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THE CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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LABOR USE IN SELECTED VILLAGES OF SUPHANBURI PROVINCE:
AN ANALYSIS OF SURVEY RESULTS

By

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Dermot Shields**

ABSTRACT

This paper presents survey data on labor use by activity and source in selected villages of Suphanburi Province, Central Thailand, over the cropping year 1981-82.

The analyses showed that farm size and the intensity of land preparation better determine total labor use per hectare than either mechanization class (2-wheel versus small 4-wheel tractors) or ownership class (owners versus hirers). Hired labor requirements per hectare varied little between classes and the variation in total per hectare labor was due primarily to variation in family labor and farm size.

Although total household labor was similar on a per farm basis for all farm classes, the smaller, often 2-wheel tractor hiring farms, spent a considerably larger amount of their time on off-farm activities. The impact of the existing accumulation of capital and land appears to have been limited since the landless and marginal families have relativelyt easy access to off-farm employment.

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The debate over the most appropriate mechanization strategy is often hampered by a lack of empirical evidence on which to base the many, and often conflicting, views that are commonly held. Any mechanization strategy has an impact not only on productivity but also on employment and thereby on income distribution in rural areas. Further, the process of agricultural mechanization takes place within an environment of rural-urban migration and often increasing average farm sizes, which both determine and are determined by the type and form of mechanization.

The Consequences of Small Rice Farm Mechanization study aimed to collect data on four sites in South East Asia, where mechanization was either already well established, or in the process of becoming so, in order to provide the sort of quantitative background data, which is required for policy intervention.

The area chosen for the Thailand study was in the largely irrigated and highly mechanized Province of Suphanburi, located in the central plain, North of Bangkok. Five villages were purposively selected to give a large enough sample of 2-wheel and small 4-wheel tractor users: within the village households were randomly selected. The survey was carried out over the cropping year 1981-82.

The vast majority of households in the sample used power tillers for land preparation and so no comparison with animal land preparation techniques were possible. Hence the analysis focuses on differences between owners and hirers of 2-wheel and small 4-wheel power tillers. Further analysis investigated the effect of farm size and the intensity of land preparation.

BACKGROUND

The major crop grown in the area is rice, with over 90 percent of the cropped area planted to modern varieties such as RD 7 and RD 11. Transplanting was the preferred method of sowing and most of the 25 percent of households who broadcast seed had farms larger than 4 hectares.

Irrigation quality varied among the households depending on the location of the plot from the main canal. Most of the irrigation facilities had been installed sometime ago and the major water control problem was drainage, as the area is regularly subject to severe flooding.

The tractorization process started in 1965 and for irrigated households in the area was nearly complete by 1978. The growth of 2-wheel and small 4-wheel tractors was indistinguishable throughout this period, although since the introduction of mechanical thresher (about 1978) the preference of farmers switched towards the 2-wheel tractor version. Two-wheel power tillers average 8 hp and usually have a petrol driven engine, while the small 4-wheel tractor have a slightly larger engine (12 hp) and a diesel engine. There was a tendency for small 4-wheel tractors to be found in the larger upland farms. Also, the extra wheels were perceived to be beneficial for tractorized threshing which was common before the introduction of the thresher.

Non-farm employment is readily and easily available in Suphanburi, an area with good communications to Bangkok. Within the province there is one large sugar processing plant and numerous small industries, where non-farm job opportunities are readily easy to find. Further many households have family members working abroad in Singapore or Middle East.

DISCUSSION OF RESULTS

Farmer Characteristics

Both farm size and family size differed significantly between mechanization classes (Table 2). Four-wheel tractor using farms had larger average farm sizes than 2-wheel tractor using farms, while for 2-wheel classes, owners had farm sizes roughly double that of hirers. A similar pattern was found for family size. The land/labor ratios were particularly small for the 2-wheel tractor-hiring class.

Labor use by Activity

1. Comparative Analysis

Average total labor requirements for each class were 75 mandays per hectare in the wet season (Table 2) and 70 mandays per hectare in the dry season (Table 3). The differences between farm classes were relatively small, except in the case of 2-wheel tractor hirers who used 20 percent more labor than the overall average in the wet season and 10 percent in the dry season.

The major activities, in terms of mandays are land preparation, planting and harvesting and again the 2-wheel tractor hiring class have significantly higher labor requirements for all these activities. This is true for both seasons.

However, the more intensive use of labor on 2-wheel tractor hiring farms was not associated with higher average labor productivity (Table 4). Average labor productivities were calculated for both total labor and preharvest labor and in both cases were lower on the the 2-wheel tractor hiring farm than for the other farm classes. Yields per hectare were not significantly higher on 2-wheel tractor hiring farms. Average labor productivity varied considerably for 4-wheel tractor users, being lower in the wet season and much higher in the dry season. This however, was due to a significantly higher yield for 4-wheel tractor hirers in the dry season.

Measures of average productivity are extremely limited and often misleading, but before undertaking a marginal analysis of labor use, farms were reclassified on the basis of farm size, irrespective of type of machine or form of ownership (Tables 5 and 6). Lower labor requirements were found on larger farms in both the wet and dry season (Figure 1) and a similar trend was observed for land productivity (Table 7) where yields in the wet season were almost 20 percent lower on the largest farm size when compared to the smallest farm size group.

In terms of average labor productivity, measured either in kg per total labor mandays or kg pre-harvest labor mandays, the smallest farm size class showed considerably lower ratios to either of the other classes, (which did not differ significantly). In terms of farm size, the higher yields and higher labor inputs on the smallest farm size class resulted in lower average productivities than on the lower yielding, lower input, larger farm classes.

The distribution of farm size classes within each mechanization class (Table 8) showed that almost two-third of the 2-wheel tractor hiring class were small farms. Therefore this farm size effect needs to be controlled for before drawing conclusions about different tractor classes.

Given the comparative similarity between the machine types and also the land intensification measurement for owning and hiring households, farms were reclassified into land preparation groups based on tractor hours per hectare used for land preparation. Again, an area effect was observed with the most intensive machine use being applied to the smallest farms (Table 9). However, total labor requirements was found to be positively related to the intensity of land preparation (Figure 2).

Labor productivity, although much lower for the largest land preparation class (mostly containing small farm size) declined marginally with more intensive land preparation (Table 10). The distribution of land preparation group by mechanization classes showed that tractor owners prepared their land more intensively than tractor hirer (Table 11).

2. Marginal Analysis

Tabular analysis is both limited and perhaps misleading since there is no allowance for the confounding effects of excluded variables. Marginal analysis for total labor in mandays per hectare as a linear function of area planted and intensity of land preparation was carried out (Table 12). The intensity of land preparation was measured as the number of tractor hours per hectare spent on land preparation. Model I included an intercept shifter separating 2-wheel and 4-wheel tractor users, irrespective of ownership, while Model II separated ownership class, irrespective of machine type. Overall, the models were highly significant although only explaining less than 20 percent of the variation in yield.

In neither the wet or dry seasons, was the mechanization dummy significantly different from zero, suggesting that labor use was similar for both machine types. The area variable was negative and highly significant showing that labor use declined with farm size. Also, the land preparation parameter was significantly positive confirming the tabular analysis that total labor use increase with intensity of land preparation.

Model II was used to test the hypothesis that owners used more labor than hirers after allowing for farm size and the intensity of land preparation. The coefficients for area planted and land preparation intensity were similar to Model I. However, a weakly significant parameter for the ownership dummy suggests that, at least in the wet season, labor use was higher on tractor owning farms.

Labor Use by Source

1. Comparative Analysis

Several mechanization studies have concluded that the major impact of mechanized land preparation is on family labor. Although this study was limited to an analysis of different tractor techniques, much of the variation in total labor per hectare is due to differences in family labor per hectare (Tables 13 and 14).

A similar pattern was exhibited by the tabular analysis for farm size classes (Table 15 and 16, Figure 1) where the variation in total labor per hectare. This was as expected since family labor is limited by family size and off-farm commitments and there is less variation in family size than in farm size. Therefore as farm size increases, family laborer hectare is bound to fall.

An interesting implication of this limit on family labor is that although hired labor per hectare appeared to be constant irrespective of farm class or farm size, it cannot be concluded that this represents the same job opportunities for landless and small farmers. In order to compensate fully for the reduction in the number of farms, caused by increased average farm size, and the fact that many 'amalgated' farmers become landless, an increase in hired labor per hectare would be necessary on the larger farms in order to stand still in terms of employment. However, in Suphanburi, with the relative ease of access to non-farm employment, on-farm job opportunities are not as important an issue as for other areas or regions. However the evidence here is that on the larger farms, hired labor use has not increased with farm size, either in terms of increased job opportunities or to compensate for the displacement of small farms. Although, no evidence is presented here, it is undoubtedly true that mechanization and farm size are strongly associated.

2. Marginal Analysis

The models presented for total labor use were reestimated for hired labor per hectare. The explanatory power of the model was very low: none of the independent variables explain much of the variation in hired labor per hectare. However, the results are consistent with the tabular analysis and confirm that farm size had no effect on hired labor use, while intensity of land preparation had a little effect in the wet season, but a highly significant effect in the dry season. This is probably due to time constraints at the time of dry season land preparation which coincides with wet season harvest and also when tractors are required for threshing. However, the low explanatory power of model suggests that little of the overall variation in hired labor per hectare was explained.

Household Labor

The fall in per hectare household labor use, associated with both larger farm sizes and mechanization, may also provide benefits to the household in terms of either increased leisure or opportunities for off-farm labor.

There was no significant difference in mandays worked by household members when taken as a whole—roughly 33 mandays per household per season (Table 19, 20 and Figure 3). However, the composition of this work showed major differences between the contribution of farm and off-farm activities. For the 2-wheel tractor hiring class over 50 percent of the hours worked were off-farm while for owners of either 2-wheel or 4-wheel tractors less than 30 percent of their time was spent on off-farm activities. These differences were almost entirely due to farm size differences.

Off-farm labor opportunities are relatively easy to find in this area of Thailand and these results suggest that excess family labor was deployed on these activities rather than enjoying increased leisure.

CONCLUSIONS

The differences in labor use between 2-wheel and small 4-wheel tractor using farms were found to be minimal. However, farms hiring in either of the tractor types were characterized by relatively small farm sizes.

Total labor use was negatively related to farm size and positively related to the intensity of land preparation. However, hired labor per hectare was roughly constant irrespective of classification group. However, given the much larger farm sizes of the tractor owning farms, a rise in hired labor would have been expected on these farms, in order to compensate for the reduced family labor per hectare.

Although the issue is not crucial in Suphanburi, a government policy encouraging or permitting the accumulation of capital and land by machine ownership and farm size enlargement will tend to reduce the employment potential of the area. Smaller farms and the sharing of capital services through the hiring or knowing of machines are more likely to maximize employment opportunities within the area. In Suphanburi, where employment opportunities are readily available, other issues such as the maximization of marketable surplus may be an important focus of government policy. However, in many other areas of Thailand, where off-farm employment is not so readily available, the impact of mechanization on employment may have social costs that policy makers need to take into account.

Table 1. Characteristics of farmers and farm holding in selected irrigated villages of Suphanburi Province, Thailand, Wet Season, 1981/1982.

Characteristics	2-wheel tractor		4-wheel tractor		All
	Owner	Hired	Owner	Hired	
Farm size (ha)	3.58	1.62	4.39	2.47	
Family size	5.6	4.7	5.6	4.4	5.3
Labor force per household	3.7	3.3	3.7	2.7	3.5
Depending ratio	1.9	2.4	1.9	1.6	2.0
Land/labor ratio	0.97	0.49	1.19	0.91	
Land/family size ratio	0.64	0.34	0.78	0.56	
Sample size	94	59	53	31	240

Source: Consequences of Small Rice Farm Mechanization.

Table 4. Average productivity ratios by mechanization class in selected villages of Suphanburi Province, Central Thailand, Wet and Dry Season, 1981/82

Average Productivity ratios	Animal	2-wheel tractor		4-wheel tractor		All
		Owner	Hired	Owner	Hired	
<u>Wet Season</u>						
Yield:						
Per hectare	3080	3760	3770	3730	3550	3730
Per total labor	28	53	41	54	50	49
Per per-harvest labor	50	103	89	131	95	104
Per land preparation	102	275	249	356	253	287
<u>Dry Season</u>						
Yield:						
Per hectare	3190	4250	3970	3950	4660	4190
Per total labor	24	63	52	61	66	59
Per pre-harvest labor	53	139	130	130	175	138
Per land preparation	75	356	399	338	480	375
Sample size (WS)	3	94	59	53	31	240
(DS)	2	94	62	52	27	237

Source: Consequences of Small Rice Farm Mechanization Project.

Table 5. Labor requirements for rice production by activity and mechanization class in selected villages, Suphanburi Province, Thailand, Wet Season 1981/82.

Activity	Small	Medium	Large
	<u>Man-day per hectare</u>		
Seedbed preparation	2	1	1
Land preparation	20	18	15
Planting	14	12	12
Application of chemicals	1	2	2
Irrigation	4	3	3
Cultivation	6	5	4
Pre-harvest	48	41	37
Harvesting	37	32	27
Post-harvesting	5	4	2
Total labor	89	76	66
Sample size	60	107	73

Source: Consequences of Small Rice Farm Mechanization Project.

Table 6. Labor requirements for rice production by activity and mechanization class in selected villages, Suphanburi Province, Thailand, Dry Season, 1981/82

Activity	Small	Medium	Large
	<u>Mandays per hectare</u>		
Seedbed preparation	1	0.5	0.5
Land preparation	17	14	12
Planting	14	11	11
Apply chemicals	2	2	2
Irrigation	7	5	2
Cultivation	5	2	2
Pre-harvest	46	34	30
Harvesting	36	28	27
Post-harvest	6	5	3
Total labor	87	67	59
Sample size	66	111	61

Source: Consequences of Small Rice Farm Mechanization Project.

Table 7. Average productivity ratios by farm size class, for selected villages in Suphanburi Province, Central Thailand.

	Small (< 1.6 ha)	Medium (1.6 - 4.0 ha)	Large (> 4.0 ha)	
<u>Wet Season</u>				
<u>Yield</u>				
Per hectare	4010	3950	3300	
Per Total labor	45	52	50	
Per pre-harvest labor	94	110	104	
Per land preparation labor	263	295	277	
<u>Dry Season</u>				
<u>Yield:</u>				
Per hectare	4300	4130	3890	
Per total labor	49	62	66	
Per pre-harvest labor	119	146	143	
Per land preparation	362	381	378	
Sample size				
	(Wet)	60	107	73
	(Dry)	66	110	61

Source: Consequences of Small Rice Farm Mechanization Project.

Table 8. Percent distribution of sample by farm size class and farm mechanization class, in selected villages, Suphanburi Province, Central Thailand, Wet Season 1981/82.

Farm size class	Animal	2-wheel tractor		4-wheel tractor	
		Owner	Hired	Owner	Hired
		<u>Percent</u>			
Small (< 1.6 ha)	100	8	64	3	22
Medium (1.6 - 4 ha)	-	51	16	19	12
Large (> 4 ha)	-	44	5	42	7
Sample size	3	94	59	53	31

Source: Consequences of Small Rice Farm Mechanization Project.

Table 9. Regression result for hired labor per hectare as a function of farm size and machine type and ownership class.

Explanatory variable	Model I		Model II	
	Wet Season	Dry Season	Wet Season	Dry Season
Intercept	26.69*** (6.40)	22.02*** (6.97)	22.7*** (7.26)	2.71*** (6.61)
Farm size	-0.14 (0.19)	-0.11 (0.16)	0.22 (0.31)	0.13 (0.20)
Soil preparation	0.22* (2.38)	0.36*** (4.33)	0.23* (2.53)	0.36* (4.24)
MECH (0, 1) ^a	2.21 (0.80)	5.45* (2.17)		
OWN (0, 1)			6.80** (2.65)	0.95 (0.40)
R ²	0.03	0.09	0.05**	0.08***
Fvalue	2.04	7.66	4.23	6.03
CV	59%	52%	58%	53%
N	234	224	234	224

Dependent variable is hired labor mandays per hectare.

(a) MECH is dummy variable with value 0 if 2-wt, and 1 if 4-wt.

(b) OWN is a dummy variable with value 0 if owner and value 1 if hired.

*** Significant at 99.9%.

** Significant at 99%.

* Significant at 95%.

Table 10. Average labor productivity ratios by land preparation classes in selected villages, Suphanburi Province, Central Thailand, Wet and Dry Season, 1981/82.

	Land Preparation class [*]				
	0 - 20	20 - 25	25 - 30	30 - 40	40+
<u>Wet Season</u>					
<u>Yield:</u>					
Per hectare	3420	3870	3630	3680	4160
Per total labor	51	56	49	49	42
Per per-harvest labor	111	119	108	104	76
Per land prep. labor	352	310	270	258	195
<u>Dry Season:</u>					
<u>Yield</u>					
Per hectare	3950	4200	3880	4590	4210
Per total labor	63	63	61	57	48
Per pre-harvest labor	156	156	128	128	96
Per land preparation	478	425	322	312	224
Sample size (Wet)	55	49	42	49	45
(Dry)	66	62	37	33	39

* Defined by the tractor hours spent on land preparation.

Source: Consequences of Small Rice Farm Mechanization Project.

Table 11. Percentage distribution of land preparation classes by mechanization group, in selected villages, Suphanburi Province, Central Thailand Wet and Dry seasons, 1981/82

Land preparation Group	Animal	2-wheel tractor		4-wheel tractor		All
		Owner	Hired	Owner	Hired	
<u>Wet Season</u>						
<u>Per hectare</u>						
1: < 20 hours	100	16	33	19	19	23
2: 20 - 25 hours		18	21	19	30	20
3: 25 - 30 hours		19	10	23	15	17
4: 30 - 40 hours		25	16	21	15	20
5: > 40 hours		22	19	19	22	20
<u>Dry season</u>						
<u>Per hectare</u>						
1: < 20 hours	100	14	27	21	39	23
2: 20 - 25 hours		18	24	25	16	20
3: 25 - 30 hours		21	10	23	13	19
4: 30 - 40 hours		26	20	18	10	20
5: > 40 hours		21	19	13	23	19
<u>Sample size</u>						
WS	3	94	59	53	31	240
DS	2	94	63	52	27	238

Source: Consequences of Small Rice Farm Mechanization Project.

Table 12. Regression equation for total labor in mandays per hectare to test whether there are significant labor difference between different tractor classes and different ownership group.

	Model I		Model II	
	Wet season	Dry season	Wet season	Dry season
Intercept	66.81*** (9.48)	60.58*** (10.57)	58.84*** (11.61)	58.30*** (12.57)
Farm size (ha)	-3.70*** (3.48)	-3.03*** (3.21)	-3.55*** (3.44)	-2.84*** (3.10)
Tractor hours (ha) Soil preparation	0.72*** (5.16)	0.51*** (4.27)	0.75*** (5.54)	0.52*** (4.43)
Mechanization (0,1) ^a	-3.84 (0.94)	+2.29 (0.65)		
Own (0,1) ^b			+10.74** (2.85)	4.31 (1.30)
R ²	0.18***	0.13***	0.20***	0.14***
Fvalue	16.59	11.14	19.51	11.63
CV	39%	37%	38%	37%
N	234	224	234	224

Dependent variable is total labor per manday per hectare.

^a Mech. is a dummy with value 0 if 2-wt, and value 1 if 4-wt.

^b Own is a dummy with value 0 if hired, and value 1 if owned

***Significant at 99.9%

**Significant at 99%

Table 13. Distribution of labor requirements for rice production by source, in selected villages, Suphanburi Province, Central Thailand, Wet Season, 1981/82.

Source of labor	Animal	2-wheel tractor		4-wheel tractor		All
		Owner	Hired	Owner	Hired	
<u>Mandays per ha.</u>						
Total labor	110	71	92	69	71	76
Hired labor	10	31	37	38	33	34
Family labor	100	40	55	31	39	42
Sample size	3	94	59	53	51	240

Table 14. Distribution of labor requirements for rice production by source, in selected villages, Suphanburi Province, Central Thailand, Dry Season, 1981/82.

Source of labor	Animal	2-wheel tractor		4-wheel tractor		All
		Owner	Hired	Owner	Hired	
<u>Man-days per ha.</u>						
Total labor	134	68	77	65	71	78
Hired labor	10	32	33	36	38	34
Family labor	124	36	44	30	33	37
Sample size	2	94	62	52	27	237

Source: Consequences of Small Rice Farm Mechanization.

Table 15. Total, hired and household labor by farm size class in selected villages, Suphanburi Province, Central Thailand, Wet Season, 1981/82.

Source of labor	Small (< 1.6 ha)	Medium (1.6 - 4 ha)	Large (> 4 ha)
Wet season			
Total labor	89	76	66
Hired labor	33	34	34
Household labor	56	42	32
Sample size	60	107	73

Source: Consequences of Small Rice Farm Mechanization Project.

Table 16. Total, hired and household labor by farm size class in selected villages, Suphanburi Province, Central Thailand, Dry Season, 1981/82.

Source of labor	Small (< 1.6 ha)	Medium (1.6 - 4 ha)	Large (> 4 ha)
Dry Season			
Total labor	87	67	59
Hired labor	46	34	30
Household labor	37	32	33
Sample size	66	110	61

Source: Consequences of Small Rice Farm Mechanization Project.

Table 17. Total, hired and household labor by land preparation class, in selected villages, Suphanburi Province, Central Thailand, Wet season, 1981/82

Source of labor	Land Preparation Class*				
	0 - 20	20 - 25	25 - 30	30 - 40	40+
	<u>Man-days per hectare</u>				
Total	67	69	74	75	99
Hired	31	35	29	32	43
Household	36	34	45	43	56
Sample size	55	49	42	49	45

*Defined by the tractor hours spent on land preparation.

Source: Consequences of Small Rice Farm Mechanization Project.

Table 18. Total hired and household labor by land preparation class in selected villages, Suphanburi Province, Central Thailand, Dry Season, 1981/82

Source of labor	Land Preparation Class*				
	0 - 20	20 - 25	25 - 30	30 - 40	40*
	<u>Man-day per hectare</u>				
Total	62	67	63	81	88
Hired	86	34	36	39	38
Household	36	33	29	43	50
Sample size	66	62	37	33	39

* Defined by the tractor hours spent on land preparation.

Source: Consequences of Small Rice Farm Mechanization Project.

Table 19. Regression equation of household labor in man-days per hectare to test the hypothesis that after controlling for farm size, there is no significant difference in household labor requirement between different tractor class.

Explanatory variables	Model I		Model II	
	Wet	Dry	Wet	Dry
Intercept	56.61*** (11.05)	43.20*** (10.80)	53.50*** (15.39)	40.85** (14.29)
Area	-4.04*** (4.36)	-3.06*** (3.88)	-4.39*** (4.78)	-3.13*** (4.00)
MECH (0,1) ^a	-7.36* (2.06)	-3.31 (1.09)		
OWN (0, 1)			2.91 (0.80)	+2.95 (1.04)
R ²	0.11***	0.07***	0.10**	0.07***
Fvalue	14.37	8.97	12.44	8.92
CV	62%	65%	62%	65%
N	234	224	234	224

Dependent variable is household labor in mandays per hectare.

^a MECH is a dummy variable with value = 0 if 2-wheel tractor and value = 1 if 4-wheel tractor.

^b OWN is a dummy variable with value = 0 if tractor is owned and value = 1 if tractor is hired.

*** Significant at 99.9%.

** Significant at 95%.

Table 20. Distribution of family, labor between farm and off-farm activities, in selected villages, Suphanburi Province, Central Thailand, Wet Season, 1981/82

	Animal	2-wheel tractor		4-wheel tractor		All
		Owner	Hired	Owner	Hired	
<u>Man-days per farm</u>						
Farm labor	44	24	15	23	21	21
Off-farm labor	4	10	16	8	11	11
Total family	48	34	31	31	32	33
% of farm	8%	29%	52%	26%	34%	33%
Sample size	3	94	59	53	34	33

Source: Consequences of Small Rice Farm Mechanization Project.

Table 21. Distribution of family labor between farm and off-farm activities in selected villages, Suphanburi Province, Central Thailand, Dry 1981/82.

	Animal	2-wheel tractor		4-wheel tractor		All
		Owner	Hired	Owner	Hired	
<u>Man-days per farm</u>						
Farm labor	40	30	18	34	18	26
Off-farm labor	2	7	10	4	10	7
Total family labor	42	37	28	38	28	33
% off farm	5%	20%	36%	11%	36%	21%
Sample size	2	94	62	52	27	37

Source: Consequences of Small Rice Farm Mechanization Project.

LABOR REQUIREMENTS BY FARM SIZE GROUP

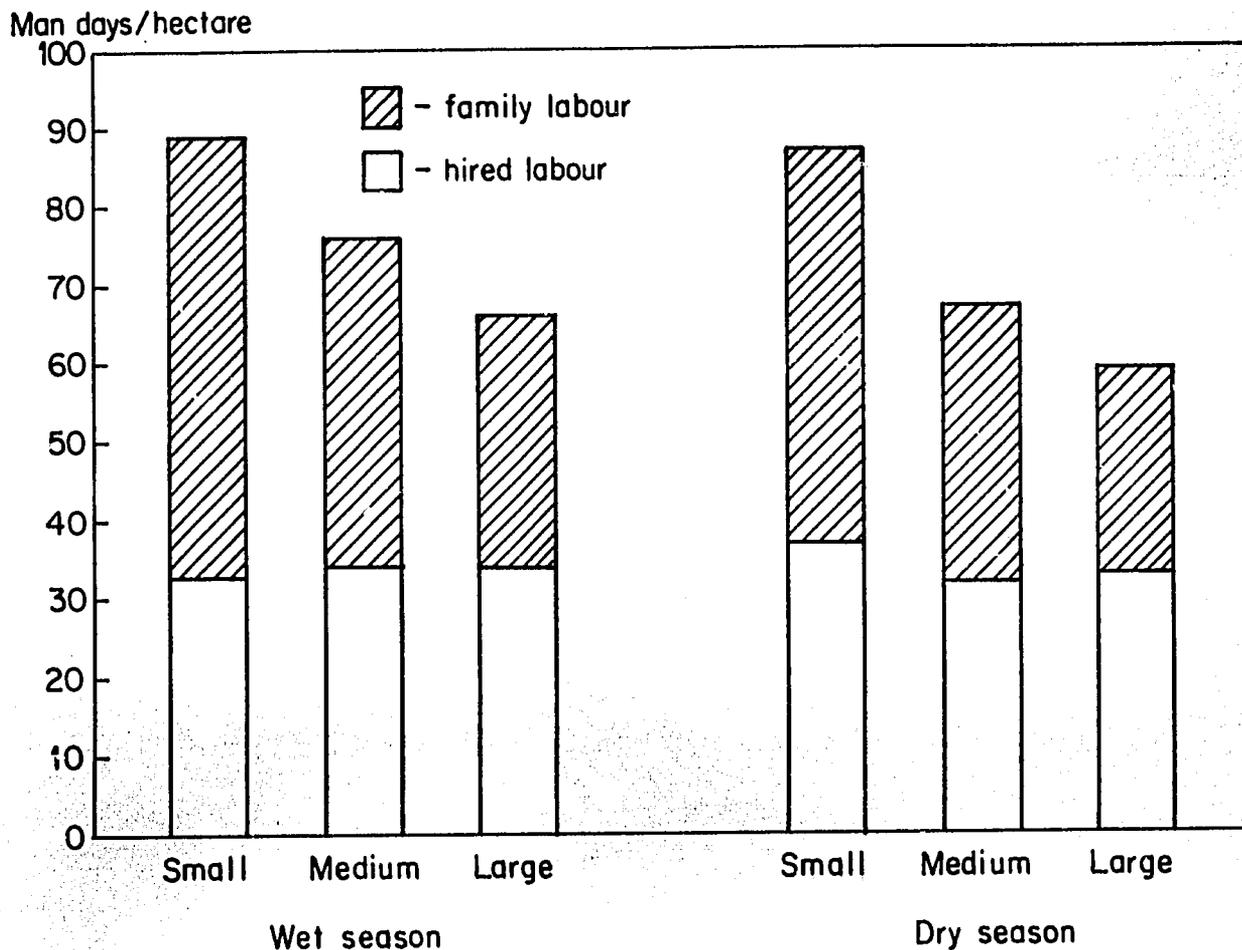


Fig. 1. Total labour requirement for more production in man-days per hectare by area class in selected villages, Suphanburi Province, Central Thailand, 1981 - 1982 .

LABOR REQUIREMENTS BY LAND PREPARATION GROUP

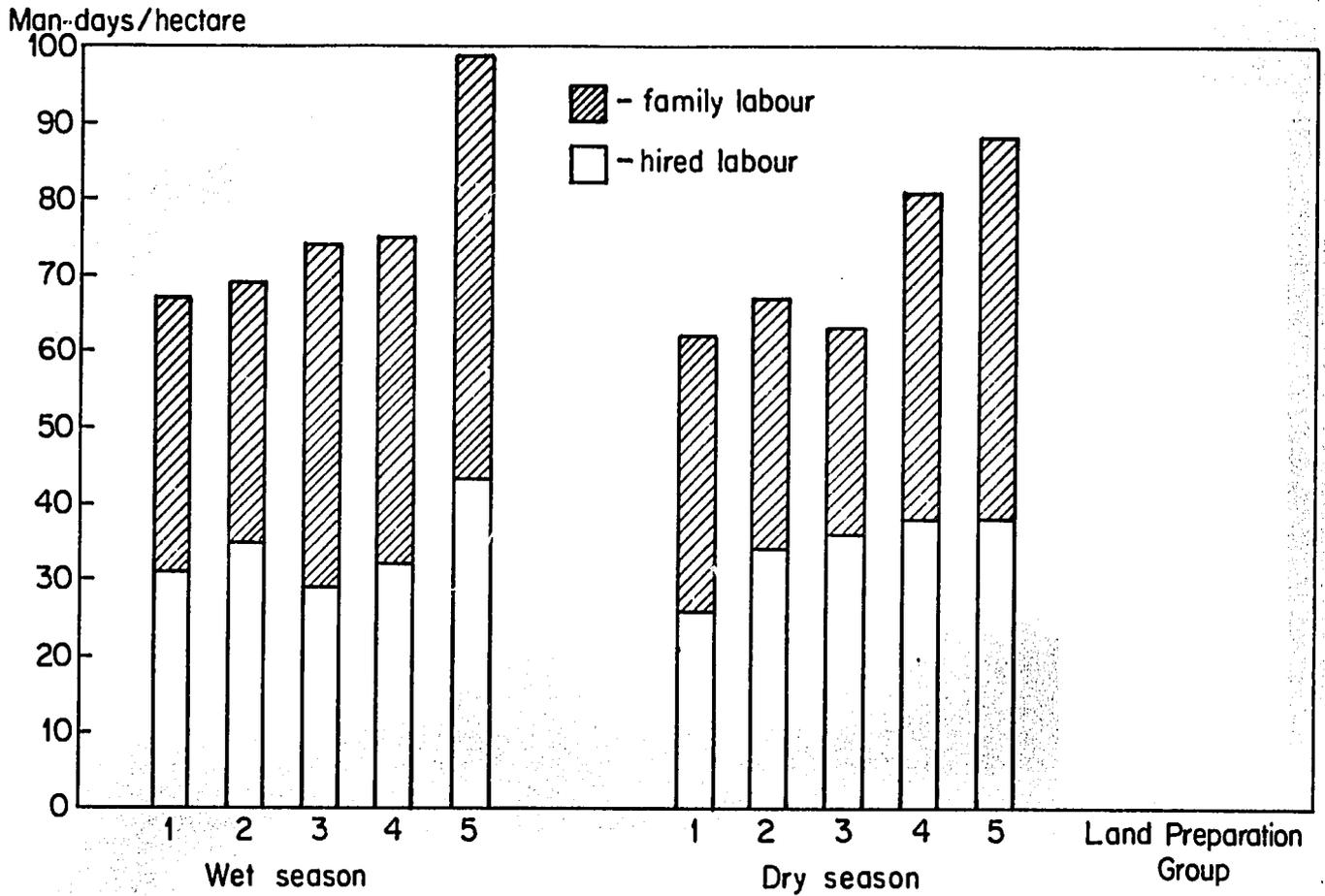


Fig. 2. Total labour requirement for more production in man-days per hectare by land preparation group in selected villages, Suphanburi Province, Central Thailand, 1981-1982.

FAMILY LABOUR PER HOUSEHOLD

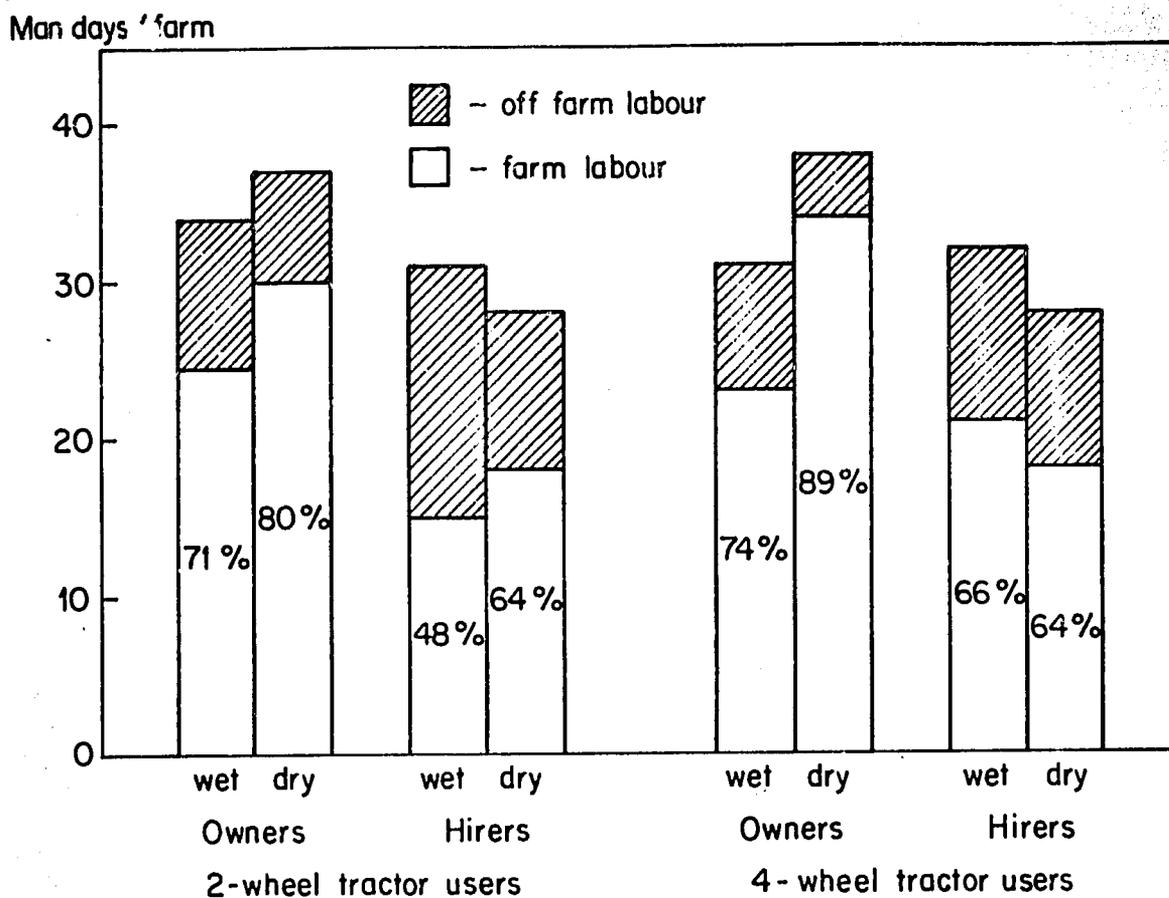


Fig. 3. Proportion of household labour spent on farm and off farm employment in selected villages, Suphanburi Province, Central Thailand, wet and dry season 1981-1982.