
1. Current input	29.86	29.43	29.60	26.96	29.50	28.47	29.36
2. Hired labor	17.21	15.14	15.94	14.66	16.57	16.08	
3. Landlord	1.96	4.93	3.77	10.73	7.47	8.61	4.79
4. Hired capital	2.48	2.67	2.00	12.27	14.51	13.60	4.93
5. Operator	48.49	47.83	48.09	30.63	34.16	32.74	44.84
Total	100	100	100	100	100	100	

Table 13. Income shares per hectare from rice production, 1981/82 Wet season, Suphanburi, Thailand.

ITEM	Tractor owner farm			Tractor hiring farm			Total average
	4T(O)	2T(O)	Average	4T(H)	2T(H)	Average	
Value added	100	100	100	100	100	100	100
Farmer							
Family labor	12.79	15.34	14.28	12.63	19.05	16.31	14.70
Owned land	27.96	23.08	25.13	17.59	22.96	20.07	24.21
Owned capital	16.61	19.36	18.19	4.52	3.21	3.78	15.22
Operator's surplus	17.13	9.84	12.90	17.09	13.74	19.45	14.25
	74.50	67.65	70.50	61.83	58.96	60.21	68.38
Hired labor	18.26	16.64	17.32	14.80	18.03	16.65	17.19
Landlord	5.08	12.22	9.23	12.93	10.76	11.69	9.73
Hired capital	2.15	3.51	2.94	10.40	12.24	11.46	4.70

Table 14. Income share per hectare from rice production, 1981/82 Dry season, Suphanburi, province, Thailand.

ITEM	Tractor owner farm			Tractor hiring farm			Total average
	4T(O)	2T(O)	Average(H)	2T(H)	4T(H)	Average	
Value added	100	100	100	100	100	100	100
Farmer							
Family labor	17.79	18.05	17.95	17.41	17.02	23.05	19.04
Owned land	30.59	22.64	23.72	25.62	19.29	24.34	
Owned capital	19.57	19.80	19.71	4.82	4.84	4.83	16.52
Operator's surplus	1.20	7.28	4.92	9.43	-9.01	-1.39	3..52
	69.15	17.77	68.30	41.95	48.47	45.78	63.47
Hired labor	24.53	21.45	22.65	26.55	20.78	23.17	22.76
Landlord	2.79	6.99	5.36	14.70	19.17	12.04	6.79
Hired capital	3.53	3.79	3.68	16.79	20.58	19.02	6.97

Table 15. Percentile measures of inequality for absentee tractor users, 1981/82 Wet Season, Suphanburi province, Thailand.

Group (%)	Percentile share							
	Net farm income				Farm household income			
	4T(O)	2T(O)	4T(H)	2T(H)	4T(O)	2T(O)	4T(H)	2T(H)
Bottom 20 percent	5.22	2.03	-	-	2.06	2.34	2.09	3.17
Bottom 30 percent	5.22	6.92	10.66	7.76	9.01	2.34	9.70	3.17
Bottom 60 percent	31.59	223.40	23.68	7.76	30.16	34.41	33.09	19.92
Top 40 percent	68.40	77.65	76.37	92.23	69.85	-	-	80.88
Top 30 percent	60.15	46.43	46.06	-	44.20	49.20	44.67	57.80
Top 20 percent	49.07	33.62	46.06	-	44.20	49.20	44.67	57.80
Top 10 percent	29.21	17.86	23.72	24.24	30.09	28.95	19.96	17.17
Top 5 percent	14.61	8.93	11.86	12.12	15.05	14.48	9.98	13.59
Concentration ratio	0.36	0.46	0.443	0.36	0.38	0.33	0.30	0.36
Average net farm earning	21880	15050	10500	7388	28940	19930	14615	12560

Table 16. Percentile measure of inequality for absentee tractor users, 1981, Dry Season, Suphanburi, Thailand.

Group	Percentile share							
	Net farm income				Farm household income			
	4T(O)	2T(O)	4T(H)	2T(H)	4T(O)	2T(O)	4T(H)	2T(H)
Bottom 20 percent	2.43	3.91	-	-	1.38	1.93	-	-
Bottom 30 percent	2.43	3.91	-	-	1.38	1.93	6.51	8.37
Bottom 40 percent	14.44	3.91	-	-	12.43	13.41	6.51	8.37
Bottom 50 percent	19.95	22.02	19.39	15.72	22.12	13.41	10.84	24.66
Top 30 percent	80.04	58.00	80.61	84.28	60.59	67.65	63.49	-
Top 20 percent	45.98	31.40	54.72	44.01	51.34	45.13	36.36	59.29
Top 10 percent	32.59	22.63	30.78	27.04	35.65	22.02	13.60	13.60
Top 5 percent	16.30	11.32	15.39	13.52	17.87	11.01	13.27	6.80
Concentration ratio	0.40	0.34	0.53	0.49	0.37	0.32	0.45	0.38
Average net farm earning	13830	11330	5850	4910	15450	14290	8900	

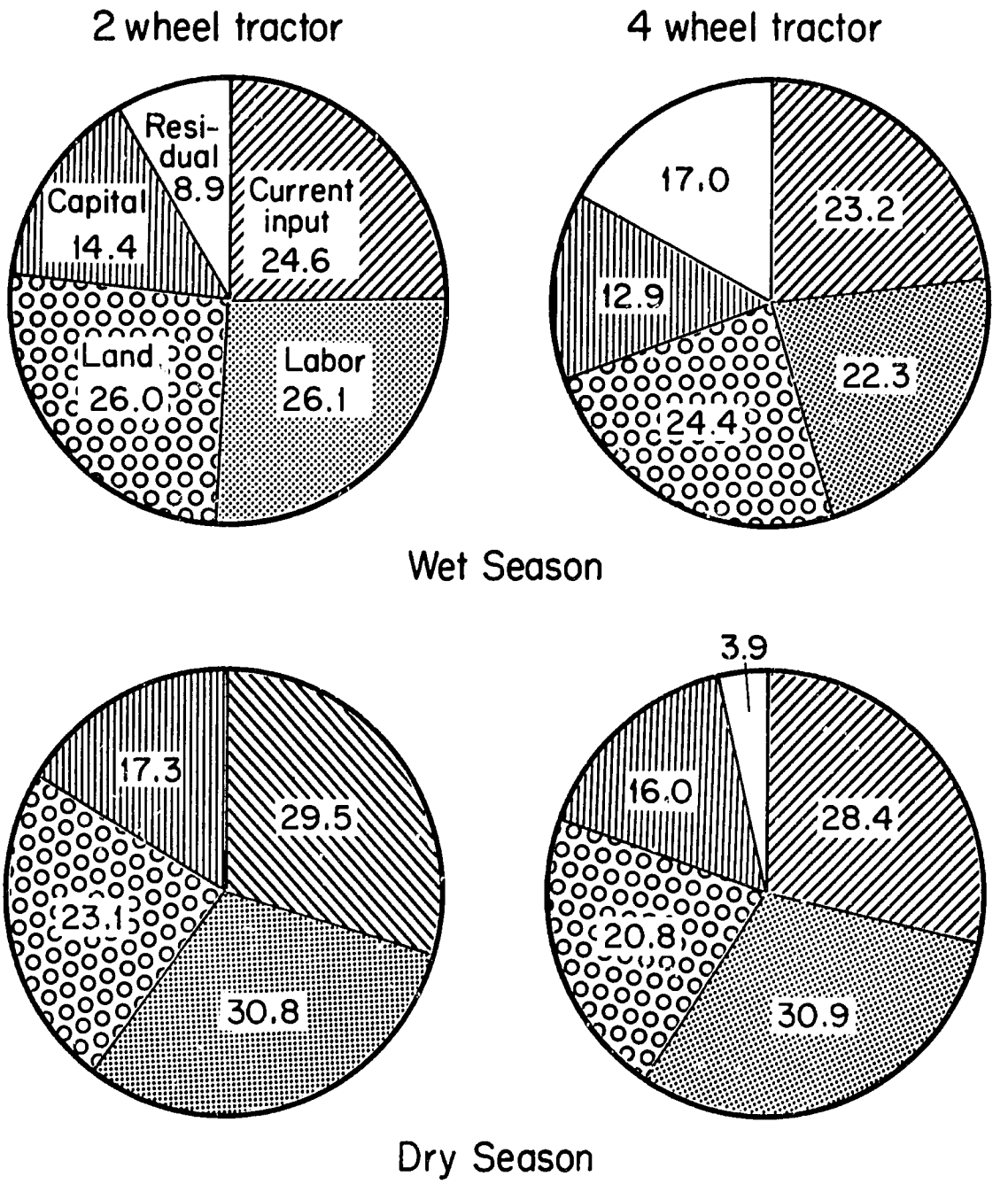

Fig.1. Rice production and distribution by factor production and tractor using, 1981-82 crop year, Suphanburi, Thailand.

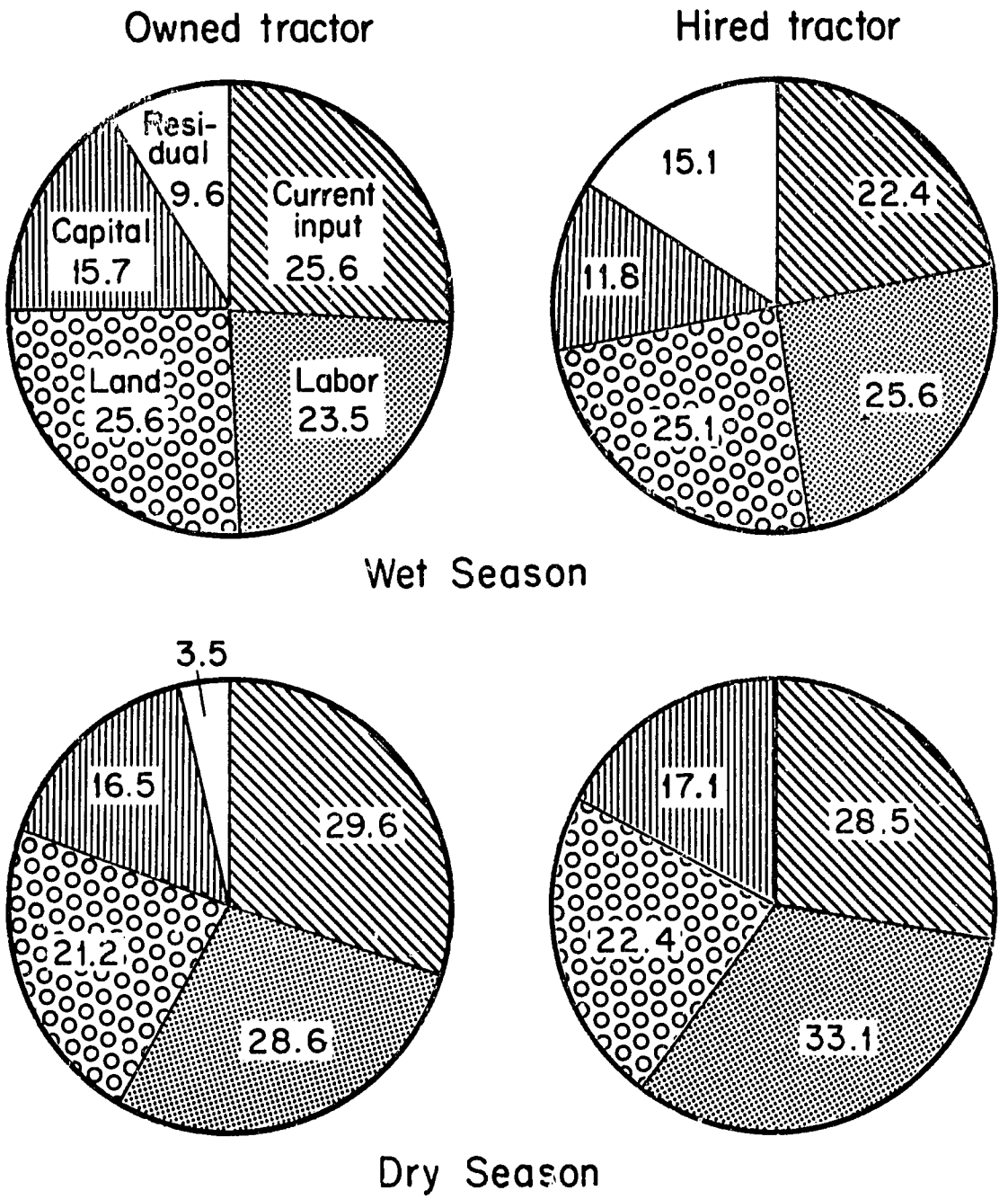

Fig. 2. Rice production and distribution by factor production and tractor ownership, 1981 - 82 crop year, Suphanburi, Thailand.

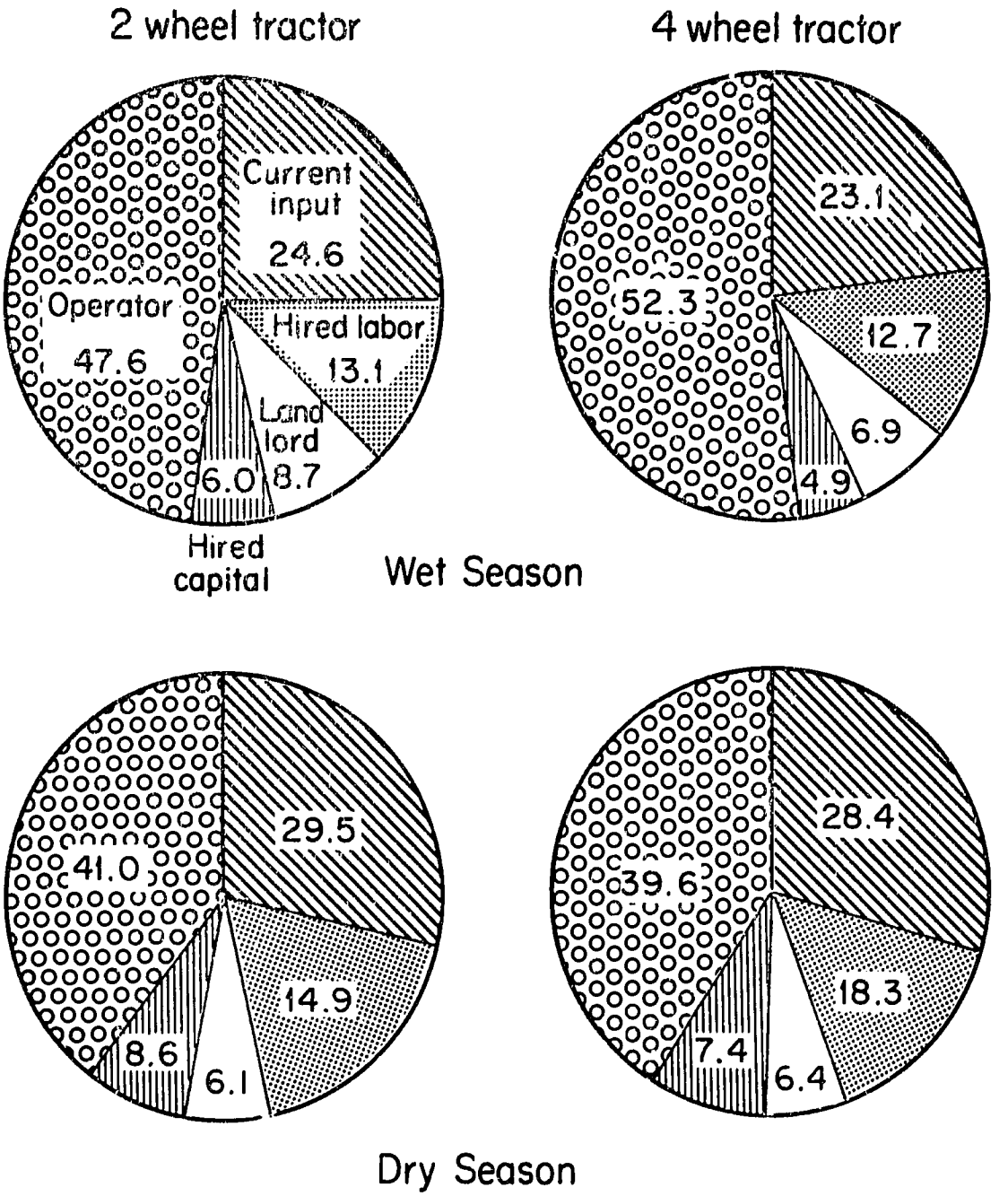

Fig. 3. Rice production and distribution by earner share and tractor using, 1981-82 crop year, Suphanburi, Thailand.

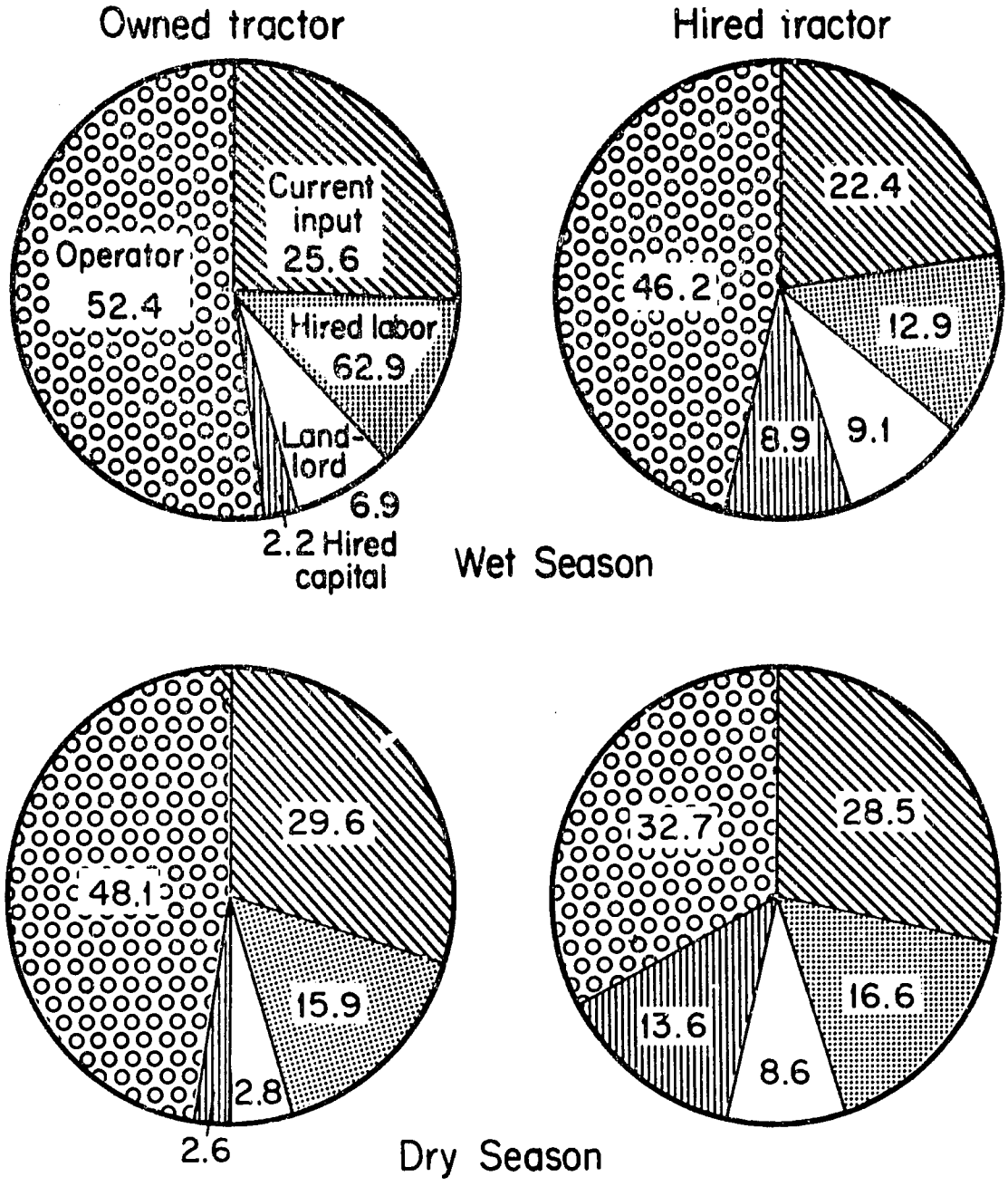

Fig. 4. Rice production and distribution by earner share and tractor ownership, 1981-82 crop year, Suphanburi, Thailand.

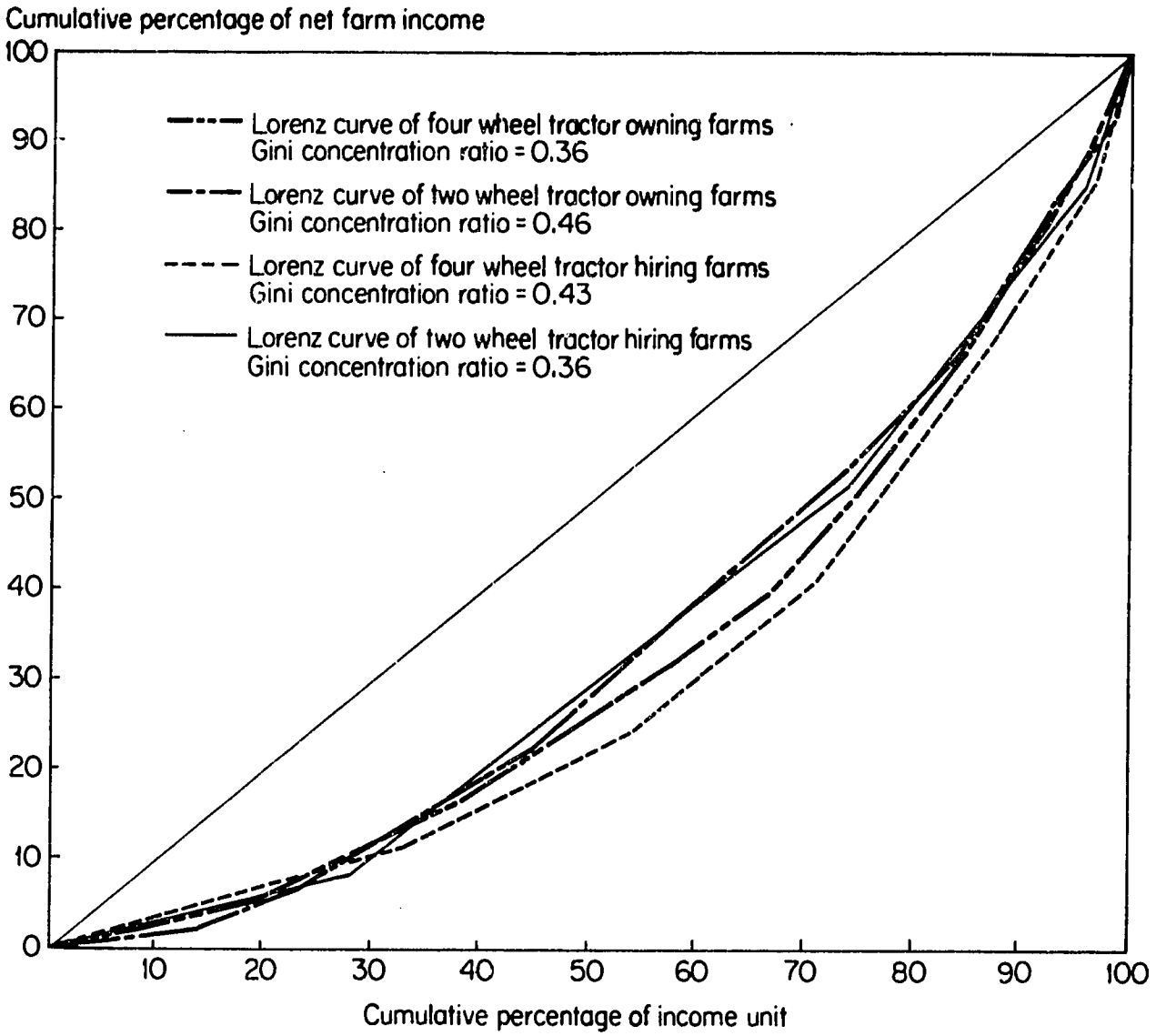

Figure 5. Lorenz curve showing the distribution of net farm income by type of tractor ownership. 1981-82, wet season, Suphanburi, Thailand.

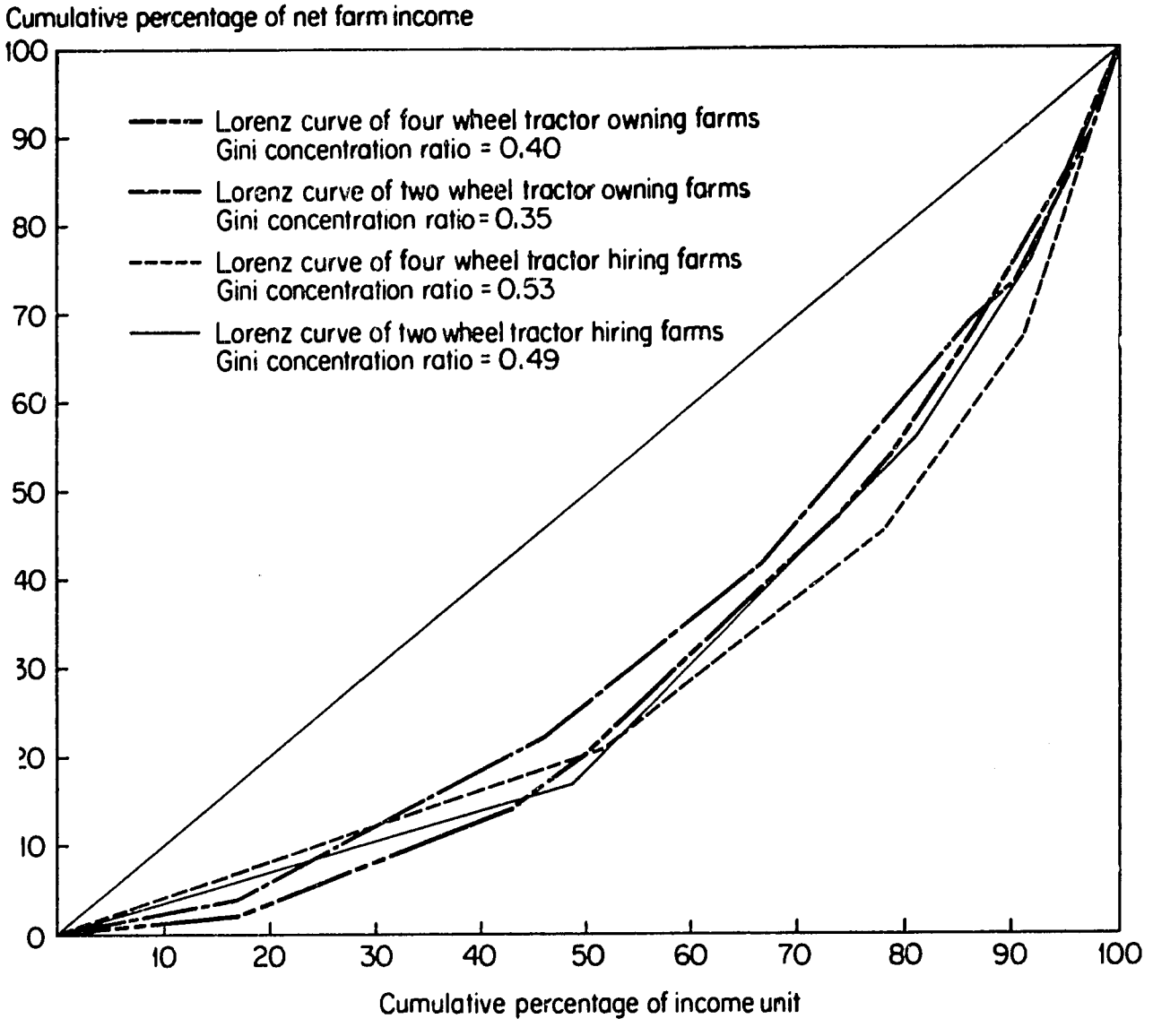

Figure 6. Lorenz curve showing the distribution of net farm income by type of tractor ownership. 1982, dry season, Suphanburi, Thailand.

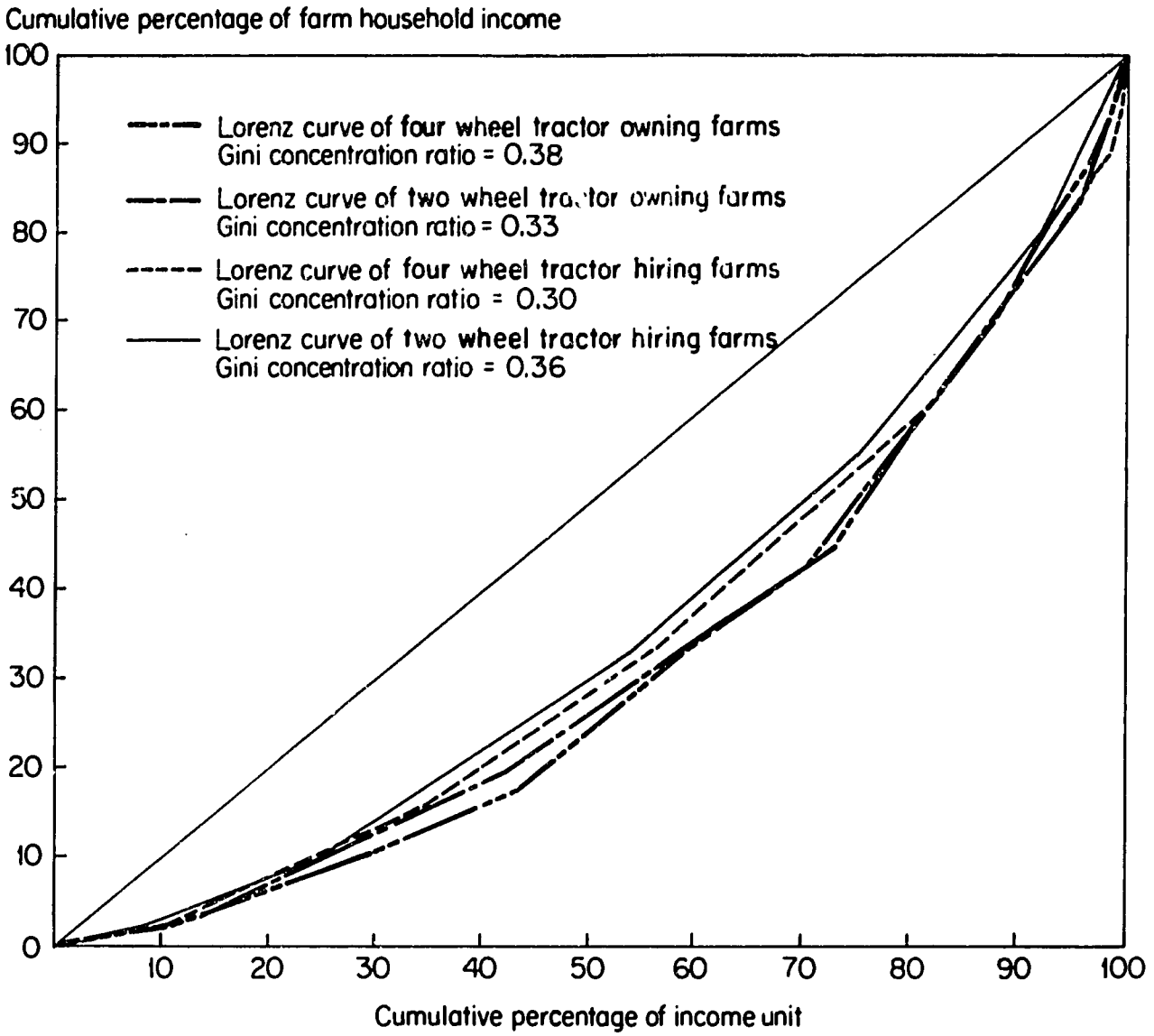

Figure 7. Lorenz curve showing the distribution of farm household income by type of tractor ownership.1981-82,wet season,Suphanburi,Thailand.

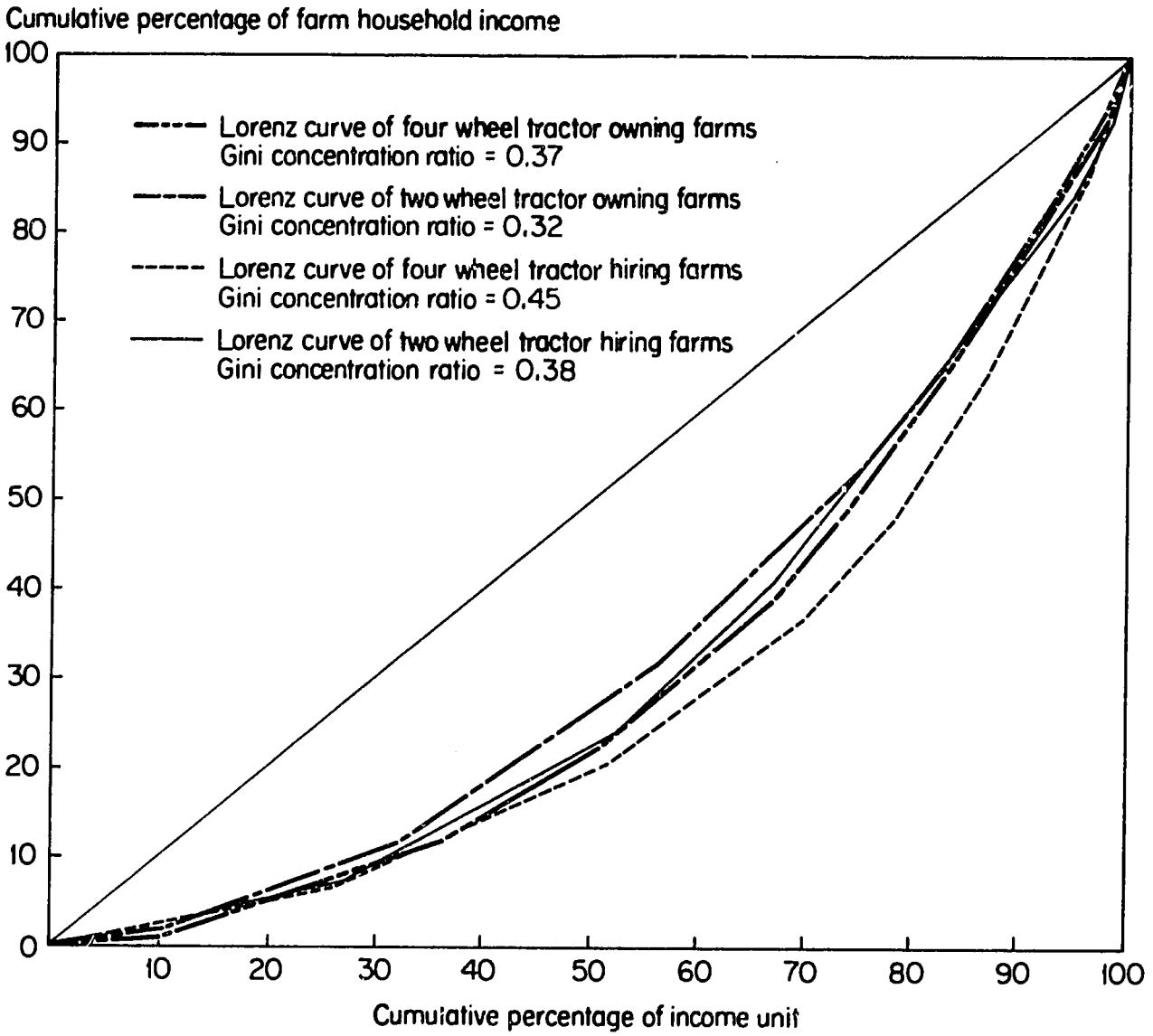

Figure 8. Lorenz curve showing the distribution of farm household income by type of tractor ownership. 1982, dry season, Suphanburi, Thailand.

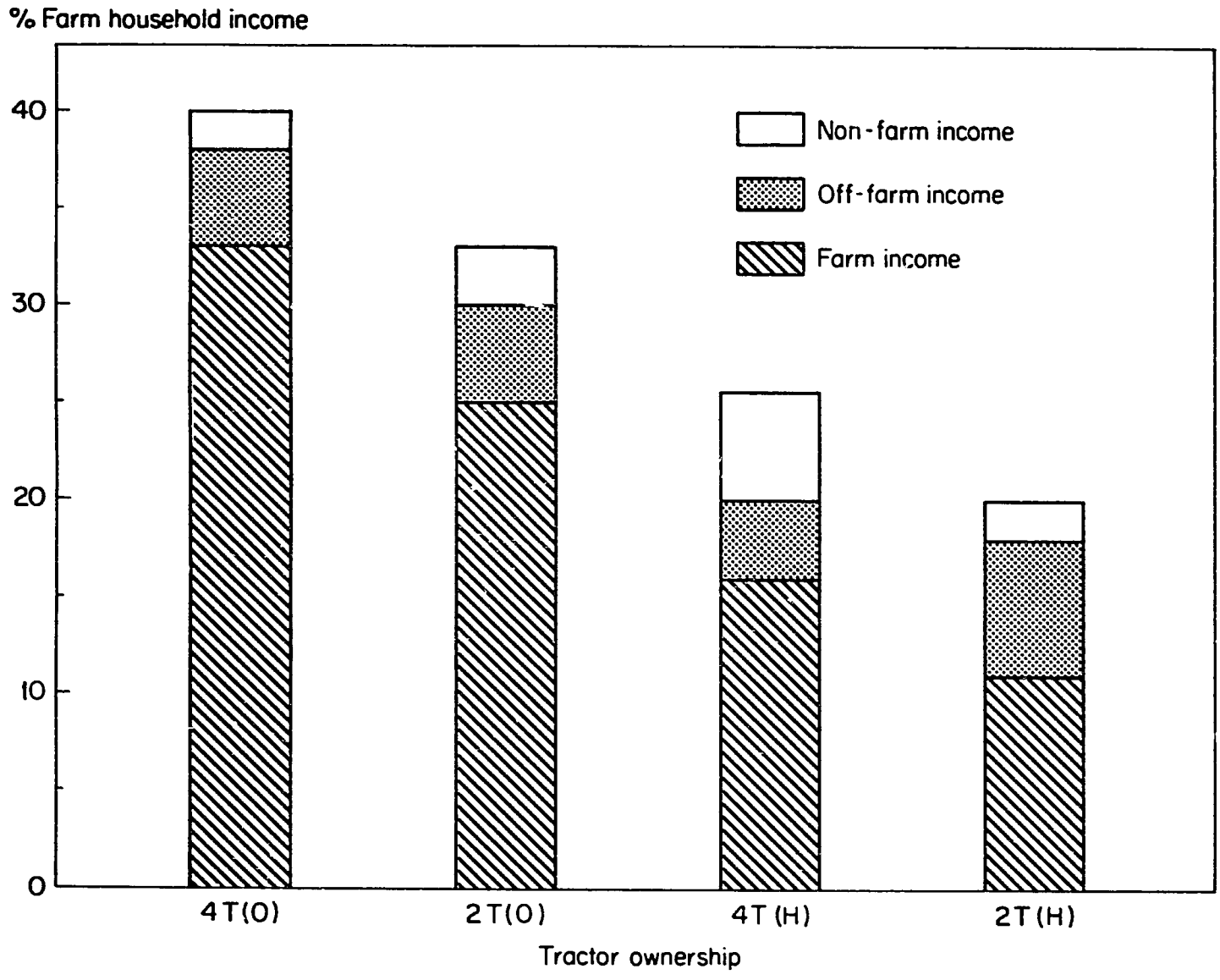

Fig.9. Household income from all sources by tractor ownership, Suphanburi, Thailand, 1981-82.