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THE CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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THE IMPACT OF AGRICULTURAL MECHANIZATION ON PRODUCTION AND EMPLOYMENT IN RICE AREAS OF WEST JAVA

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THE IMPACT OF AGRICULTURAL MECHANIZATION ON PRODUCTION AND EMPLOYMENT IN RICE AREAS OF WEST JAVA*

John Lingard and Al Sri Bagyo**

Abstract

Considerable controversy exists about the desirability of farm mechanization in Indonesia. Its effects on production and rural employment in the rice areas of West Java are analyzed using a large data set and three different methods. A t test indicates that both rice yields and fertilizer use were higher on mechanized farms. In contrast they used less pesticides than non-mechanized farms. Although labour use per hectare per season was lower on mechanized farms, the total annual labour use per farm was higher due to the large area differences. Surprisingly mechanized farms had a lower cropping intensity. Decomposition analysis was used to investigate the impact of mechanization on production and total labour use. Results show the most important explanator to be area, while yield and cropping intensity had only minor effects. The area effect also gave the highest contribution to the total labour use. Regression analysis was used to further detemine whether yield differences were mainly due to mechanization or to other factors. Results again show that farm size and fertilizer were the main explanators, mechanization dummies were small and insignificant whilst pesticide use was both significant and negative.

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INTRODUCTION

Agricultural mechanization is beginning to bring far reaching changes in the farming structure and institutions of Indonesia and the desirability of some of these changes is now being seriously questioned. Recent articles in the Bulletin of Indonesian Economic Studies by Sinaga (1978) and Hayami and Hafid (1979) are examples of the growing literature on the mechanization issue and Collier has written numerous articles in the past decade. More recently Herdt (1981) has assembled much evidence on rice farm mechanization in Asia as a whole and attempted to provide a perspective on the sequence of mechanization. Binswanger (1978) in his seminal work on tractors in the Indian subcontinent outlined the two schools of thought in the controversial debate and pleaded for more empirical studies to be carried out. It is with the latter purpose in mind that we write this paper providing actual statistical results from a large purpose-built study carried out in West Java. Our results in themselves are perhaps neither remarkable nor surprising but they are based on evidence and not conjecture. The current debate in the policy arena in Indonesia appears to be failing to recognize the fallability of eclecticism (the indiscriminate use of selective pieces of evidence, often from small samples) and hard policy conclusions ideally should be backed up by comprehensive analysis on a standardized basis. This paper presents one of the first of such analyses; it is to be hoped that many others will follow from the work being carried out at IRRI and from the numerous Indonesian graduate students currently working on similar data sets in Universities throughout the world.

A recent feature of rice production in West Java has been the spread of double cropping. The introduction of double cropping was made possible both by the construction of Jatiluhur dam and the introduction of early maturing rice varieties and this has tended to create a much greater impetus for farm mechanization. These two factors have enabled additional land to be cultivated with rice and cropping intensities increased with improved irrigation. As a consequence, more labour has been needed to expand rice production. There is however an insufficient supply of local labour during peak seasons of labour demand and the shortage becomes critical when there is no inflow of migrants or outside supplementary labour periods. Some authors and public figures have welcomed the introduction of tractors to modify this peak labour demand-supply imbalance. Referring to a shortage of agricultural labour in rural areas, some have suggested that large amounts of rice fields have in the past been left uncultivated or improperly cultivated because of the labour shortage, and many observers have advocated the rapid introduction of

tractors, particularly in Karawang, Subang and Indramayu regions where labour shortage for land preparation before planting the dry season paddy crop have been noted.

Imported hand-tractors and smaller numbers of four-wheeled mini-tractors have been rapidly adopted in sawah (lowland ricefields) cultivation since 1975 in parts of rural Java and Bali particularly in the north coastal plain of Java, although no statistics are available on the number of tractors presently in use.

OBJECTIVES

This study was conducted with three main objectives:

(i) To compare input use, labour use, cropping intensity, farm size and output between mechanized and non-mechanized farms.

(ii) To decompose the effects of mechanization on total output and total labour use into its component elements such as cropping intensity, area and yield and labour use per hectare.

(iii) To investigate whether the difference of yield is mainly due to mechanization or to differences in using other inputs such as fertilizers and pesticides.

THE DATA

Part of the "Consequences of Small Rice Farm Mechanization Project in Asia" survey conducted by the International Rice Research Institute in Indonesia, was taken as the source of data in this study. In Indonesia, the survey was conducted in two provinces, South Sulawesi and West Java. The West Java data of Wet Season 1979/80, dry Season I 1980 and dry Season II 1980 were used in this study.

Two sample districts in West Java with the most tractor users were to be selected. Based on this criteria, Subang and Indramayu

were selected as sample districts. From each sample district, four villages with the highest population of farmers using tractors were identified and taken as sample villages. Before selecting the sample farmers, a block census was conducted in all sample villages. Census respondents were grouped based on land cultivation tools used in wet seasons 1979/80. The six groups taken for sample stratification were: tractor owner, tractor hirer, animal user, manual labour user, animal and manual labour user and landless farmer. A total of sixty farmers was selected from each group in each sample village based on the proportion of each village in the census so that there were 360 sample farmers in the study. Since some of the samples gave incomplete information for the purpose of the study, only 282 were eventually used. The samples were grouped into six categories based on the tools used for land preparation as shown in Table 1. If a farmer only used a tractor for plowing and harrowing in two seasons (four passes land preparation) he was considered as a pure mechanized farmer (T_1). If he used labour only, he was a pure manual farmer (M_1). An animal-manual farmer (A_1) used half animal and half manual. If three quarters of the land preparation was done by tractor, he was a mainly mechanized farmer (T_2). If three quarters of land preparation was done by labour, he was a mainly-manual farmer (M_2). For T_3, the farmer used either tractor, animal or labour in several combinations so that he could not be classified as mechanized or non-mechanized farmer.

THE STUDY AREA

The surveys were conducted in the districts of Subang and Indramayu, in the province of West Java. Four sample villages with a high degree of mechanization were selected from each district. In Subang, the sample villages were Bojongsengah, Pamanukan, Mariuk and Tambakdahan, while in Indramayu they were Sukadana, Gabuskulon, Anjatan and Sukra. The number of sample farmers included for each village is shown in Table 2. All the farmers are irrigated and the predominant cropping pattern is double-cropped rice with a possible secondary crop in the third season.

METHODOLOGY

To test whether the input use, labour use, cropping intensity, farm size and output between mechanized and non-mechanized farms were

significantly different, a t test was used. Arithmetic means for each variable for both mechanized and non-mechanized farms were computed separately. The observed differences in the mean level between mechanized and non-mechanized states were then tested using a t-statistic.

To decompose the effects of mechanization on total output and total labour use into its component elements, decomposition analysis was used as a combination of the models formulated by Binswanger (1978), Krishna (1976), and subsequently developed by Tan (1981) where

$\Delta Q = \Sigma Ci^{o}.A^{o}\Delta Yi.Pi$ - yield effect

$+ \Sigma Ci^{o}.Yi^{o}\Delta A.Pi$ - area effect

$+ \Sigma A^{o}.Yi^{o}\Delta Ci.Pi$ - cropping intensity effect

$+ \Sigma Ci^{o}\Delta Yi\Delta A.Pi$

$+ \Sigma A^{o}.\Delta Ci\Delta Yi.Pi$ - first order interaction effect

$+ \Sigma Yi^{o}.\Delta Ci.\Delta A.Pi$

$+ \Sigma \Delta Ci.\Delta Yi\Delta A.Pi$ - second order interaction term

and

ΔQ = output difference between mechanized and non-mechanized farms

A^{o} = farm size or area of non-mechanized farms

ΔA = area difference

Ci^{o} = cropping intensity of ith crop of non-mechanized farms; when i = 1 crop is rice, i = 2 crop is beans.

ΔCi = cropping intensity difference

Yi^{o} = yield of non-mechanized farms

ΔYi = yield difference

Pi = price of ith crop

The approach used in decomposing labour use differences due to mechanization was essentially similar to that used in decomposing output differences. Production function analysis was also used to

support the decomposition analysis in analyzing the impact of mechanization on production so that it could be determined whether differences in rice yield were mainly due to mechanization or to the use of other inputs such as fertilizers and insecticides.

RESULTS

Tables 3 and 4 show results of the test for differences in input utilization between mechanized and non-mechanized farms using the t-test. In general, mechanized farms used more fertilizer per hectare than non-mechanized farms and when the mechanized farm groups used less fertilizer than non-mechanized farm groups, the difference was not significant. Since Tables 5 and 6 show that mechanized farms were about three times larger than non-mechanized farms, it can be tentatively suggested that farmers using tractors were wealthier and more able to afford fertilizer than farmers not using tractors.

Mechanized farms surprisingly used less pesticide per hectare than non-mechanized farms. This result was contrary to some previous studies which reported that mechanization increased input utilization including crop protection inputs such as pesticides. Farmers using tractors might be expected to have a better education and thus know when to use pesticide and how much to apply. During the particular study period however, there was no serious pest damage consequently they did not use much pesticide. The farmers not using tractors are generally small farmers who bear more risk from rice alone since their family life depends solely on their small farms and consequently they often use pesticide as a precautionary measure. As a result even when serious pest damage is not an imminent danger, they still apply liberal amounts of pesticide compared to tractor-using farmers. Even when some mechanized farmer groups used more pesticide than non-mechanized farmer groups the difference was not statistically significant.

Labour use per hectare per season was lower on mechanized than on non-mechanized farms. This result was consistent with the results of several previous studies which found that mechanization replaces animal and labour power. Since the assumed reason for the adoption of tractors by large farms is shortage of labor during the peak season of labour demand, it is not unexpected that mechanized farms use less labour than non-mechanized farms. Non-tractor users may not have experienced labour unavailability at peak periods. For labour use per farm per year, mechanized farms used more labour than non-mechanized farms. Even if labour use per hectare per season was lower on mechanized than on non-mechanzied farms, the mechanized farms were about three times larger and the impact of the area increase exceeded the impact of the per hectare labour decrease.

Tables 5 and 6 show the tests for differences of farm size, cropping intensity and production between mechanized and non-mechanized farms. Mechanized farms were significantly larger than non-mechanized farms, because in the study area, the use of hand tractors by large farms was a response to the problem of getting labour in the peak season of labour demand while small farms do not normally suffer from such problems. The finding that mechanized farms had a significantly lower cropping intensity than non-mechanized farms was contrary to most previous studies. As shown in the decomposition analysis methodology, cropping intensity is measured across both rice and secondary crops. Those reported in Tables 5 and 6 apply to rice and bean cropping intensity and it appears that the larger tractor using farms did not attempt to raise crops (normally beans) in the third season since this is very risky due to likely water shortages. The predominant cropping pattern on all farms is however double cropped rice.

The yield per hectare both per season and per year was higher on mechanized than on non-mechanized farms. Since input data showed that mechanized farms used more fertilizer than non-mechanized farms, it should be determined whether the yield increase was due to mechanization or fertilizer. Inspite of lower cropping intensities, rice production per farm per year was higher on mechanized than on non-mechanized farms because of the higher yields and larger sizes of mechanized farms.

DECOMPOSITION ANALYSIS

The results of decomposition analyses are presented in Tables 7 and 8. Table 7 shows that the component element which contributed the largest percentage of the output difference between mechanized and non-mechanized farms was the area effect. This varied between 87 and 123 per cent. Taking comparison between T_1 (pure mechanized farms)and M_1 (pure animal farms), the area effect was 97 per cent. This means that if these two types of farms differed only in area and other component element were the same, the output difference would be 97 per cent of the absolute change. The same case occurs with yield and cropping intensity. If yield was the only difference, the two types of farms would have an output difference of 4 per cent of the absolute change. If the only difference between the two types of farms was cropping intensity, there would be output difference of 3 per cent of the absolute change. Negative sign means mechanized farms would have lower output than non-mechanized farms.

For the first order interaction effects, the interaction effect of yield and area was 13 per cent out of absolute change. It means that yield and area differences of the two farm types simultaneously had an impact on the output difference of 13 per cent, while area and cropping intensity had an interaction effect of 9 per cent out of the absolute change. The interaction effect of yield and cropping intensity was very small. In the case of second order interaction effects, the interaction effect of yield, area and cropping intensity was a mere 1 per cent.

Table 8 also shows that the component element which contributed the largest percentage to the total labour use difference between mechanized and unmechanized farms was the area effect which varied between 152 to 207 per cent out of the absolute total labour use. Labour use per hectare gave a negative effect and varied between 14 to 29 percent. Cropping intensity also gave a negative effect and varied between 3 to 10 per cent. The interaction effect of labour use per hectare and area was negative and varied between 25 to 69 per cent while area and cropping intensity gave a negative interaction effect of 7 to 20 per cent. Other interaction effects were very small. All the decomposition analysis showed that the most important factor of explaining the total output and total labour differences between mechanized and unmechanized farms was area.

Production function analysis was also used to explain whether difference of yield was mainly due to mechanization or other factors like fertilizer and pesticide use. In Table 9, a Cobb Douglas production function is presented with production per farm as the dependent variable. Some 87% of the variation in production is explained by the function with farm size, nitrogen use and insecticide use being statistically significant at the 1% level, trisuperphosphate at the 5% level. Farm size and nitrogen use are the major explanators, the coefficients have the expected order of magnitude but the negative sign for insecticides is surprising since, generally in the north coastal rice areas of West Java, including the data site, a major constraint to increasing production is pest damage. The result may however be consistent with earlier researches that during the survey there was no serious pest damage and consequently insecticide use had no major effect on production during that year.

The coefficients' sum of 1.05 indicates constant returns to scale across the sample and the mechanization dummies for T_1 (pure mechanized farms) and T_2 (mainly mechanized farms) are both small and insignificant. The negative sign for the T_2 coefficient is somewhat surprising however. A further specification of the functional form seeking to explain per hectare yields in terms of per hectare input use produced no improvement on the results presented in Table 9. We would not, however, wish to attach too much significance to these production elasticities. The function suffers from

specification bias due to omission of a water availability input, a land quality input and from pooling the data across seasons. It is presented merely to confirm the importance of the fertilizer and other inputs and to indicate that, at this level of aggregation, the mechanization effects are very small.

CONCLUSION

Three different methods have been used to analyze the effects of mechanization on production and labour use in rice areas of West Java. As yet the results are inconclusive about the effects which may be attributed to mechanization alone, but the study has systematically explored some differences in input use between mechanized and non-mechanized farms. On a per hectare basis, mechanized farms used more fertilizer, less pesticide and less labour and obtained higher yields. They were also considerably larger than non-mechanized farms but had a lower cropping intensity. The yield differences are primarily due to these other factors rather than to any mechanization effects per se. Questions arise as to the pervasive factor of farm size and the nature of the causal relationship between farm size and mechanization. Why precisely did the larger farms mechanize and why is fertilizer use almost always higher on mechanized than non-mechanized farms? Sinaga (1981) has suggested that, on average, the difference between farm types in fertilizer use accounts fully for any yield differences, even assuming relatively modest responses. Our results confirm the importance of fertilizers in explaining yield differences between different categories of rice farms. Unquestionably the mechanized farms have a lower per hectare labour use than the animal using or the manual farms. As Lingard and Wicks (1982) illustrate, the Java area surveyed contains many landless labourer households; further mechanization of the manual land preparation process could result in major job-displacement and should be guarded against unless there are significant yield or cropping intensity increases.

Table 1. Sample farms by type of power use in land preparation (West Java, wet season 1979/80 and dry season 1980).

Land Preparation				Type of mechanization	No. of sample farms
Wet season		Dry season			
Plowing	Harrowing	Plowing	Harrowing		
T	T	T	T	T_1	62
M	M	M	M	M_1	50
A	A	M	M	A_1	50
T	T	T	M	T_2	35
A	M	M	M	M_2	35
T/A/M	T/A/M	A/M	A/M	T_3	50
					282

Note: T = handtractor; A = animal; M = manual.

T_1 = pure mechanized farms

M_1 = pure manual farms

A_1 = animal-manual farms

T_2 = mainly mechanized farms

M_2 = mainly manual farms

T_3 = unclassified farms.

Table 2. Sample farms by location and type of mechanization (West Java, 1980) (%).

Location	Distribution of sample farms (%) by type of mechanization						Total	Percent
	T_1	M_1	A_1	T_2	M_2	T_3		
Indramayu								
Sukadana	17	5	1	-	1	6	30	10
Gabuskulon	2	4	1	12	10	8	37	13
Anjatan	13	5	3	-	6	6	33	11
Sukra	12	3	1	3	2	6	27	9
Subang								
Bojongsengah	4	10	30	1	1	3	49	17
Pamanukan	3	10	2	7	3	7	32	11
Mariuk	9	1	10	10	1	9	40	14
Tambakdahan	2	12	2	2	11	5	34	12
Total	62	50	50	35	35	50	282	100

Table 3. Test differences of input utilization between mechanized (T_1) and unmechanized farms (West Java, 1979/80)

Variables	Difference		
	T_1 vs M_1	T_1 vs A_1	T_1 vs M_2
		N use per hectare (kg)	
Wet season	-1 (0.14)	23 (4.34)[aa]	-15 (1.63)
Dry Season	-1 (0.03)	7 (1.00)	- 9 (0.96)
Annual	-6 (0.45)	27 (2.79)[aa]	-24 (1.49)
		TSP use per hectare (kg)	
Wet season	13 (1.49)	28 (3.72)[aa]	-10 (0.92)
Dry season	5 (0.54)	22 (2.97)[aa]	1 (0.08)
Annual	19 (1.26)	50 (4.19)[aa]	- 1 (0.11)
		Pesticide use per ha (Rp)	
Wet season	-572 (1.03)	-2632 (4.76)[aa]	317 (0.67)
Dry season	-416 (0.61)	-1968 (2.90)[aa]	-426 (0.66)
Annual	-928 (0.84)	-4212 (4.03)[aa]	350 (0.28)
		Labour use per hectare (mds)	
Wet season	-57 (7.58)[aa]	-34 (6.20)[aa]	-35 (6.77)[aa]
Dry season	-37 (4.85)[aa]	-27 (5.39)[aa]	-21 (3.17)[aa]
Annual	-106 (6.64)[aa]	-62 (5.74)[aa]	-42 (4.72)[aa]
		Labour use per farm	
Annual	396 (6.39)[aa]	301 (4.93)[aa]	324 (4.77)[aa]

[aa]Significant at 5 and 1 per cent level, respectively.

Numbers in parentheses are t values.

Table 4. Test for differences of input utilization between mechanized (T_2) and unmechanized farms (West Java, 1979/80).

Variables	Difference		
	T_2 vs M_1	T_2 vs A_1	T_2 vs M_2
		N use per hectare (kg)	
Wet season	-3 (0.27)	21 (2.61)[a]	-17 (1.52)
Dry season	9 (0.98)	17 (1.88)	1 (0.08)
Annual	6 (0.31)	39 (2.73)[aa]	-12 (0.64)
		TSP use per hectare (kg)	
Wet season	15 (1.63)	30 (3.80)[aa]	-8 (0.70)
Dry season	20 (1.74)	37 (3.80)[aa]	16 (1.53)
Annual	33 (2.04)[a]	64 (4.54)[aa]	13 (0.94)
		Pesticide use per ha (Rp)	
Wet season	-798 (1.12)	-2858 (0.40)	91 (0.13)
Dry season	-70 (0.09)	-1622 (2.00)	-80 (0.09)
Annual	-30 (0.22)	-3585 (2.66)[a]	977 (0.94)
		Labour use per ha (mds)	
Wet season	-49 (6.42)[aa]	-26 (4.59)[aa]	-27 (4.79)[aa]
Dry season	-28 (2.67)[aa]	-18 (2.14)[a]	-12 (1.21)
Annual	-84 (4.01)[aa]	-40 (2.57)[a]	-23 (1.49)
		Labour use per farm	
Annual	426 (4.23)[aa]	331 (3.30)[aa]	354 (3.39)[aa]

[a,aa] Significant at 5 and 1 per cent level, respectively.

Numbers in parentheses are t values.

Table 5. Test for differences of farm size, cropping intensity and production between mechanized (T_1) and unmechanized farms (West Java, 1979/80)

Variables	Difference		
	T_1 vs M_1	T_1 vs A_1	T_1 vs M_2
Farm size (ha)	3.61 (7.98)[aa]	3.01 (6.26)[aa]	3.15 (6.33)[aa]
Cropping intensity	-0.19 (4.00)[aa]	-0.17 (3.57)[aa]	-0.20 (3.94)[aa]
Yield per hectare (kg)			
Wet season	411 (2.23)[a]	159 (1.02)	-401 (1.86)
Dry season	647 (2.58)[a]	974 (4.02)[aa]	196 (0.71)
Annual	1102 (3.41)[aa]	1225 (4.06)[aa]	155 (0.42)
Production per farm			
Per annum (kg)	27332 (8.33)[aa]	22615 (6.70)[aa]	22038 (6.18)[aa]

[a,aa]Significant at 5 and 1 per cent level, respectively.

Numbers in parentheses are t values.

Table 6. Test for difference of farm size, cropping intensity and production between mechanized (T_2) and unmechanized farms (West Java, 1979/80).

Variables	Difference		
	T_2 vs M_1	T_2 vs A_1	T_2 vs M_2
Farm size (ha)	3.09 (6.65)[aa]	2.49 (4.29)[aa]	2.59 (4.49)[aa]
Cropping intensity	-0.11 (2.26)[a]	-0.09 (1.78)	-0.12 (2.39)[a]
Yield per hectare (kg)			
Wet season	458 (2.03)[a]	206 (1.01)	-354 (1.34)
Dry season	531 (1.71)	858 (2.89)[aa]	80 (0.24)
Annual	1096 (2.44)[a]	1219 (2.89)[aa]	-161 (0.31)
Production per farm			
Per annum (kg)	26129 (4.86)[aa]	214212 (3.95)[aa]	20835 (3.76)[aa]

[a],[aa] Significant at 5 and 1 per cent level, respectively.

Number in parentheses are t values.

Table 7. Decomposition analysis of output differences between mechanized and unmechanized farms.

Effects	Percentage share					
	T_1 vs M_1	T_1 vs A_1	T_1 vs M_2	T_2 vs M_1	T_2 vs A_1	T_2 vs M_2
Source of output differences						
A. Individual effects						
Yield effect	3.92	5.41	-1.52	5.43	8.21	1.45
Area effect	96.91	99.99	122.83	86.82	87.40	106.75
Cropping intensity effect	-2.83	-4.93	-6.13	-1.71	-2.75	-3.85
B. First order interaction effect						
Yield and area	13.12	9.69	-3.11	15.54	12.17	2.47
Yield and cropping intensity	-0.38	-0.48	0.15	-0.31	0.38	-0.09
Area and cropping intensity	-9.46	-8.83	-12.54	-4.89	-4.08	-6.58
C. Second order interaction effect						
Yield, area and cropping intensity	-1.28	-0.85	0.32	-0.88	-0.57	-0.15
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 8. Decomposition analysis of labour use differences between mechanized and unmechanized farms.

Effects	Percentage share					
	T_1 vs M_2	T_1 vs A_1	T_1 vs M_2	T_2 vs M_1	T_2 vs A_1	T_2 vs M_2
Source of labour use differences						
A. Individual effets						
Labour use per hectare effect	-20.62	-29.28	-25.71	-14.31	-17.02	-15.15
Area effect	206.86	202.49	200.77	164.61	152.25	153.39
Cropping intensity effect	-6.04	-10.12	-10.03	-3.25	-4.80	-5.50
B. First order interaction effects						
Labour use per ha. and area	-68.81	-52.51	-52.52	-40.90	-25.26	-25.84
Labour use per ha. and cropping intensity	2.05	2.62	2.64	0.80	0.79	0.90
Area and cropping intensity	-20.18	-17.81	-20.51	-9.26	-7.11	-9.40
C. Second order interaction effects						
Labour use per ha., area and cropping intensity	6.74	4.61	5.36	2.31	1.15	1.60
Total	100.00	100.00	100.00	100.00	100.00	100.00

Table 9. Estimates Cobb Douglas production function using pooled data for mechanized and unmechanized farms; production per farm as dependent variable

Items	
Number of observations	596
R^2	0.87
F value	474.77
Regression coefficient of independent variables:	
Farm size (ha)	0.77 (10.36)[aa]
Nitrogen (kg per farm)	0.22 (4.37)[aa]
Trisuperphosphate (kg per farm)	0.06 (1.92)[a]
Insecticide (Rp per farm)	-0.07 (2.79)[aa]
Labour (mandays) per farm)	0.07 (1.10)
Mechanization dummies:	
T_1	0.03 (0.64)
T_2	-0.04 (0.73)
Intercept	6.83

[a], [aa] Significant at 5 and 1 per cent level, respectively.

Figures in parentheses are t values.

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