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THE CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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EFFECTS OF MINI-TRACTOR MECHANIZATION ON EMPLOYMENT AND LABOR USE INTENSITY, SIDRAP AND PINRANG, SOUTH SULAWESI, INDONESIA

By

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ABSTRACT

The mechanization of land preparation can be expected to reduce labor requirements/rice crop. In order to evaluate the magnitude and nature of this impact, a farmer survey was conducted during 1979-81 in Sidrap and Pinrang District, South Sulawesi. Respondents included non-mechanized and mechanized farmers in rainfed and irrigated environments. The data showed that while mechanization reduces human/animal land preparation labor requirements, this is primarily family labor. Consequently, mechanization improves farmers welfare by freeing family labor for alternative work opportunities or leisure activities.

INTRODUCTION

The impact of mechanization on employment has raised a great deal of concern in Indonesia because at least 65% (BPS, 1976) of the population is employed in agriculture, the economy has not grown rapidly, enough to absorb the population increase (Manguno, 1981) and the mechanization of agriculture may displace labor with no alternative employment opportunities.

OBJECTIVES

The objective of this paper is to evaluate the impact of the introduction of mini-tractors on labor use in Sidrap and Pinrang, South Sulawesi. Specific relationships explored are the impact of mechanization on:

1) land preparation labor use; including total, family and hired labor

2) crop establishment and maintenance labor

3) harvest labor, and

4) total labor use.

STUDY AREA

Sidrap and Pinrang Districts are located 200 km north of Ujung Pandanga, the capital of South Sulawesi. The area is primarily agricultural, with 35% of Sidrap and 30% of Pinrang irrigated and double cropped to rice (Consequences Team, 1981). The population density is relatively low compared to Java, averaging 83 to 108 persons/km^2 in Sidrap and Pinrang (Consequences Team, 1981). In these districts almost all farmers own land and there are virtually no landless laborers.[1]

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[1] A census of over 2,000 household identified less than ten landless agricultural households.

SURVEY DESIGN AND METHODOLOGY

Sampling. A random sample of respondents were selected from four villages in both Sidrap and Pinrang -- including rainfed and irrigated farmers -- who prepared their fields by non-mechanized and mechanized techniques.

Data collection. A survey was undertaken to collect data during the 1979 wet, 1979/80 dry (second crop), 1979/80 dry (third crop), 1980 wet and 1980/81 dry (second crop)season. Very few farmers plant a third crop and in the 1979/80 dry season drought was severe. Consequently, only the three normal seasons are evaluated in this report.

Tractor introduction. Mini-tractors were introduced in 1974 and the population increased to a total of 505 units in 1979. Although the number appears large, most of the land is still prepared by animal or manpower. Assuming all mini-tractors are still operating and each unit prepares 25 ha/season (Consequences Team, 1981), the maximum percent of the area plowed by mini-tractors in 1980 was only 30% in Sidrap and 19% in Pinrang Districts (Table 1).

RESULTS

Labor input data for three seasons is presented in Tables 2, 3 and 4. The following discussion is based on these tables.

Land preparation labor. In the wet season, non-mechanized farms employ about twice as much human and animal labor as mechanized operations.[2] Almost all of this labor was supplied by the family. The data suggested that mechanization reduces family labor input -- not hired labor use -- and in the 1980 wet season, mechanized farms actually employed more hired labor than non-mechanized operations. On the other hand, in the dry season total human labor use was less than in the wet season with almost all of this labor supplied by the family. Generally, irrigated farms required less human and animal labor, although this relationship is not true in all years/seasons.

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[2]Most mechanized farmers used combinations of man, animal and tractor labor to prepare their fields.

Crop establishment and maintenance labor. There are no strong theoretical reasons why land preparation mechanization should have a major impact on labor used for planting and crop maintenance. This is confirmed by the data which showed no systematic relationship between power source and planting, fertilizing, weeding and pest control labor use. On the other hand, irrigated (mechanized and non-mechanized) farms tended to use slightly less weeding labor and more fertilizing labor as a consequence of better water control and higher input use.

Harvest labor. The amount of labor used for harvesting is a function of the yield, as all respondents hired laborers who used a sickle. Generally, in the same water environment mechanized fields gave slightly higher yields than non-mechanized, although this appears to be the consequence of higher urea applications (Table 5). As a result, harvest labor input tends to be slightly higher for mechanized, compared to non-mechanized farms.

Total labor. For the three reasons considered, there was very little differences between total human labor used on mechanized and non-mechanized farms, with mechanized farms using an average (over all seasons and environments) of 3.6 less MD/ha. On the other hand, if harvesting labor is excluded, the mechanized farms used an average of 12.4 MD/ha less than the non-mechanized.

CONCLUSION

As would be expected, mechanized land preparation reduces the human labor input/crop required for land preparation. On the other hand, it has little or no impact on labor requirements for crop establishment and maintenance. While mechanized farms used more harvest labor, this is due to higher yields probably resulting from higher fertilizer application.

In Sidrap and Pinrang Districts, the man-land ratio is relatively low and there are virtually no landless laborers. Most of the land preparation labor displaced by the mini-tractor is family labor and much of the hired labor is actually exchange labor. Consequently, farmers who hire mini-tractor services appear to be choosing to pay for a service which frees family labor for alternative work opportunities or leisure. In these circumstances, land preparation mechanization contributes towards improving farmers' welfare without having a negative labor displacing impact.

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Table 1. Tractor population, hectares planted and percent of area mechanically prepared by year, Sidrap and Pinrang Districts, South Sulawesi.

Year	Sidrap			Pinrang		
	mini-tractor number[a]	Ha.harvested (WS and DS)[b]	%tractor plowed[c]	mini-tractor number[a]	Ha.harvested (WS and DS)[b]	%tractor plowed[c]
1974	12	N.A.	N.A.	9	N.A.	N.A.
1975	36	49,807	3.6	30	41,397	3.6
1976	76	55,438	6.9	97	44,074	11.0
1977	148	60,549	12.2	109	36,103	15.1
1978	151	60,616	12.5	131	63,542	10.3
1979	297	51,368	30.0	208	55,073	18.9

N.A. = Data not available.

a) Data from DIPERTA, District Office, including all mini-tractors whether or not operating.

b) Data from BPS, respective years.

c) Assuming 25 ha plowed/mini-tractor/season, based on data reported in Consequences Team, 1981.

Table 2. Number of workdays/ha (8 hours), Consequences Cooperators, Sidrap and Pinrang Districts, South Sulawesi, Indonesia, wet season, 1979.

Environment/ Operation	Non-mechanized			Mechanized		
	Family	Hired[a]	Total	Family	Hired[a]	Total
Rainfed (No.)		(84)			(48)	
Land preparation[b]						
human[c]	23.2	15.5	38.8	15.4	4.8	20.2
animal[d]	39.9[f]		39.9	17.7[f]		17.7
tractor	0.0	0.0	0.0	0.0	2.2	2.3
Planting	3.4	14.4	17.8	5.9	22.9	28.8
Fertilizing	0.5	0.0	0.5	0.6	0.0	0.6
Weeding	16.7	8.5	25.2	16.3	8.6	24.9
Pesticide	2.0	7.6	9.6	0.8	0.4	1.2
Harvest/transport	8.8	23.0	31.8	5.4	48.0	53.4
Other[e]	1.9	2.8	4.7	1.0	0.8	1.8
Total human	56.6	71.8	128.4	45.4	85.1	130.9
excluding harvest	47.8	48.8	96.6	40.0	36.7	76.7
Irrigated (No.)		(82)			(76)	
Land preparation[b]						
man[c]	25.0	4.2	29.2	7.8	3.8	11.6
animal[d]	18.0[f]		18.0	7.2[f]		7.2
tractor	0.0	0.0	0.0	0.0	1.5	7.2
Planting	2.3	19.7	22.0	3.4	15.8	19.2
Fertilizing	1.3	0.0	1.3	1.5	0.8	2.3
Weeding	15.0	5.6	20.6	8.7	6.0	14.7
Pesticide	3.2	0.2	3.4	2.0	0.7	2.7
Harvest/transport	2.3	20.0	22.3	2.0	47.8	49.8
Other[e]	5.0	0.0	5.0	2.8	0.4	3.2
Total human[c]	54.1	49.7	103.8	28.2	75.3	103.5
excluding harvest	51.8	29.7	81.5	26.2	27.5	53.7

a) Hired and exchange labor
b) Including seedbed preparation
c) Includes human labor used with animal and tractor.
d) Total family and hired animal days. Farmers often hire animals with which he himself will use for plowing.
e) Irrigating, and drying; rainfed mechanized farmers mostly sold at harvest without drying.
f) Family plus hired

Source: Consequences of Mechanization Survey.

Table 3. Number of workdays (8 hours), Consequences Cooperators, Sidrap and Pinrang Districts, South Sulawesi, Indonesia, Wet season 1980.

Environment/ Operation	Non-mechanized			Mechanized		
	Family	Hired[a]	Total	Family	Hired[a]	Total
Rainfed (No.)		(71)			(40)	
Land preparation[b]						
Human[c]	18.4	0.8	19.2	9.5	2.0	11.5
Animal[d]	29.9[f]		29.9	11.5		11.5
Tractor	0.0	0.0	0.0	0.0	1.2	1.2
Planting	3.3	15.9	19.2	3.0	18.0	21.0
Fertilizer	0.5	0.0	0.5	0.7	0.1	0.8
Weeding	12.1	0.1	12.2	12.0	0.0	12.0
Pesticide	0.5	0.0	0.5	0.9	0.0	0.9
Harvest/transport	2.2	22.0	24.2	1.8	25.4	27.2
Other[e]	0.1	0.0	0.1	0.2	0.0	0.2
Total human	37.1	38.8	75.9	28.1	45.5	73.6
excluding harvest	34.9	16.8	51.7	26.2	20.1	46.4
Irrigated (No.)		(30)			(83)	
Land preparation[b]						
Man[c]	20.4	1.1	21.5	7.6	4.1	11.7
Animal[d]	16.9		16.9	4.9		4.9
Tractor	0.0	0.0	0.0	0.0	1.2	1.2
Planting	4.9	18.3	23.2	4.3	15.9	20.0
Fertilizing	0.9	0.0	0.9	1.0	0.0	1.0
Weeding	7.0	0.0	1.0	6.6	0.2	6.8
Pesticide	1.6	0.0	1.6	1.7	0.0	1.7
Harvest/transport	0.9	26.7	27.6	1.4	28.5	29.9
Other[e]	0.9	0.0	0.9	1.5	0.0	1.5
Total human[c]	36.6	46.1	86.3	24.1	48.7	72.6
excluding harvest	35.7	19.4	58.7	22.7	20.2	42.7

a) Hired and exchange labor
b) Including seedbed preparation
c) Includes human labor used with animal and tractor.
d) Total family and hired animal days. Farmers often hire animals with which he himself will use for plowing.
e) Irrigating, and drying, rainfed mechanized farmers mostly sold at harvest without drying.
f) Family plus hired

Sources: Consequences of Mechanization Survey.

Table 4. Number of workdays/ha (8 hours), Consequences Cooperators, Sidrap and Pinrang Districts, South Sulawesi, Indonesia, dry season, 1980/81.

Environment/ Operation	Non-mechanized			Mechanized		
	Family	Hired[a]	Total	Family	Hired[a]	Total
Rainfed (No.)		(g)			(7)[h]	
Land preparation[b]						
Human[c]	12.8	3.9	16.7	12.5	1.6	14.1
Animal[d]	18.2		18.2	7.4		7.4
Tractor	0.0	0.0	0.0	0.0	1.5	1.5
Planting	2.5	24.3	26.8	2.9	21.8	24.7
Fertilizing	0.7	0.2	0.9	1.1	0.0	1.1
Weeding	9.7	1.3	11.0	1.7	0.0	1.7
Pesticide	1.2	0.0	1.2	9.0	0.0	9.0
Harvest/transport	1.7	19.8	21.5	0.9	21.2	23.1
Other[e]	0.7	0.0	0.7	5.5	0.0	5.5
Total human	29.3	49.5	78.8	33.6	46.1	79.2
excluding harvest	27.6	29.7	57.3	32.7	24.9	56.1
Irrigated (No.)		(53)			(104)	
Land preparation[b]						
Man[c]	14.5	1.1	15.6	8.7	2.8	11.5
Animal[d]	19.8		19.8	7.0		7.0
Tractor	0.0	0.0	0.0	0.0	1.3	1.3
Planting	1.4	20.0	21.4	2.6	17.5	20.1
Fertilizing	0.8	0.8	0.8	0.9	0.1	1.0
Weeding	7.9	0.0	7.9	8.5	0.1	8.6
Pesticide	1.3	0.0	1.3	1.1	0.0	1.1
Harvest/transplant	0.9	31.3	32.2	0.9	31.3	32.2
Other[e]	0.6	0.0	0.6	1.3	0.0	1.3
Total human[c]	27.4	53.2	79.8	24.0	51.8	75.8
excluding harvest	26.5	21.9	47.6	23.1	20.5	43.6

a) Hired and exchange labor
b) Including seedbed preparation
c) Includes human labor used with animal and tractor.
d) Total family and hired animal days. Farmers often hire animals with which he himself will use for plowing.
e) Irrigating, and drying; rainfed mechanized farmers mostly sold at harvest without drying.
f) Family plus hired.
g) 21.07 ha
h) 5.87 ha

Source: Consequences of Mechanization Survey.

Table 5. Yields and urea use, Consequences Cooperators, Sidrap and Pinrang, South Sulawesi, Indonesia, 1979-81.

Season	Non-mechanized		Mechanized	
	Rainfed	Irrigated	Rainfed	Irrigated
1979 W.S. (No.)	(4)	(82)	(48)	(76)
Yield (kg/ha)[a]	508	1,099	768	1,551
Urea (kg/ha)	45	45	84	136
1980 W.S. (No.)	(71)	(30)	(40)	(83)
Yield (kg/ha)	2,552	2,548	2,413	2,910
Urea (kg/ha)	89	107	108	156
1980/81 D.S. (No.)	(b)	(53)	(7[c])	(104)
Yield (kg/ha)	4,214	5,655	4,841	4,735
Urea (kg/ha)	103	77	130	152

a) Low yields due to severe drought.

b) 21.97 ha

c) 5.87 ha

Source: Consequences of Mechanization Survey.

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