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THE CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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THE IMPACT OF HANDTRACTORS ON INCOME AND EMPLOYMENT  
OPPORTUNITIES OF MIGRANT LABORERS IN JAVA

By

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#### ABSTRACT

*Rice production in Mariuk and Tambakdahan villages, Subang, West Java is becoming increasingly mechanized. This has led to concern over the welfare of migrant laborers. A survey of 125 farmers and 66 migrant laborers was undertaken to determine the current situation. Results indicated that 28% of the labor used in rice production in Mariuk was migrant labor and 20% in Tambakdahan. The migrants tended to be relatively young (average 28 years) with little education and small families. Although mechanization has reduced employment opportunities there still appears to be a labor shortage during the peak period of wet season harvest/dry season planting. The average annual income of migrant laborers was RP81,200, at which RP18,500 came from farm labor outside their home village. Most migrant laborers came from marginal areas in West Java.*

## INTRODUCTION

### Identification of Problem

Irrigation and technology improvements make it possible to grow two crops of rice on a large scale, and sometimes even a third crop is now possible. This means a higher demand for labor in agriculture in spite of the almost stationery area devoted to agriculture in Java. Yet in many places irrigation water is not sufficient, so that more efficient management and efficient structures are called for. This is reflected in the effort to provide farmers with tertiary and quaterly structures together with the formation of water users association.

Higher technology means also the need for precision and timeliness. The use of a very few plant types on a large area means vulnerability with respect to pest infestation. The sudden and massive BPH infestation in recent years is a clear warning to the new challenge behind the success story of technological advance.

Timeliness in land preparation means that farmers are required to finish the work within a short period of time. It also means that there must be a higher concentration of labor. When we assume that labor requirements can be distributed evenly throughout the year we see that labor supply is more than enough, yet when we calculate the demand for labor within the peak season we come to the conclusion that a labor shortage may occur in the agricultural sector. This is particularly felt during land preparation and harvest.

Little is known about what is happening in the rice sector in matters related to labor shortages during some critical periods in the season. Some scientists advocate the introduction of tractors to alleviate labor shortages in land preparation. Others, perhaps the majority, claim that the labor shortage is only an issue suggested by large landowners to secure more income. If this is true the introduction of tractors will only worsen the trend of increasing uneven distribution of income. Labor mobility and seasonal migration of labor is the solution already used by the rural people.

This study is an attempt to look closer into the problem. Choosing a typical rice producing area in Java we have collected information to answer the following questions:

- a. Whether it is really true that labor demand is higher than labor supply within some periods of time, so that it is necessary to introduce tractors to alleviate the problem?
- b. What is the direct and indirect effect of tractors on the pattern of labor migration and seasonal employment?
- c. What are the demographic characteristics of migrants and the motive force behind their migration?
- d. Is it true that migration of labor is diminishing because of the introduction of new and more intensive cropping systems in both the area of origin and in area where they find employment?

#### Research Objectives

The research objectives to answer these questions and offer solutions to the main problems discussed earlier are the following:

- a. To estimate the proportion of migrant labor in rice production,
- b. To estimate income and working opportunities of migrant labor in the village of origin as well as in the village of destination.
- c. To identify factors affecting the magnitude of migration, such as the introduction of tractors.

#### Research Methodology

Subang was selected as the site for the research. Two villages were chosen (Mariuk and Tambakdahan) out of the four villages being studied by the Agro Economic Survey's Rural Dynamics Study on agricultural mechanization which was specially

sponsored by the Agro Economic Survey.

In Mariuk there were 55 farmer respondents and 37 migrant respondent who were randomly chosen, while in Tambakdahan 70 farmers and 29 migrants.

Before the sample of farmers was taken, a census of farmer households was conducted (farm operators only) to identify the existing statistical population to determine who were the migrant employers and non-employers for the wet season 1979-80. Each category was then subdivided into three strata, namely (1) tractor users, (2) animal users, and (3) laborers.

Interviews were conducted during the wet season 1979-80 harvest period that coincided with the land preparation for the dry season 1980.

#### HAND TRACTORS IN MARIUK AND TAMBAKDAHAN

In Mariuk hand tractors were introduced in 1969. At that time, nine handtractors were purchased by rich farmers in the village. Up to 1975 the number increased quite slowly and only large landowners could use and purchase these tractors. In 1978 the number increased to 22. It was at this time that the use of handtractors was not confined to large farmers alone, but began to spread to other farmers as well. In the wet season 1979-80 the number was already 46 owned by 38 farmers.

In Tambakdahan the advance of handtractors was much slower. Even though the village belongs to a well developed, agricultural area, as Mariuk is, the number of tractors in the village was small, only 5 owned by 5 farmers in the wet season 1979-80. The slow advance of tractors, according to farmers' perception was due to the unfavourable rural roads which meant that the tractors were confined only to rice fields near the road. In Mariuk a better rural road system is available that can be used by handtractors,

In this area, land preparation is not usually done in the dry season for rice cultivation. Farmers use a much simpler walikjerami system, which is cutting the straw and spreading it - slightly trodden - evenly in the field. Yet recently some farmers have begun using tractors for land preparation in dry season.

In Table 1 is shown the number of tractor users and the associated area. In Mariuk we see that 35.1 per cent of farmers used tractor covering 59.0 per cent of the rice area in the wet season 1979-80; in Tambakdahan only 3.7 per cent of the farmers used tractors on 6.5 per cent of the total area. Note also that the majority of the farmers in Tambakdahan used animals (70.5 per cent) on 56.0 per cent of the area.

Table 1. - Number of households (HH) by category of land preparation labor, Wet Season 1979-80

Labor or power category	Mariuk				Tambakdahan			
	HH	%	Area (ha)	%	HH	%	Area (ha)	%
1. tractor	294	35.1	630	59.0	41	3.7	62	6.5
2. Animal	245	29.3	254	23.8	283	25.8	362	37.5
3. Laborers only	298	35.3	183	17.2	774	70.5	541	56.0
Total	837	100.	1067	100.	1098	100.	995	100.

Source: Household census

It is interesting that for both villages the average working area of the tractors was almost the same, namely 13.7 ha/tractor in Mariuk compared to 12.4 ha/tractor in Tambakdahan. In Table 2 we see that land preparation was done in a period of two months, and in Mariuk most of the activity was carried out in the first half of October, In Tambakdahan it was more evenly distributed up to the first half of November.

According to irrigation scheduling, land preparation should be finished in one month for Mariuk. For Tambakdahan it was six weeks because some of the area in the southern part of the village belonged to a different irrigation rotation category. However, the farmers could not, in general, follow the time schedule determined by the irrigation service. Quite probably the main reason for this was the lack of labor.

Table 2. - Land preparation period, Wet Season 1979-80.

Month	Mariuk		Tambakdahan	
	Area (Ha)	Percent	Area (Ha)	Percent
October				
- 1st half	10.6	13.	32.3	33.
- 2nd half	45.5	56	37.1	40.
November				
- 1st half	19.9	24.	24.7	27.
- 2nd half	5.5	7.	1.0	1.

#### LABOR SUPPLY AND DEMAND IN RICE PRODUCTION

Both Mariuk and Tambakdahan are monoculture rice areas where two crops of rice can be grown every year. Wet season rice is in the period of October-March, followed by dry season rice in April-July. The last two months of the year (August and September) are left fallow. The percentage of the population above ten years working as farm operators or employed as family laborers in their own farms was 40.6 and 35.6 per cent for Mariuk and Tambakdahan respectively. The percentage employed as hired farm laborers was about the same (Table 3).

Table 3 - Population above ten years by employment category.

Employment	Mariuk		Tambakdahan	
	Population	%	Population	%
1. Farmer	2159	40.6	2495	35.6
2. Trader	167	3.1	210	3.0
3. Government services <sup>a/</sup>				
4. Farm laborer				
Total	5316	100.	6999	100.

<sup>a/</sup> Civil servant, village officials, military, and retired officials.

The relatively large proportion of laborers is also reflected in the Gini Ratio for farm ownership and for farm operation size. For Mariuk the Gini Ratio is respectively 0.81 and 0.79, while in Tambakdahan it is 0.87 and 0.74 (see Annexes). We see that the distribution is highly inequitable. Based on the census data 63 per cent of the households (out of 2050 households) in Mariuk were landless; in Tambakdahan it was 74 per cent out of 2396 households.

The average size of farm operation for tractor users was twice the size as that for users of human labor alone (Table 4) and this was also true for the farmers who used migrant laborers and farmers who did not use migrant laborers. It can thus be concluded that larger landowners tend to use tractors and migrant laborers. Those using animals have a farm size between tractor users and human labor.

The average work hours to produce rice for Mariuk and Tambakdahan was almost the same, 1030 and 1043 work hours per ha per crop (see Annex 9). In Mariuk 28.7 per cent of the labor used in rice production was migrant labor compared to only 19.8 per cent in Tambakdahan. Most of the migrant laborers were used in land preparation and harvesting. In the dry season the use of migrant labor was even higher which was due to the simultaneous activities of wet season harvest and dry season land preparation.

Labor supply and the demand for labor are shown in Annexes 5 and 6. It is shown that the shortage of labor does appear during wet season land preparation, wet season harvest and dry season harvest and dry season land preparation. The peak labor demand in these periods is due to the relatively short duration of the rice cultivation operations shown in Annexes 7 and 8.

If the farmers follow strictly the irrigation schedule, then this period is even shorter and it is impossible to finish the land preparation in the village within the one month prescribed for each golongan (rotation) category for the water management.

Given the scheduling practiced in Mariuk and Tambakdahan, we see that Mariuk had a shortage of labor in the Wet Season 1979-80 of 4,710 work hours which is equivalent to 393 laborers. In the dry season land preparation time (and wet season harvest) the shortage was 674 laborers (during the first week of the second half of March) out of which 533 laborers were needed for land preparation; in the second week of the second half of March the shortage jumped to 2,184 laborer out of which 207 were needed for land preparation.

In Tambakdahan there was just enough labor supply to meet the need for wet season land preparation (Annex 6). It explains the low demand for tractors. In the dry season the shortage of labor was equivalent to 403 laborers, which is appreciably smaller compared to Mariuk. The larger duration of time practiced by farmers in Tambakdahan appears to help alleviate the problem of seasonal labor shortages in the village. The fact that the government tries hard to ensure the formal scheduling followed by farmers (which is much shorter) means that the policy requires the introduction of more tractors into the area. Labor migration from outside the village - especially from Central Java - helped also to alleviate the problem.

The pressure is seen from the fact that farmers began experimenting with the use of tractors for the dry season crop. Interviews suggest that many more farmers plan to buy tractors and even mechanical tools for harvesting. Some farmers were forced to actively look for labor by visiting the migrant villages in Central Java (Brebés). Some may actually function as informal agents for employment bureaus.

In Tambakdahan the shift from human labor to tractors may be accelerated if the supply of labor is declining. The difference between labor supply and labor demand was only 21 laborers (equivalent) for the wet season 1979-80 land preparation. The shortage of labor will become more manifest when the non-agricultural sector is able to absorb more of the existing labor supply. Urban migration is also believed to be selective, preferring the most active labor force which is needed also in the agricultural sector.

## INCOME AND EMPLOYMENT OF MIGRANT LABORERS

The household census provides information on the number of migrants entering both villages in the land preparation season 1979-80. In Mariuk there were 388 migrants and 705 in Tambakdahan. In Mariuk 59.8 per cent of the migrants were from Central Java, In Tambakdahan the percentage was 36.3 (see Annex 2). Most of them came from the poor areas in the southern part of Pekalongan, Pemalang, Tegal and Brebes (Annex 3).

Migrants from nearby areas came from Pemanukan and Pusakanegara. In Tambakdahan 15.5 per cent of the migrants came from the neighboring kabupaten, mostly from Indramayu. On the average every farmer who hired migrants employed an average of 8 migrants. On a per ha basis (migrants per ha) Mariuk had a smaller (2.77/ha) average compared to Tambakdahan (4.29/ha). This is associated with the higher use of tractors in Mariuk which indicates that tractor users tend to hire fewer migrants. This suggests that migrant employment is reduced by the introduction of tractors.

Generally migrants know when they are needed and they are aware that they are less in demand in the wet season land preparation period. Indeed the introduction of tractors in Mariuk reflects how tractors can fill in the shortage of labor. From the 66 migrant respondents only 42.4 per cent worked in the wet season land preparation period (1979-80); for the dry season harvest (1979) it was only 10.6 per cent. But it is also true that wet season land preparation is not a critical period for migrants because this period coincides with the land preparation period in their own villages in Central Java. The critical lack of employment in their home villages is after the wet season harvest because only one crop of rice is possible due to the lack of irrigation in these villages.

Also, the average workdays for migrants was 63.3 per cent higher in the combined wet season harvest and dry season land preparation period as compared to other periods. Yet the average workdays are almost equal for all seasons. It means that the number of migrants moving to the area seems to be very well tailored to the existing demand. This is a kind of "invisible hand" that no government service can compete with.

Based on the information from the respondents, a migrant can work for about three months a year. Yet when the aggregate number of migrants is used the yearly employment is only one and a half months.

Farm activities of the migrants include (1) land preparation, (2) "walikjerami", (3) harvest, (4) transplanting, and weeding. But the most important activity is land preparation and "walikjerami" where

69.7 per cent of the migrants were engaged within a one year period. Only 4.5 per cent of them were also involved in harvesting and 25.8 per cent did transplanting and weeding in addition to the land preparation. For land preparation migrants receive free housing, meals and cigarettes. But, in the harvesting activity the estimated gross earnings is high although they do not receive the facilities given for land preparation laborers, so that their net earnings are smaller. The net income received by the migrants per year is Rp18,536 or 285 kg gabah equivalence (Table 5). If they have an average of 45.7 workdays it means a net daily income of Rp405. When meals are included their income is estimated at Rp32,189 or equivalent to 506 kg of gabah which is the same as a daily wage rate of Rp720. When we deduct the transportation cost from their villages (estimated at Rp4,690 per migrant) then the average net income for the migrant was Rp13,846.

This wage rate is far from being satisfactory which is probably why the migrants begin to look for better opportunities and move to urban areas such as Jakarta and Bogor. This was revealed in the interviews conducted in the villages of migrant origin. Some of the migrants in June 1981 went to Jakarta and Bogor to work in various construction projects. The wage rate is a sufficient Rp2000 per day and they can work for about 15 days. When transportation costs and living allowances are considered, the estimated net wage rate is about Rp1,140 which is much higher compared to only Rp405 in the agricultural sector.

Yet it is felt that in the future the tendency of shifting employment to the urban sector is expected to accelerate. Indeed many migrants felt that the urban sector is more attractive. But they also know that the risk is high because probably the information system is not as reliable. Cases of failures were mentioned due to the failure to get the expected job.

#### MIGRANT CHARACTERISTICS AND EMPLOYMENT IN THEIR HOME VILLAGES

##### Village of Origin

The 66 migrants came from various villages, but most of them (55) came from 15 villages in Central Java, and only one came from the neighboring village, Pusanegara. Most of the villages belong to Pekalongan and Pemalang in Central Java (see Annex 3).

Table 5. Number of Migrants and average work days by season.

	Number of migrants	Per cent	Average work days			Average income	
			Per Case	Per total respondents	Per Cent	Cash (Rp)	Cash plus meals (Rp)
1. Land preparation 1979/80	28	42.4	32	13,6	29,8	4232	8930
2. Wet season harvest 1979/80 dry season land preparation 1980	66	100	28,9	28,9	63,3	12512	22008
3. Dry season harvest 1979	7	10.6	29,9	3,2	6,9	1792	1951
4. T o t a l	66	100.	-	45,7	100.	18536	32889

Source: Migrant interviews

The villages are situated in the southern part of Pekalongan and Pemalang in hilly to mountainous areas. Rice fields are located in the valleys served by traditional irrigation network or simply rainfed. Only one rice crop is possible per year. Land preparation is carried out in November and December which is one month later than the land preparation period in Mariuk and Tambakdahan.

An irrigation network is available in Sidmulyo, Kaibahan (Pekalongan) and Kasirejo (Pemalang) while the rest are in rainfed areas. The villages form a contiguous area from Pekalongan to Brebes. Some of the villages are located within the forest zone such as Pasir, Kwasen, Lur Agung, Ujungnegoro and Kalimade.

The road and the transportation network to these villages varies from very bad to good. Some villages are accessible only to motorcycles or none at all.

#### Characteristics of Migrants

Most of the migrants (65.1 per cent) were below 28 years of age, and 24.2 per cent were between 14-20. Average age was 28 ranging from 14 to 55 years.

The level of education was an average of only 2.06 years and one third of the migrants were illiterate. Only 6.1 per cent finished their primary education.

Thus the migrants belong to the most active and young population group having an average family size of only 2.64 members. About 25.7 per cent of migrants were not married and 30.3 per cent married but without children; the rest (44 per cent) had a family of 3 to 5 persons.

Of the migrants, 59.1 per cent were employed in hoeing as the only job; 37.9 per cent had other jobs outside the farm activity and only 3 per cent were engaged in trade. Skill and knowledge are probably the reason preventing them to move to other types of employment.

The year they began migrating differs depending on their age. About 6.2 per cent began before 1970 and 48 per cent began in 1979-80.

Most of the migrants have formed into groups (78.9 per cent) consisting of 2 to 20 migrants. Usually each group has members from the same village. This grouping is preserved in the village of destination where they work for specific clients who they worked for in the previous season. But the members of each group were not the same from season to season.

Income and Employment in the Home Village

The migrants average income and employment in their home villages are shown in Table 6.

Their income source from agricultural farm labor is their major source of income when the opportunities in their home village and outside are combined (42.5 per cent). The average income received as migrant laborers is higher (53.7 per cent) than their income earned as farm laborers in their home villages and the income from their farm operations is large enough, comprising about one-third of their total income.

Table 6. - Average yearly income and employment of migrants in their villages and outside,

	Employed Respondents		Workdays		Income	
	No. of respondents	%	Workdays	%	Income	%
1. Farm operation	27	41.	n.d.	n.d.	26,800	33.
2. Farm laborer						
a. Home village	54	82.	50.	35.	16,000	20.
b. Outside the village	66	100.	46	32	18,500	23.
3. Non agriculture	39	59	47	33	19,900	25
Total	66	100.	143	100.	81,200	100.

n.d. = not determined.

Their non-agricultural jobs can be classified as a migrant activity because of this work is done outside the village. When this is combined with the migrants sources of income in the agricultural sector then 47.3 per cent of their income is derived from migration.

When we define 300 workdays as full employment standard per year the migrants can only work for 48 per cent of their full employment capacity or above five months employment per year.

The migrants total income ranged between Rp17,000 to Rp250,000 and an average of Rp81,200 which does not include income received by the other working members of the family. The majority of migrants (44.4 per cent) earned an income between Rp50,000 and Rp100,000.

#### SUMMARY AND CONCLUSIONS

1. The increasing use of tractors in an area like Mariuk and Tambakdahan is due to the relative scarcity of labor during land preparation and harvest. This pressure is increasing due to the introduction of better management practices (water management, cropping system management, and pest management) requiring more and more precision and a tighter irrigation schedule. This is particularly true when other non-rice (palawija) as the third crop is seriously considered.

2. Farmers seem unable to follow the strict irrigation scheduling because of the induced labor scarcity. Yet even with partial adoption of the strict scheduling labor shortages appear from time to time.

3. Relative shortage of labor are alleviated by migration of laborers most of whom come from marginal areas in Central Java. Yet there is no clear indication whether we can rely upon this source of labor in the future. There is a "felt tendency" that more of these migrant laborers will be shifted to the urban sector,

4. The research methodology used in this study did not allow the author to determine whether tractors are really harmful to migrant laborers. It does show that tractors reduce employment opportunities, yet it does not show whether or not migrant laborers can find employment somewhere else.

5. Employment opportunities for migrants are highest in the wet season harvest that coincides with the dry season land preparation. Only about half of the migrants are needed in the wet season land preparation.

6. Most migrants are relatively young laborers (average 28 years) having no land in their home villages. Their level of education is low (2 years average) and the main reason for migration is the low agricultural activity in their home villages,

7. Combining all of their work activities migrants can on the average, work for only five months a year. The average earning from all sources is Rp81,200 or US\$130 per year.

8. Where tractor use is high like Mariuk only a few migrants can enter this labor market. This is also true when it is expressed in terms of migrants per ha.

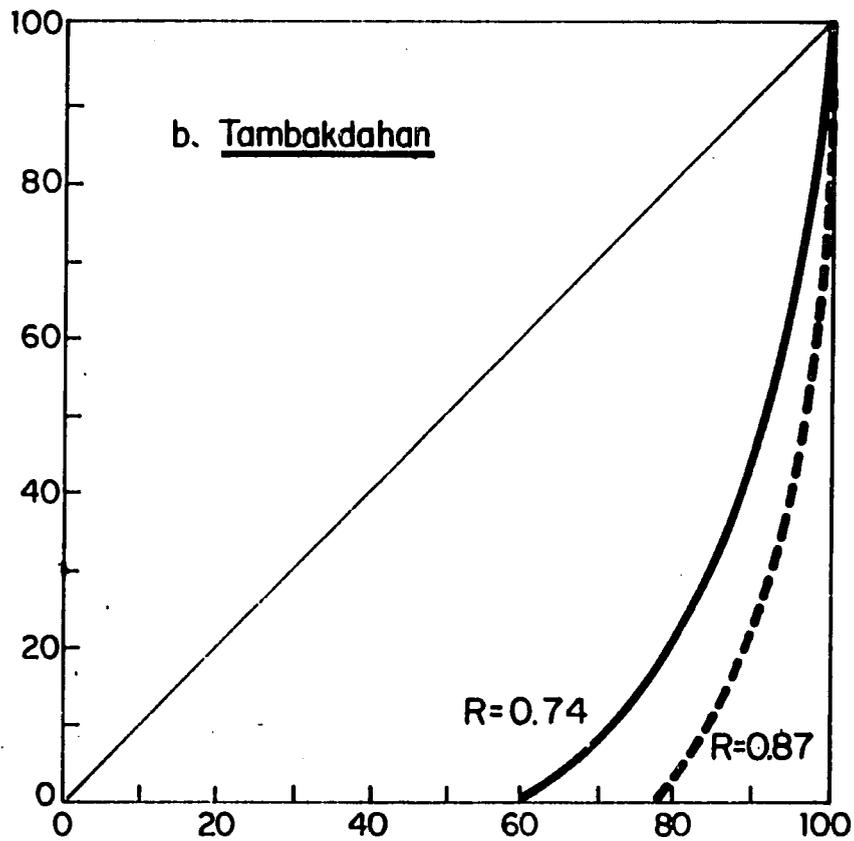
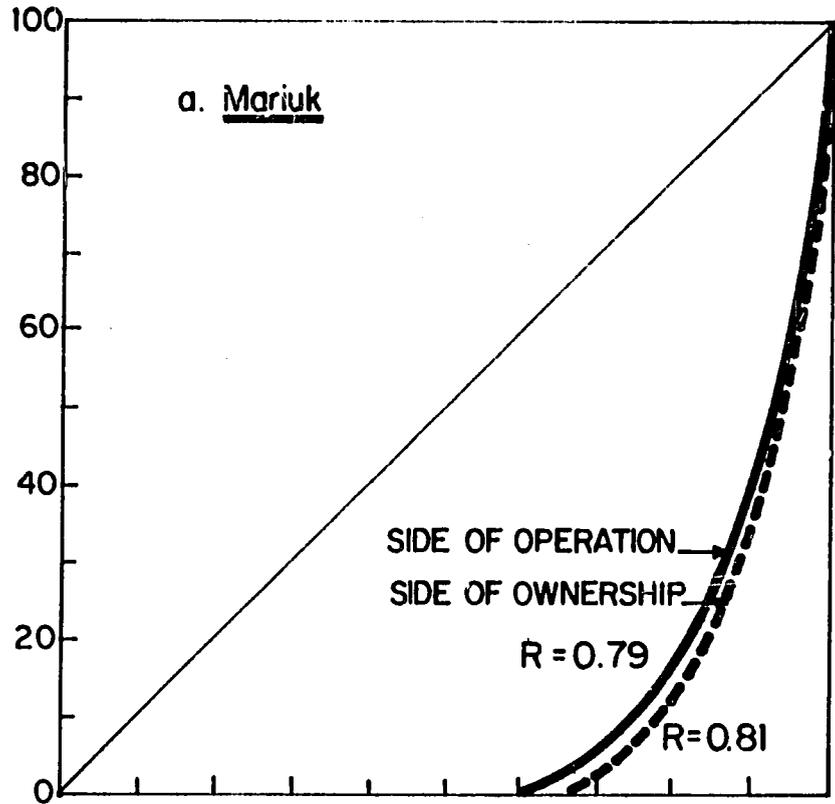
9. The increasing pressure of labor shortages will force farmers to use tractors also for land preparation in the dry season.

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Annex 1. Lorentz curve of farm size 1980.



Annex 2. - Number of migrants working in Mariuk and Tambakdahan  
Wet season 1979/80.

Migrant's home village	Mariuk		Tambakdahan	
1. Within the Kecamatan	95	(24.5)	35	( 4.9)
2. Outside the Kecamatan but within the Kabupaten	55	(14.2)	305	(43.3)
3. Outside the Kabupaten but within West Java	6	( 1.5)	109	(15.5)
4. Outside West Java	232	(59.8)	256	(36.3)
5. Total (1+2+3+4)	338		705	
6. Number of families employing migrants	51		90	
7. Employment rate				
a. Per farmer	7.61		7.83	
b. Per hectare	2.77		4.29	

Source: Household census, 1980.  
( ) percentage of total.

Annex 3. - Location of home villages of migrants employed in Mariuk and Tambakdahan, 1980.

<u>Kabupaten</u>	<u>Kecamatan</u>	<u>Village</u>	<u>Number of Sample</u>	<u>Percentage</u>	
<u>West Java</u>					
1. Subang	Pusakanegara	Karanganyar	1	1.5	
<u>Central Java</u>					
2. Brebes	Jatibaring	Songgom	2	3.0	
3. Tegal	Margasari	Danaraja	4	6.1	
4. Pema- lang	1. Bodeh	1. Pasir	11	16.7	
		2. Kwasen	2	3.0	
		3. Kesirejo	4	6.1	
	2. Bantar- bolong	1. B. Bolong	3	4.5	
		2. Glandang	3	4.5	
		3. Pedagung	1	1.5	
	3. Pemaalang	Silarang	2	3.0	
	<u>Sub-total (4)</u>			<u>26</u>	<u>39.4</u>
	5. Peka- longan	1. Ksesi	1. Ujungnegara	14	21.2
2. Wonolowan			1	1.5	
3. Kalimete			2	3.0	
4. Kaobahan			1	1.5	
5. Sidomulyo			3	4.5	
6. Winduraja			5	7.6	
2. Kandang- serang		Lor Agung	7	10.6	
<u>Sub-total (5)</u>			<u>33</u>	<u>50.0</u>	
TOTAL (1-5)			66	100.0	

Annex 4. - Number of migrant laborers having or operating their own farm in their home village.

Type of farm and tenure	Wet Season				Dry Season			
	Number of cases	Per cent (%)	Average area		Number of cases	Per cent (%)	Average area	
			Per case	Total respondents			Per case	Total respondents
1. No land and no operation	40	61.	-	-	40	61.	-	-
2. Land owner								
a. Sawah	22	33.	0.38	0.13	22	33.	0.38	0.13
b. Upland	6	9.	0.23	0.02	6	9.	0.23	0.02
Total	<u>26</u>	<u>39.</u>	<u>0.38</u>	<u>0.15</u>	<u>26</u>	<u>39.</u>	<u>0.38</u>	<u>0.15</u>
3. Farm operator								
a. Sawah owner operator	19	29.	0.40	0.12	12	18.	0.32	0.06
b. Tenant	3	5.	0.53	0.02	2	3.	0.44	0.01
Total	<u>22</u>	<u>33.</u>	<u>0.42</u>	<u>0.14</u>	<u>14</u>	<u>21.</u>	<u>0.34</u>	<u>0.07</u>
c. Upland owner	6	9.	0.23	0.02	6	9.	0.23	0.02
Total swamp + upland	<u>26</u>	<u>39.</u>	<u>0.41</u>	<u>0.16</u>	<u>20</u>	<u>30.</u>	<u>0.31</u>	<u>0.09</u>
4. Not operated land								
a. Leased out	3	5.	0.26	0.01	4	6.	0.24	0.02
b. Fallow	-	-	-	-	6	9.	0.60	0.05
Total	<u>3</u>	<u>5.</u>	<u>0.26</u>	<u>0.01</u>	<u>10</u>	<u>15.</u>	<u>0.46</u>	<u>0.07</u>

Annex 5. Supply and Demand ( in workdays) for Labor in Mariuk.

Month <sup>1)</sup>	Demand for labor <sup>2)</sup> (workdays)				Supply of labor <sup>2)</sup> (workdays)			Difference	Deficit or surplus plus (head)
	Seeding & land prepara.	Harvest	Transpl. and weed-ing	Total	Men	Women	Total		
1. October I	5,184	-	-	5,184	17,016	-	17,016	+11,832	+ 986
II	21,726	-	-	21,726	17,016	-	17,016	- 4,710	- 393
2. November I	10,218	-	-	10,218	17,016	-	17,016	+ 6,798	+ 567
II	2,685	-	-	2,685	17,016	-	17,016	+14,331	+1,194
3. February I	-	3,282	-	3,282	17,016	17,592	34,608	+31,326	+2,611
II	43	3,744	-	3,787	17,016	17,592	34,608	+30,821	+2,568
4. March I	4,136	38,560	-	42,696	17,016	17,592	34,608	- 8,088	- 674 <sup>2)</sup>
II	10,772	13,845	36,201	60,818	17,016	17,592	34,608	-26,210	-2,184 <sup>2)</sup>
5. April I	1,142	-	16,354	17,496	17,016	17,592	34,608	+17,112	+1,426
II	-	-	34,391	34,391	17,016	17,592	34,608	+ 212	+ 18
6. May I	-	-	21,734	21,734	17,016	17,592	34,608	+12,874	+1,073

1) I = first half of the month  
II = second half of the month

2) see Annex 5a.

Annex 5a.

A. Labor potential (supply)

1. Farm laborer families

- a. Total population above 10 years = 2,195
- b. Available male laborers above 15 =  
 $2,195 \times 0.89 \times 0.49 = 957$
- c. Available female laborers above 15 =  
 $2,195 \times 0.89 \times 0.51 = 996$

2. Farm operators and owner families

- a. Total population above 10 years = 2,159
- b. Available male laborers above 15 =  
 $2,159 \times 0.89 \times 0.49 \times 0.49 = 461$
- c. Available female laborers above 15 =  
 $2,159 \times 0.81 \times 0.51 \times 0.48 = 470$

3. Available man labor in two weeks:

$$(1b + 2b) \times 12 \text{ days} = 17,592 \text{ wd.}$$

4. Available female labor in two weeks:

$$(1c + 2c) \times 12 \text{ days} = 17,592 \text{ wd.}$$

B. Labor demand first half of March

- 1. Half of harvesting labor is male labor
- 2. Demand for male harvesting labor  
 $= 0.50 \times 38,560 = 19,280 \text{ md.}$
- 3. Demand for male labor for land preparation 4,136.
- 4. Total labor demanded 23,416 wd.
- 5. Available labor 17,016 wd.
- 6. Labor shortage 6,400 wd.  
(eq. 533 male laborers)

C. Labor Demand, second half of March

- 1. Male harvesting labor  
 $0.50 \times 13,845 = 6,923 \text{ wd.}$
- 2. Land preparation = 10,772 wd.
- 3. Other activities  $0.05 \times 36,201 = 1,810$
- 4. Total male labor demanded = 19,505 wd.
- 5. Available labor = 17,016 wd.
- 6. Labor shortage = 2,489 wd.  
(eq. 207 male laborers)

Annex 6. Labor supply and labor demand (in workdays) in Tambakdahan.

Month <sup>1/</sup>	Labor demand (workdays)				Labor supply (workdays)			Difference + / -	Surplus/ deficit (head)
	Seeding + land preparation	Harvest	Trans- planting + weeding	Total	Male	Female	Total		
1. Oct. I	15,184	-	-	15,184	19,260	-	19,260	+ 4,076	+ 340
II	19,006	-	-	19,006	19,260	-	19,260	+ 254	+ 21
2. Nov. I	12,667	-	-	12,667	19,260	-	19,260	+ 6,593	+ 549
II	602	-	-	602	19,260	-	19,260	+18,658	+ 1,555
3. Feb. I	367	12,041	-	12,408	19,260	19,260	38,520	+26,112	+ 2,176
II	3,877	20,574	-	24,451	19,260	19,260	38,520	+14,069	+ 1,172
4. Mar. I	10,408	27,472	5,471	43,351	19,260	19,260	38,520	- 4,831	- 403 <sup>2/</sup>
II	6,531	6,313	17,378	30,222	19,260	19,260	38,520	+ 8,298	+ 692
5. Apr. I	-	-	30,397	30,397	19,260	19,260	38,520	+ 8,123	+ 677
II	-	-	20,564	20,564	19,260	19,260	38,520	+17,956	+ 1,496
6. May I	-	-	1,292	1,292	19,260	19,260	38,520	+37,228	+ 3,102

1/ I = First half of the month

II = second half of the month.

2/ See Annex 6a.

Annex 6a.

A. Labor potential (supply)

1. Farm laborer families

- a. Total population above 10 years = 2,735
- b. Available male laborers above 15 =  
 $2,735 \times 0.84 \times 0.48 = 1,103$
- c. Available female laborers above 15 =  
 $2,735 \times 0.84 \times 0.52 = 1,195$

2. Farm operators and owner families

- a. Total population above 10 years = 2,495
- b. Available male laborers above 15 =  
 $2,495 \times 0.51 \times 0.47 = 502$
- c. Available female laborers above 15 =  
 $2,495 \times 0.49 \times 0.40 = 410$

3. Available male labor in two weeks:

$$(1b + 2b) \times 12 \text{ days} = 19,260 \text{ wd.}$$

4. Available female labor in two weeks:

$$(1c + 2c) \times 12 \text{ days} = 19,260 \text{ wd.}$$

B. Labor Demand, first half of March

- 1. Man harvesting labor 50 percent of total:  
 $0.50 \times 27,472 = 13,736 \text{ wd.}$
- 2. Man laborer for land preparation = 10,408 wd.
- 3. Man labor for other jobs of total = 273 wd.
- 4. Total man labor = 24,417 wd.
- 5. Available man labor = 19,260 wd.
- 6. Shortage = 5,157 wd.

(eq. 430 man laborers)

Annex 7. Percentage of area by phase of farm activities in Mariuk (1,159 ha)<sup>1/</sup>

Month	Seeding		Land preparation		Trans-planting		Weeding		Harvesting		Seeding		Land preparation		Trans-planting		Weeding		Harvesting		
	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	
Oct. I	12.9	150	13.0	151																	
II	41.1	476	55.9	648																	
Nov. I	38.2	443	24.4	283	12.9	147															
II	7.7	90	6.7	77	46.3	526	7.8	88													
Dec. I					37.9	430	63.1	717													
II					2.9	33	26.2	298													
Jan I							2.9	33													
II																					
Feb. I							5.5	64													
II							6.3	73			0.4	4									
Mar. I							64.9	752	34.3	398	23.3	270									
II							23.3	270	61.0	707	68.6	795	10.6	123							
Apr. I									4.6	54	7.8	90	18.6	216	23.8	276					
II													70.8	820	24.3	282					
May I																	51.9	601			
II																					
Jun. I																					
II																				9.4	106
Jul. I																				7.2	82
II																				62.3	708
Aug. I																				21.1	240

<sup>1/</sup> for total area operated by 55 operator samples.

Annex 8. Percentage of area by phase of farm activities in Tambakdahan (1,136 ha)<sup>1/</sup>

Month	Seeding		Land preparation		Trans-planting		Weeding		Harvesting		Seeding		Land preparation		Trans-planting		Weeding		Harvesting		
	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	%	ha	
Oct. I	26.4	300	32.5	369																	
II	42.0	477	39.9	453																	
Nov. I	27.9	317	26.6	302	40.4	459	32.6	370													
II	3.7	42	1.0	12	51.0	580	8.9	101													
Dec. I					8.5	97	50.6	575													
II							7.9	90													
Jan. I																					
II																					
Feb. I									18.1	206	3.4	39	1.4	16							
II									31.0	352	17.3	197	18.5	210							
Mar. I									41.4	470	49.2	559	49.1	558	17.8	203					
II									9.5	108	30.0	341	31.0	352	33.1	376	16.3	185			
Apr. I															34.9	397	44.3	503			
II														14.1	160	36.5	415				
May I																2.9	33				
II																					
Jun. I																					
II																					
Jul. I																					
II																				60.8	690
Aug. I																				25.5	290
																				13.7	156

<sup>1/</sup> Percentage from total area operated by 77 operator samples.

Annex 9. Percentage of family and hired labor, from in and outside the village, Mariuk and Tambakdahan, Wet season 1979/80 and dry season 1980.

Phase of activity	Wet season 1979/80								Dry season 1980							
	Mariuk				Tambakdahan				Mariuk				Tambakdahan			
	Total hour/ha	FL %	HLWV %	HLOV %	Total hour/ha	FL %	HLWV %	HLOV %	Total	FL %	HLWV %	HLOV %	Total	FL %	HLWV %	HLOV %
1. Seeding	25.9	38.6	53.0	8.4	26.9	38.2	54.8	7.0	24.5	47.7	35.5	16.7	25.3	39.3	38.3	22.3
2. Land preparation	220.6	16.4	56.1	27.4	258.3	14.4	58.3	27.3	78.4	9.7	53.0	37.3	79.6	9.1	56.3	34.6
3. Trans-planting	209.8	4.8	76.5	18.7	194.2	5.5	92.8	1.7	n.a.	-	-	-	n.a.	-	-	-
4. Weeding	240.1	12.5	64.6	22.9	165.0	29.2	68.7	2.0	n.a.	-	-	-	n.a.	-	-	-
5. Harvesting	334.0	15.6	42.9	41.5	398.8	7.8	60.4	31.8	291.9 <sup>1/</sup>	15.4	51.1	33.5	326.2 <sup>1/</sup>	8.3	61.2	30.5
Total	1030.4	13.4	57.9	28.7	1043.2	13.1	67.1	19.8	-	-	-	-	-	-	-	-

<sup>1/</sup> Dry season 79 data

FL = family labor; HLWV = hired labor within the village

HLOV = hired labor from outside the village.

## CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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