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THE CONSEQUENCES OF SMALL RICE FARM MECHANIZATION PROJECT

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EFFECTS OF MECHANIZATION ON INTENSITY OF LAND USE

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ABSTRACT

Use of land under different types of farm was analyzed. Farming activities of 42 Farm Record Keeping Cooperators were gathered for two cropping seasons. The farms were characterized as to topography and soil type, source of water supply, farm size, average area cultivated and production. Farm machines and draft animal ownership and tenure status of the farm operators were determined under the farm classifications. The findings revealed that rice-rice is the dominant pattern in the gravity irrigated areas. The cropping pattern for the rainfed and pump irrigated farms is still rice-rice but the dominant pattern is rice-fallow because only those who have access to supplementary irrigation from creeks grow second rice crop. Cropping intensity was found to be significantly different between the mechanized and non-mechanized farms at 1% probability level. Mechanized farms when grouped together regardless of the source of water supply gave an almost similar turnaround time to that of the non-mechanized farms.

INTRODUCTION

When one speaks of a farmer one does not refer to the person alone but also to the land that he cultivates, because land is his main resource and the basic input to agricultural production (Ratnam) 1979). Hence, it is essential to understand how the farmer utilizes his land and what inputs he uses in relation to the land he tills.

The workshop of 1978 (Workshop Report 1978) developed a set of hypotheses regarding mechanization and land use. These included that the use of machines tends to increase cropping intensity, lessen the turnaround period, change the composition of the cropping pattern and allow the farmer more timely cultivation.

SOURCE OF DATA

The data used here were from 42 Farm Record Keeping Cooperators from two irrigated villages in Cabanatuan City (Lagare and Caalibangbangan) and two rainfed villages in Guimba (San Andres and Bunol), Nueva Ecija, who were randomly chosen from the Consequences survey's list of sample respondents. The number of respondents in each village is shown in Table 1. They were studied in detail by the use of Farm Schedules which the cooperators filled in daily. The data were based on two cropping seasons, Wet Season 1979 and Dry Season 1979-1980.

DESCRIPTION OF THE FARMS

The two types of farms studied were irrigated, either by gravity or pump, and non-irrigated or rainfed. These farms were further classified into mechanized and non-mechanized to investigate certain mechanization issues (Table 2). A mechanized farm was defined as one where a two-wheel or four-wheel tractor was used in primary tilling, and a non-mechanized farm defined as one first tilled by animal. If a farm had two or more parcels, the biggest was chosen, the power use was determined and this is used as the basis for classification.

Topography and soil type

Topographically, the land in the four villages is level, though broken by creeks. Two types of soil surface texture predominate in the study areas - silt loam and clay loam - and the soil is well adapted to cultivable farming. Rice is produced almost exclusively with vegetables such as tomato, mungbeans, eggplant and stringbeans, particularly in Caalibangbangan, grown as second crops.

Source of water supply

Lagare and Caalibangbangan fields are irrigated by gravity flow through ditches and canals leading from the dam and two rice harvests are possible each year.

Bunol and San Andres are rainfed villages and farmers usually grow a single rice crop a year although some use pumps to grow rice in the dry season as well as in the wet season when rainfall in not adequate.

Farm size and average area cultivated

There is not much difference between villages in the average farm size. In three villages the average is more than two hectares and it is only in Caalibangbangan that average farm size falls to 1.74 hectares (Table 3). Farm sizes ranged from 0.25 to 4.99 hectares in the irrigated areas and 1.0 to 4.80 hectares in the rainfed areas.

In both seasons the number of non-mechanized farms was higher than the mechanized farms. In the wet season, 18 out of 42 utilized machine in land preparation. As shown in Table 4, the 18 mechanized farms averaged 2.06 hectares while the 24 non-mechanized farms averaged an almost similar area, 2.07 hectares. Similarly, in the dry season, 61% or 21 farms were non-mechanized and 13 farms were mechanized. The average area for both type of farms decreased, 1.97 for the machine plowed and 1.27 hectares for the animal plowed farms.

Production

It is evident from Table 5 that the average gross production per hectare of the mechanized farms is higher than the non-mechanized. Irrigation clearly contributes to production. Production on gravity irrigated farms was 33.35 cavans per hectare higher than on rainfed mechanized farms. The non-mechanized farms exhibited a similar result. The gross harvest of the gravity irrigated non-mechanized farms was 51.41 cavans per hectare higher than the rainfed non-mechanized farms. Comparing mechanized and non-mechanized farms in the gravity irrigated areas, mechanized farms have higher produce than the non-mechanized. The same is true in the rainfed areas.

Farm implements ownership

Mechanized farm operators tend to own their machine and owners of draft animal tend to be operators of non-mechanized farms (Table 6). A two-wheel tractor owner falls within the non-mechanized category because his tractor had broken down and was not repaired during the time the data was gathered. Likewise, four irrigation pump owners operated non-irrigated farms because of the same reason.

Land tenure

The majority of the cooperators are leasehold tenants (33%) and amortizing owners (30%). Other tenures found in the Farm Record Keeping sites were owner cultivators, share tenants and combinations of those mentioned. Table 7 shows that owner cultivators and part owner operators (amortizing owners and owner cultivator cum leasehold tenant) cultivate mechanized farms. More leaseholders and combinations of tenures fall under the non-mechanized farm classification.

LAND USE BY VILLAGE

Due to gravity irrigation in Lagare and Caalibangbangan 100% of the sampled area was cultivated both in the wet and dry season. This is shown in Table 8. In Caalibangbangan, 1.65 hectares were considered not cultivated because it was not farmed by our respondents but by other farmers. About 99% of the Farm Record Keeping areas was planted to modern varieties IR-36 being the dominant variety.

In San Andres and Bunol, 89% of the farms was tilled in the wet season. The remaining percentage was not cultivated due to insufficient water supply. In the dry season, only 17% or 6.21 hectares in San Andres and 31% or 4.52 hectares in Bunol was cultivated. Only those with irrigation pumps are able to farm in the dry season.

LAND USE BY TYPE OF FARM

Mechanized farms have a bigger area than the non-mechanized farms in the gravity irrigated areas. This is true in the wet and in the dry season. In the rainfall and/or pump areas, it is otherwise. Non-mechanized farms have a greater area than the mechanized farms. In order to avoid double expense on machines, it is the choice of using either pump or machine alone. Others who can truly afford practice using both. (Table 9)

MECHANIZATION EFFECT ON:

Cropping Pattern and Intensity

One measure of the intensity of land use is to find out the area or the amount of land upon which crops were planted and actually harvested. The total sampled land area involved in this discussion is 42.25 hectares of gravity irrigated and 50.88 hectares of rainfall and/or pump irrigated. Environmental conditions, as had been attested by a number of studies, could affect land utilization. To fully understand land use in two different conditions, a separate discussion is necessary.

Lagare and Caalibangbangan displayed a very high cropping intensity, 2.00 for Lagare and 1.97 for Caalibangbangan. These two villages, generally, grow two rice crops in a year. This can be attributed largely to water availability, both being gravity irrigated. The average effective crop area for the two villages was the same for the two seasons. (Table 10).

Only a portion (about 500 sq. meters) of one of the mechanized farms in Lagare managed to produce a third rice crop because the crop prior to the third is an early maturing variety. IR-50 matures in only 105 days according to the farmer's experience. Because there was still water in the paddy, the farmer thought of preparing it and grow IR-50 again. It was harvested just in time with the harvesting of the second rice crop farm around his area. The same case happened to one of the non-mechanized parcels in Bunol but this time the farmer's third crop was harvested later than the second crop.

Why do farmers in these villages do not grow a third crop? Interviews with them brought three answers. First, they want the land to "rest" for a while because they opined that the fertility of the soil is reduced by frequent cultivation. Second, pests (rats, insects, etc.) would concentrate on their farms if only one or two of them grow third crop. Third, lack of cash to finance the third crop.

Proximity to the market and accessibility to transportation justify farmers in Caalibangbangan growing vegetables on some portions of their lands. Three non-mechanized parcels planted to vegetables were cultivated thrice in a year. These parcels were planted to tomato, stringbeans, eggplant and mungbeans. These vegetables can be harvested in only 50 to 60 days the reason why farmers can grow it three times in a year.

In the rainfed villages, usually only a single rice crop is grown during the year, but there are cases where farms are planted to rice in the dry season because of the availability of irrigation

pumps. Bunol, having a high water table, has a higher cropping intensity, 1.25 than San Andres, 1.08.

In the overall analysis between mechanized and non-mechanized farms regardless of the source of water supply, a significant result at 1% probability level was found. Cropping intensity differs. However, blocking for source of water supply, there is insufficient evidence to conclude that the cropping intensity population mean for mechanized differs from that of the non-mechanized (Table 10). It maybe that the overall significant difference is explained by, or accounted for, by irrigation rather than mechanization.

Turnaround Period

Turnaround period is most meaningfully defined as the time from the harvest of one crop to the planting of the subsequent crops. (R. Magbanua, et al., 1977). The turnaround period was determined by getting the last harvest date of the first crop (Wet season 1979) and the first planting of the second crop (Dry season 19790-980).

A total of 38 parcels was observed, 29 of which were gravity irrigated and 9 were pump irrigated. The cropping pattern for all was rice-rice. Turnaround period in the gravity irrigated areas is shorter on mechanized than on non-mechanized farms (Table 11). However, this trend disappears if we look at it by village. In one village (Lagare), mechanized farms have shorter turnaround time than the non-mechanized. In another village (Caalibangbangan), it was otherwise. To investigate whether water delivery from the dam might have cause the difference, the schedule was obtained from the National Irrigation Administration (NIA) and together with some interviews, it was found that the water reaches Lagare first since it is nearer to the source than Caalibangbangan. This made farmers of Lagare prepare their lands and plant ahead of Caalibangbangan. Lagare farmers were able to plant in January, Caalibangbangan farmers in February. Another reason would be the turnaround time for mechanized farms in Lagare ranged from only 39 days to as long as 86 days while in Caalibangbangan the range was from 67 to 93 days. For animal plowed farms, the ranges were 55-102 days in Lagare and 66-84 days in Caalibangbangan.

Differences in turnaround period between the mechanized and non-mechanized farms in pump irrigated villages cannot be determined due to the lack of sufficient number of parcels within the mechanized category.

Overall, the mechanized averaged 69.05 days and the non-mechanized, 69.39 days, the difference is insignificant, and therefore the turnaround period of the two types can be regarded as being similar.

CONCLUSIONS AND RECOMMENDATIONS

To a certain extent, the data used although considered not too substantial provided answers to the questions and hypotheses posited. A need to investigate the same topic using the farm survey data is suggested to confirm what has been found. A related research is also suggested emphasizing land utilization and mechanization not only of one farming operation but all operations that can be better done by machinery. In this case, we can fully evaluate mechanization effects in the utilization of land.

Based on the preceeding discussion, the conclusions of this paper are:

1. Cropping pattern in mechanized farms does not seem to differ to that of the non-mechanized. Rice-rice was the cropping pattern adopted by the two types of farm. Adopting other pattern like vegetable-vegetable depended on such factor as management knowledge and market.

2. Cropping intensity between mechanized and non-mechanized farms was found to be significantly different at 1% level when the analysis was done on combined gravity, pump and rainfall irrigated farms. The overall difference is explained by irrigation rather than mechanization.

3. Mechanized farms when grouped together regardless of the source of water supply gave an almost similar turnaround time to that of the non-mechanized. Machine plowed farms have nearly same planting date as that of the animal plowed.

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Table 1. Frequency distribution of farm record keeping (FRK) Cooperators by occupation.

Village	Farm operator	Landless field laborer	Total
Cabanatuan City:			
Lagare	10	1	11
Caalibangbangan	12	1	13
Guimba			
San Andres	14	-	14
Bunol	6	3	9
Total	42	5	47

Table 2. Frequency distribution of FRK cooperators by type of farm and season.

Village	Mechanized				Non-mechanized			
	Irrigated		Non-irrigated		Irrigated		Non-irrigated	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
Lagare	5	6	-	-	5	4	-	-
Caalibangbangan	9	6	-	-	3	5	-	-
San Andres	-	-	4	-	6	8	4	-
Bunol	-	1	-	-	2	3	4	-
Total	14	13	4	-	16	20	8	-

Table 3. General characteristics of the farms.

Village	Average farm size (ha)	Dominant soil surface texture	Topography
Cabanatuan			
Lagare	2.22	silt loam	flat
Caalibangbangan	1.74	clay loam	flat
Guimba			
San Andres	2.58	silt loam	flat
Bunol	2.47	silt loam	flat

Table 4. Average area (ha) cultivated by type of farm and season.

Farm type	Mechanized	Non-mechanized	Average area
Wet season			
Irrigated	1.96 (14)	1.93 (16)	1.94 (30)
Non-irrigated	2.43 (4)	2.34 (8)	2.37 (12)
Average area:	2.06 (18)	2.07 (24)	
Dry season			
Irrigated	1.97 (13)	1.27 (21)	1.54 (34)
Non-irrigated	-	-	-
Average area:	1.97 (13)	1.27 (21)	

( ) = no. reporting

Table 5. Average gross production (in cavan) per hectare by type of farm and season.

Farm Classification	Average production per hectare	
	Wet season	Dry season
Gravity irrigated:		
Mechanized	100.8 (22)	104.6 (19)
Non-mechanized	91.1 (9)	101.3 (10)
Pump irrigated:		
Mechanized		88.3 (1)
Non-mechanized	52.2 (17)	53.4 (12)
Rainfed		
Mechanized	67.4 (10)	-
Non-mechanized	39.7 (16)	-

( ) = no. reporting

Table 6. Frequency distribution of farm machine and draft animal ownership by type of farm

Farm machine/draft animal	Mechanized		Non-mechanized	
	Irrigated	Non-irrigated	Irrigated	Non-irrigated
Number reporting	14	4	16	8
2 wheel tractor only	2			
2 wheel and carabao	2		1	
Carabao only	2	1	9	3
Irrigation pump			1	
Irrigation pump and carabao		2	2	2

Table 7. Frequency distribution of FRK cooperators by tenure and by type of farm.

Tenure	Mechanized		Non-mechanized	
	Irrigated	Non-irrigated	Irrigated	Non-irrigated
Owner cultivator	2			
Amortizing owner	5	3	3	2
Leasehold tenant	4		7	3
Owner cultivator cum leasehold tenant	2			
Owner cultivator cum leasehold tenant cum share tenant			1	
Amortizing owner cum other tenure arrangement		1	3	2
Leasehold tenant cum share tenant				1
Other tenure arrangement*	1		2	
Total	14	4	16	8

*Mortgaged, borrowed , share tenant.

Table 8. Land use by village and season.

	Lagare		Caalibangbangan		San Andres		Bunol	
Total land area (ha)	22.25		20.90		36.08		14.80	
	Wet	Dry	Wet	Dry	Wet	Dry	Wet	Dry
No. reporting a crop	10	10	12	12	14	8	6	4
Total area of cropped land	22.25	22.25	19.25	20.35	32.11	6.21	13.20	4.52
Total area devoted to								
a. Main crops								
Rice traditional	-	-	-	0.38	-	-	-	-
Rice improved	22.19	22.15	18.40	18.67	32.11	6.21	13.20	4.52
b. Second crops	0.06	0.10	0.85	1.3	-	-	-	-
Area not cultivated	-	-	1.65	0.55*	3.97	29.87	1.60	10.28

*0.35 in which R is a share tenant was returned to owner so only 0.2 was not cultivated.

Table 9. Land use by type of farm and season.

	MECHANIZED					NON-MECHANIZED				
	Irrigated				Non-irrigated	Irrigated				Non-irrigated
	Gravity		Pump			Gravity		Pump		
	Wet	Dry	Wet	Dry	Wet	Wet	Dry	Wet	Dry	Wet
Total land area (ha)	27.93	25.40	-	1.00	9.71	14.32	16.85	19.67	34.49	21.50
No. reporting	14	12	-	1	4	8	10	8	11	8
Total area of cropped land	27.43	25.20	-	0.47	9.71	14.06	16.50	16.85	10.26	18.75
Total area devoted to:										
a. Main crops										
Rice traditional	-	-	-	-	-	-	0.38	-	-	-
Rice improved	27.38	24.60	-	0.47	9.71	13.20	15.32	16.85	10.26	18.75
b. Second crops	0.05	0.60	-	-	-	0.87	0.80	-	-	-
Area not cultivated	0.50	0.20	-	0.53	-	0.25	0.35	2.82	24.23	2.75

Table 10. Cropping intensities by type of farm and by village.

	Ave. farm size (ha)	Average effective crop area (ha) Wet	Dry	Cropping intensity
By type of farm				
Gravity irrigated:				
Mechanized	1.99 (12)	1.95	1.98	1.98
Non-mechanized	1.79 (7)	1.76	1.75	1.99
Mechanized (wet) and non-mechanized (dry)	2.00 (2)	2.00	2.00	2.00
Non-mechanzied (wet) and mechanized (dry)	1.72 (1)	1.72	1.72	1.72
Rainfed and pump:				
Mechanized	-	-	-	-
Non-mechanized	3.10 (5)	2.69	0.62	1.20
Pump and pump:				
Mechanized	-	-	-	-
Non-mechanized	2.66 (5)	1.89	1.05	1.25
Pump:				
Mechanized	-	-	-	-
Non-mechanized	2.6 (3)	2.13	-	1.0
Rainfed:				
Mechanized	1.51 (2)	1.51	-	1.0
Non-mechanized	2.00 (3)	1.77	-	0.89
Rainfed mechanized and pump non-mechanized	3.35 (2)	3.35	1.03	1.44
By Village				
Cabanatuan:				
Lagare	2.22 (10)	2.22	2.22	2.00
Caalibangbangan	1.74 (12)	1.70	1.70	1.97
Guimba:				
San Andres	2.58 (14)	2.29	0.44	1.08
Bunol	2.47 (6)	2.20	0.75	1.25

( ) = number reporting

Table 11. Turnaround period (number of days) by type of farm and by village.

	TYPE OF FARM			
	Gravity irrigated		Pump-irrigated	
	Mechanized	Non-mechanized	Mechanized	Non-mechanized
Average	71.6 (19)	78.0 (10)	20.0 (1)	58.6 (8)
By village				
Cabanatuan				
Lagare	65.6 (11)	81.2 (5)	-	-
Caalibangbangan	79.9 (8)	74.8 (5)	-	-
Guimba				
San Andres	-	-	-	57.4 (5)
Bunol	-	-	20.0 (1)	60.7 (3)

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