PN-AAH-237

IRRI RESEARCH PAPER SERIES
Number 31 July 1979

CHANGES IN RICE HARVESTING SYSTEMS IN CENTRAL LUZON AND LAGUNA

M. KIKUCHI, V. G. CORDOVA, E. B. MARCIANO, and Y. HAYAMI

The International Rice Research Institute
P.O. Box 933, Manila, Philippines

CHANGES IN RICE HARVESTING SYSTEMS IN CENTRAL LUZON AND LAGUNA[1]

ABSTRACT

In the Philippines, dramatic changes in rice harvesting and threshing arrangements are occurring in response to growing population pressures, land reform, improvements in irrigation systems, and the introduction of modern rice varieties.

This study focuses on the geographic and historical changes in harvesting and threshing arrangements in a major rice-producing area. Data were collected by surveying 100 farms along the main highways in Central Luzon and Laguna. Historical documents and interviews of resource persons such as the ex-managers of *hacienda* and operators of threshing machines supplemented the farmer interviews.

The results suggest that in those areas the changes in rice harvesting and threshing arrangements in the past decade reflect not only the private choice of farmers but also the outcome of social interactions in rural communities, especially among small rice farmers and landless workers.

---

[1]by M. Kikuchi, postdoctoral fellow, V. G. Cordova, senior research assistant, E. B. Marciano, research aide, and Y. Hayami, visiting economist, International Rice Research Institute, Los Baños, Philippines. Submitted to the IRRI Research Paper Series Committee in September 1978.

CHANGES IN RICE HARVESTING SYSTEMS IN CENTRAL LUZON AND LAGUNA

Typically, the labor required for harvesting and threshing rice in Asia is nearly 30% of total labor and 50% of total hired labor in rice production. As a result, harvesting and threshing represent major employment opportunities for landless workers and for small farmers whose incomes from farming are insufficient to meet their subsistence need. Therefore, choice of technology and contractual arrangements with respect to the use of labor and capital for rice harvesting and threshing is a critical determinant of the income and the well-being of the rural poor.

In the Philippines, the technology and the contractual arrangements for rice harvesting and threshing are undergoing a dramatic change. This study identifies the changing patterns of socioeconomic factors that underlay the change.

THE PROBLEM AND APPROACH

Harvesting is the stage in rice production where income is distributed among resource contributors. Typically, production costs are deducted from the output, and the residual is divided between the landlord and the tenant. Harvest workers also receive a significant share because the harvesting and threshing costs are usually the largest items among production costs.

Harvesting-threshing work is the major source of income for landless agricultural workers in the rural community. In a village study in Laguna province, Philippines, more than 45% of landless workers' income was from harvesting and threshing (Hayami et al 1978). In the Philippines, the crop is usually cut by hand, but threshing methods vary from hand beating to large mechanical threshers. In general, the more mechanized the threshing operation, the smaller the laborers' share of the harvesting cost.

Interacting with the choice of threshing technology are several contractual arrangements. The choice of technology and contractual arrangement depends partly on relative prices of capital and labor and the technical conditions such as irrigation and seed varieties (Hayami and Ruttan 1971). It also depends on risk, such as that of insufficient labor at the peak of harvesting, and transaction costs, such as those involved in labor recruitment, management, and work enforcement (Cheung 1969).

In addition, the mix depends on social and institutional environments in the rural community. The landlord-tenant relationship is an especially critical factor. Responsibility for payment of harvesting cost depends on the tenure types, which range from fixed-rent leaseholding to sharecropping with cost-sharing arrangements. Share-tenants may not be free to choose the method of harvesting.

An equally important social factor may be the principle of mutual help and income sharing in a community. It is a basic code in the village community that the well-to-do members help the poor (Scott 1976). Because of that code a strong preference seems to exist among well-off farmers for contracts that promote a patron-client relationship with small farmers and landless workers. In many cases, such contracts have the merit of reducing risk and transaction costs.

Thus, the choice of harvesting arrangement depends on many economic and social factors. Changes in such factors induce changes in the harvesting arrangements. In the Philippines, dramatic changes in rice harvesting arrangements have been occurring in response to growing population pressure, land reform, improvements in irrigation systems, technological changes in land preparation and crop establishment, and the introduction of modern rice varieties.

Our study identifies geographic and historical patterns of changes in the harvesting and threshing arrangements in a major rice-producing area of the Philippines in relation to changes in economic and social factors.

Study site and data collection

Our study covers five provinces in Central Luzon (Bulacan, Nueva Ecija, Pangasinan, Tarlac, and Pampanga) and Laguna province (Fig. 1). Central Luzon is the country's largest contiguous rice-producing area, and is commonly called the *rice bowl* of the Philippines.

Data collection

Our analysis is primarily based on data collected during surveys in February and July 1978. The sample contained many farms in the Central Luzon/Laguna loop surveys, which had been conducted repeatedly by the Agricultural Economics Department of the International Rice Research Institute in 1966, 1970, and 1974 to collect data on rice production costs and returns. The survey is referred to as the loop survey, because of the shape of the survey route (Fig. 1).

Our survey in February covered 89 farms. The owners of 40 had been interviewed periodically in previous loop surveys. The 49 new observations were in locations somewhat remote from the main highways to reduce possible bias due to selection of the farms along the highways.

The July survey checked several anomalies found in a preliminary analysis of the data from the first survey. In the process, a few farms were added to the sample, but some previous observations were deleted because we found them highly unreliable despite the second interviews. The data on 100 farms were used for the final analysis (Table 1).

To broaden our perspective, we interviewed persons such as the ex-managers of haciendas and the commercial operators of threshing machines. We also collected historical data on the harvesting and threshing arrangements reported in past studies. Such data enlarged our historical perspective

and served to check the reliability of data on forms of past arrangements recalled by sample respondents.

GEOGRAPHIC AND HISTORICAL PERSPECTIVE

The history of development and the socioeconomic characteristics, such as landlord-tenant relations, of the six provinces are not homogenous. We divided the region into two subregions: Coastal Region and Inner Central Luzon. The Coastal Region includes Laguna, the southern parts of Bulacan and Pampanga, and the northern part of Pangasinan. Inner Central Luzon encompasses the remaining landlocked area.

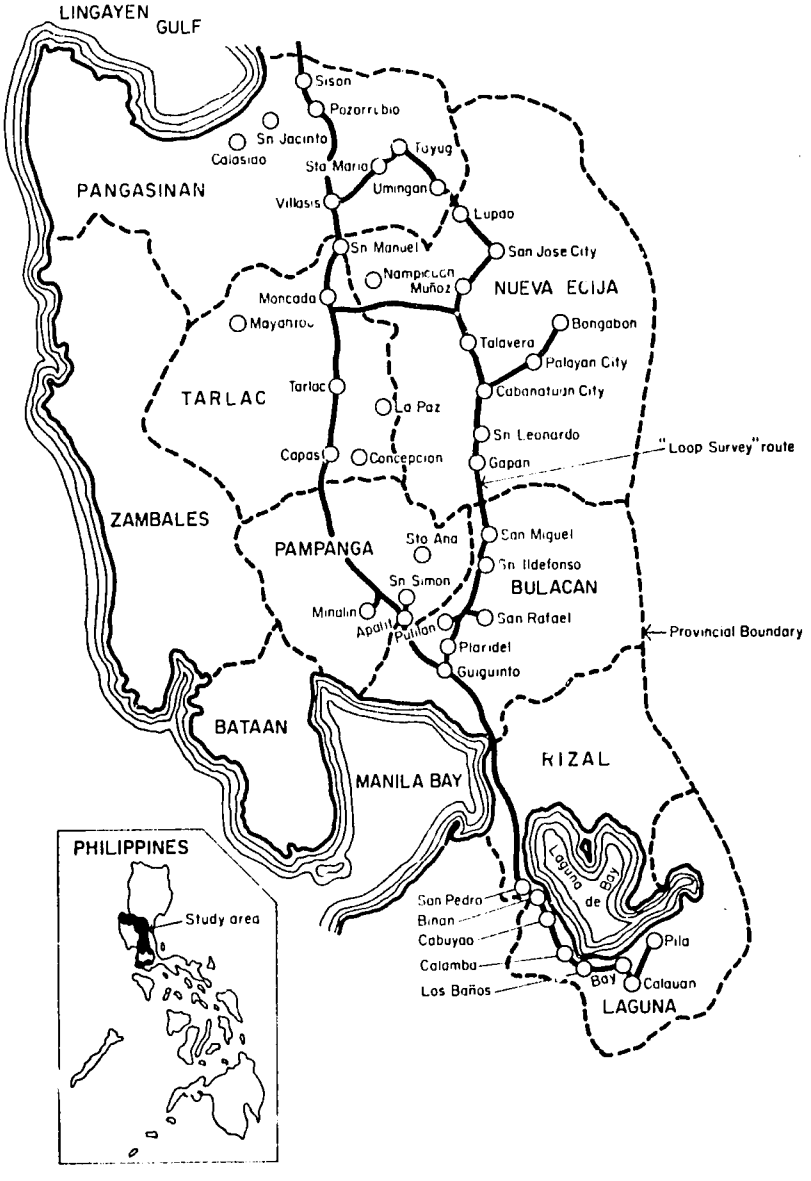

Fig. 1. The Central Luzon/Laguna "loop survey" route and the municipalities covered by the survey. Philippines.

Most areas in the Coastal Region are easily accessible by sea or lake and have a long history of settlement, Laguna, southern Bulacan, and Pampanga were major suppliers of rice to Manila before Inner Central Luzon developed as a rice-producing region in the late 19th century and early 20th century.

Landlord-tenant relationships

Corresponding to the difference in settlement age is a major difference in the landownership pattern. Both regions are characterized by pervasive landlordism; however, landholdings in the Coastal Region are relatively small and scattered and typically range from 10 to 20 ha. The land accumulation by landlords proceeded piece by piece through a moneylending scheme called *pacto de retroventa*. In that scheme the moneylender secured control of land as a mortgage for his loan. During the loan period, the peasant cultivated the land as a sharecropper of his creditor. If unable to repay the loan at the termination of the loan period, the peasant relinguished claim to the land for a debt that usually represented only 30 to 50% of the land value (McLennan 1969).

Table 1. Characteristics of 100 farms used in final analysis of data on patterns of rice harvesting and threshing arrangements. Central Luzon and Laguna province, Philippines. 1978.

	Laguna	Bulacan	Nueva Ecija	Panga-sinan	Tarlac	Pampanga	Total
Sample size	11	11	39	13	19	7	100
Tenure status:							
Before land reform:[a]							
Owner	1	0	0	3	3	0	7
Owner/tenant	0	2	0	1	2	0	5
Leasehold tenant	0	0	2	2	3	0	7
Share-tenant	10	8	36	6	9	7	75
After land reform:							
Owner	1	0	1	4	5	1	12
Owner/tenant	1	2	2	2	3	0	10
Leasehold tenant	7	6	34	4	7	6	64
Share-tenant	2	3	2	3	4	0	14
Irrigation:							
Rainfed	0	5	8	5	7	3	28
Irrigated - 1 crop	0	1	3	5	0	2	11
Irrigated - 2 crops	11	5	28	3	12	2	61
Av. harvested area (ha/farm):							
Wet season	2.2	2.8	2.7	3.0	2.8	2.5	2.7
Dry season	2.2	1.0	1.6	0.3	1.4	0.3	1.3

[a] The sample farmers who just started farming are not included.

A land tenure arrangement was developed in the form of share-tenancy called *kasamajan*, a Tagalog word meaning partnership; typically both output and production costs were shared equally by the landlord and the tenant (*kasama*). The system became firmly rooted in the 18th century (McLennan 1969). In general, the landlord-tenant relation in the Coastal Region is a paternalistic one. The landlord patronizes the tenant by advancing credit and by using his connection influence, in return for the loyalty of the tenant (Anderson 1964, Larkin 1972).

In contrast, Inner Central Luzon saw the development of the huge estates (*haciendas*) of several hundred to thousands of hectares. Haciendas originated from royal grants and purchases of undeveloped royal domain called *realengas*. This process of large-scale land acquisition by the Spaniards began in the 18th century after the removal of restrictions on Spanish residence in the provinces.

Until the 19th century, the Inner Central Luzon haciendas were primarily engaged in cattle ranching. Subsequently, the haciendas in the lowland areas developed a system of rice monoculture with tenants who had migrated from the Ilocos and Southern Tagalog regions. The upland areas were converted into sugar plantations.

The landlord-tenant relation in the large haciendas with their hundreds or thousands of tenants was inevitably less paternalistic than in the Coastal Region. Typically, the hacienda owners lived in Manila and the management was carried out by a farm manager (*encargado*) and a number of overseers (*katiwalas*) (Umehara 1974). The tenure contract was geared to economic considerations, and was enforced more strongly by legal means than by the sense of obligation based on the patron-client relation. As a result, the haciendas became a hotbed for tenant uprisings (Dalisay 1937, Pelzer 1945, Rivera and McMillan 1954).

Land tenure-harvesting arrangements

The difference in the landlord-tenant relationship between the Coastal Region and the Inner Central Luzon affected the choice of harvesting arrangements. Simultaneously, technological developments in harvesting and threshing influenced the choice of land tenure system.

In both areas harvesting is still done manually with sickles. In the Coastal Region, especially in Laguna, the threshing is still mainly by hand beating on wooden or bamboo plates. But, in Inner Central Luzon a large threshing machine (*tilyadora* or *trilladora*) has been commonly used. The *tilyadora* thresher is of a McCormick-Deering design dating from about 1910. The threshing by *tilyadora* is generally done in a central location on a farm. Unthreshed crops are hauled and stored in large stacks (*mandala*) until the *tilyadora* arrives.

Labor contracts for harvesting differed with threshing methods.

In the Coastal Region, the traditional form of labor contract was *hunusan*. In that system, a farmer specified a day of harvesting and anyone could participate in harvesting and threshing and receive a part of the output.

The share ranges from one-fourth to one-eighth but was commonly one-sixth. The typical land tenure arrangement was such that the output was divided half and half between landlords and tenants after the share of harvesters was deducted.

The *hunusan* is old in origin. Before sickles were introduced, a common practice in the Philippines and in other countries in Asia was to cut panicles by hand knives (*ani-ani*) with mass participation of village people (Africa 1920). The harvested panicles were bundled and the harvesters received one out of six bundles. The system was apparently based on the principle of mutual help and income-sharing within the community.

Such an arrangement based on community principles could not be used in Inner Central Luzon. With *tilyadora*, crop cutting and threshing became two separate operations. The amount of output could not be ascertained at the stage of crop cutting. Therefore, harvesters were employed at a fixed daily wage rate (*upahan*) or at a fixed payment per certain area harvested (*pakyaw*). Exchange labor (*suyuan*) was also used. The cost of harvesting was shouldered by tenants. The threshing fee by *tilyadora* (at a rate from 4 to 6% of output) was deducted before the output was divided between landlords and tenants.

The introduction of *tilyadora* in Inner Central Luzon is partly explained by a relative labor shortage in the areas of new settlements. A more important reason is that *tilyadoras* allowed the hacienda owners to determine output and collect the right amount of rent in kind. On the haciendas, tenants were requested to store their harvested crops in certain locations. *Tilyadoras* owned or contracted by the haciendas went around for threshing under the supervision of overseers. No chance of cheating was left for the tenants.

The *tilyadora* was the factor underlying the emergence of the share-cropping system on the haciendas. Share cropping (*kasama*) was a common form of tenancy in the Inner Central Luzon until the recent land reform. However, in the early stage of the development of rice haciendas, the common tenure arrangement was the leasehold for a fixed rent (*canon*). In the beginning of settlement, the hacienda owners gave a parcel of land gratis to settlers for the period of land opening, and asked only nominal rents even after the gratis period. However, as population and labor force grew, the *canon* was raised gradually and finally shifted into the *kasama* system (Hester and Mabbun 1924; McLennan 1969). That shift was mostly during the 1920s and 1930s. The 1903 census indicates 2,215 cash tenants and only 290 share-tenants in Nueva Ecija; the 1918 census, 2,796 cash tenants and 1,798 share-tenants. By 1939, Nueva Ecija had only 867 cash tenants and 50,831 share-tenants (McLennan 1969) During the 1920s and 30s the *tilyadora* became the common method of threshing. Interviews with aged people, including a former hacienda manager, who witnessed the process of tenure change, produced evidence in support of the argument that the share cropping system could not have been adopted in the haciendas without *tilyadora*.

Historical data

Through the historical process as described above, two different types of harvesting and threshing arrangements were developed in Central Luzon and

Laguna: the *hunusan* system -- an output-sharing contract including both harvesting and hand threshing; and the *tilyadora* system -- a fixed-wage contract for harvesting (*upahan or pakyaw*) with the use of *tilyadora*. In order to identify the traditional pattern of regional distributions in harvesting arrangements, we have searched for the cases of the harvesting contracts in past studies and documents. Those cases for the period extending from 1920 to 64 are plotted in Figure 2 which clearly shows that traditionally, the *hunusan* system was the common practice in the Coastal Region and that the *tilyadora* system was the common practice in Inner Central Luzon.

RECENT CHANGING PATTERNS FOR RICE HARVESTING

Major changes in harvesting arrangements occurred in Central Luzon and Laguna during the past decade. Our survey data for 1968 showed that a decade ago the regional distribution of harvesting arrangements by municipalities was essentially the same as that of the traditional pattern (Fig. 3). However, by 1978 an entirely different pattern had emerged (Fig. 4).

The most dramatic change was from the fixed-wage labor for harvesting to the output-sharing contract for both harvesting and threshing (*hunusan*). Together with this shift, mechanical threshing by use of *tilyadora* was replaced by the hand beating method. In 1968, 96% of farmers sampled in Inner Central Luzon used the *tilyadora*. However, the percentage declined sharply to 33% in 1978 (Table 2). Most of the farmers shifted completely to *hunusan* with hand threshing in both wet and dry seasons or adopted the new system partially, using it in the wet season and the traditional system in the dry season (mixture).

Another major change was the rapid diffusion of a new contractual arrangement called *gama* in the Coastal Region. *Gama* is an output-sharing arrangement similar to *hunusan*, except that employment for harvesting and threshing is limited to workers who weeded without receiving wages. In other words, in *gama* the weeding labor is a free service of workers to establish a right to participate in harvesting and threshing and to receive a certain share (usually one-sixth) of the harvest. In 1968, 83% of sample farms in the Coastal Region used *hunusan* the ratio declined to less than 50% by 1978 with the spread of *gama*. Although not documented in this study, the introduction of small mechanical threshers in the Coastal Region has been fairly rapid since 1976 often in conjunction with *gama*. The *gama* workers may contract with the owner of the small mechanical threshers or the farmers may pay cash for harvesting and contract separately for threshing. It appears that unlike the *tilyadora*, the new small threshers are compatible with *gama*.

Gama originated in Laguna province from a Tagalog word, *gamas*, meaning weeding. The same system is called *arkila* in Nueva Ecija, *tampa* in Pangasinan, *aguiagui* in Bicol, and *sagod* in Iloilo. A variation called *atorga* in Pampanga, is offering free pulling of seedlings to establish the right to be employed as harvesters. Another variation in Pangasinan is to give the harvesting right to workers who provided free service for transplanting. We group variations under *gama*.

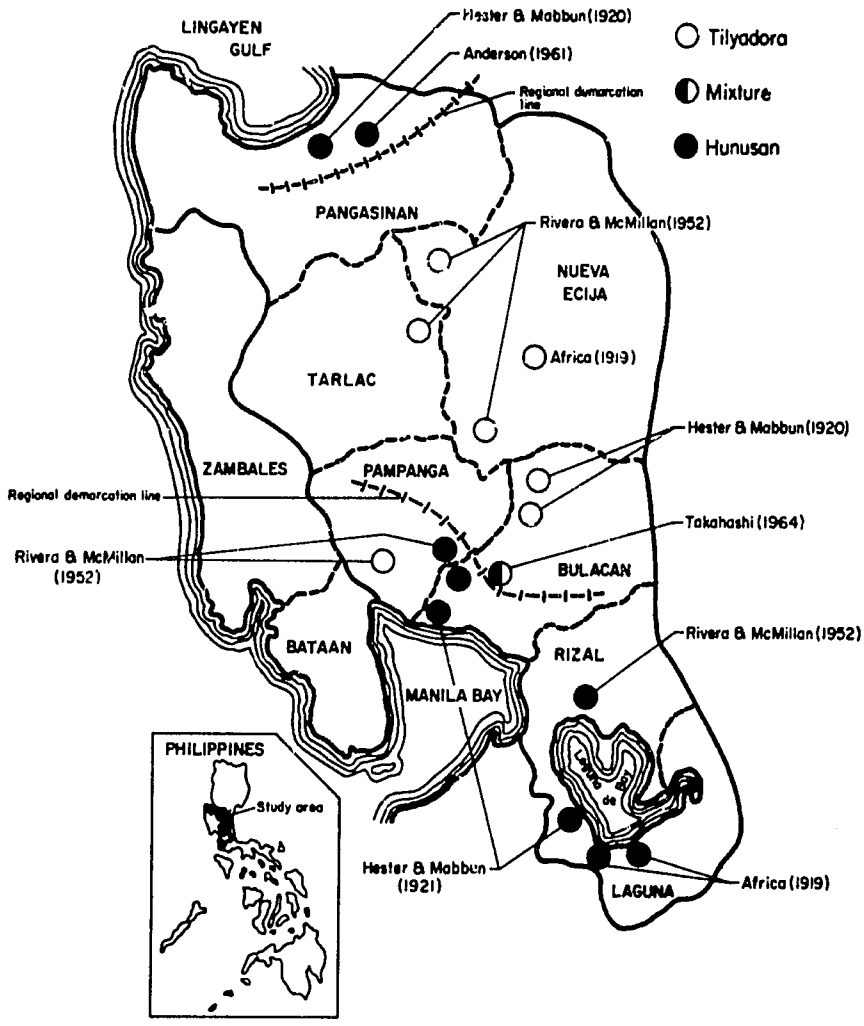

Fig. 2. Traditional pattern in the regional distribution of different harvesting systems, based on past studies. Note: The names of persons who conducted the surveys and the survey years are placed outside and inside the parentheses, respectively.

Diffusion of the new harvesting systems over time in both the Coastal Region and Inner Central Luzon shows in Table 3.

Shift from tilyadora to hand threshing

The shift from the *tilyadora* to *hunusan* was not uniform within Inner Central Luzon. The shift was most complete in the eastern part of the region, especially northern Bulacan and south-to-central Nueva Ecija, where *hunusan* was adopted by most farmers for both crop seasons (Fig. 4).

In the western part of Inner Central Luzon (southern Pangasinan, Tarlac, and northern Pampanga), the diffusion of *hunusan* was slower and partial in the sense that the new system was used for the wet season only.

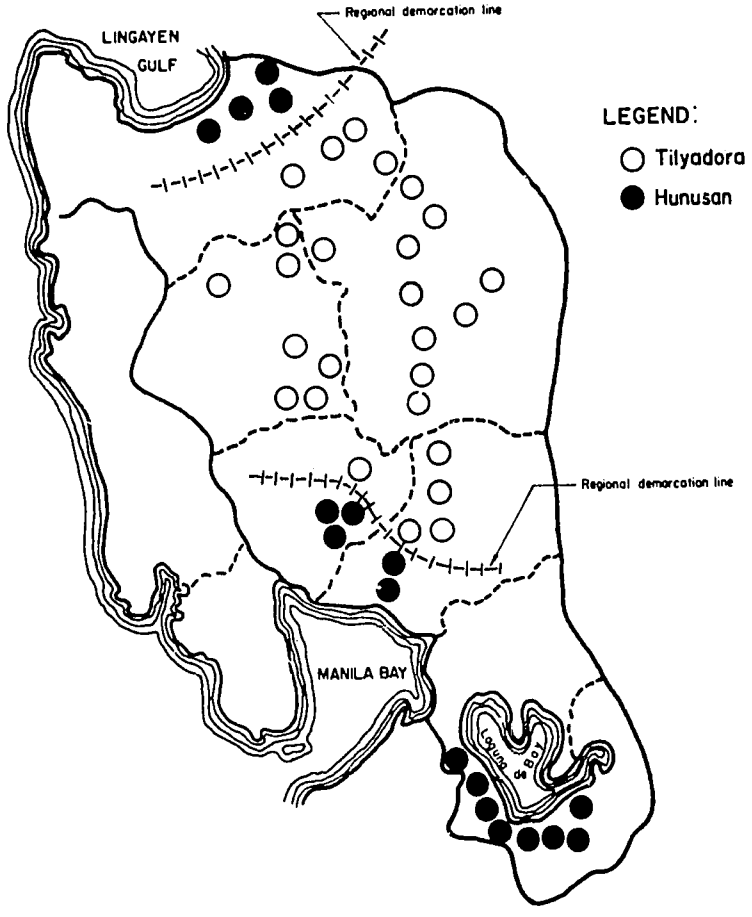

Fig. 3. Regional distribution of different harvesting systems commonly used by municipalities in the survey areas in 1968. Source: Appendix A.

Several socioeconomic factors underlay both rapidity and the regional difference of change in the harvesting system. The most basic condition for the shift in harvesting arrangements was land reform based on the Agricultural Land Reform Code of 1963 (revised in 1971) and enforced by Presidential Decree No. 27 after declaration of martial law.

Land reform resulted in the demise of rice haciendas. The share-tenants were converted to leaseholders or amortizing owners. With the land tenure reform, the critical role of the *tilyadora* for hacienda management as a device to ascertain tenants' outputs and to collect correct crop shares as rents was lost. The tenant became free to choose his harvesting method.

The emancipated farmers, especially in northern Bulacan and south-central Nueva Ecija where the large rice haciendas were most widely developed, quickly abandoned the *tilyadora* and adopted *hunusan*. Figure 5 compares the years of adoption of *hunusan* with the years of the tenure change. Almost

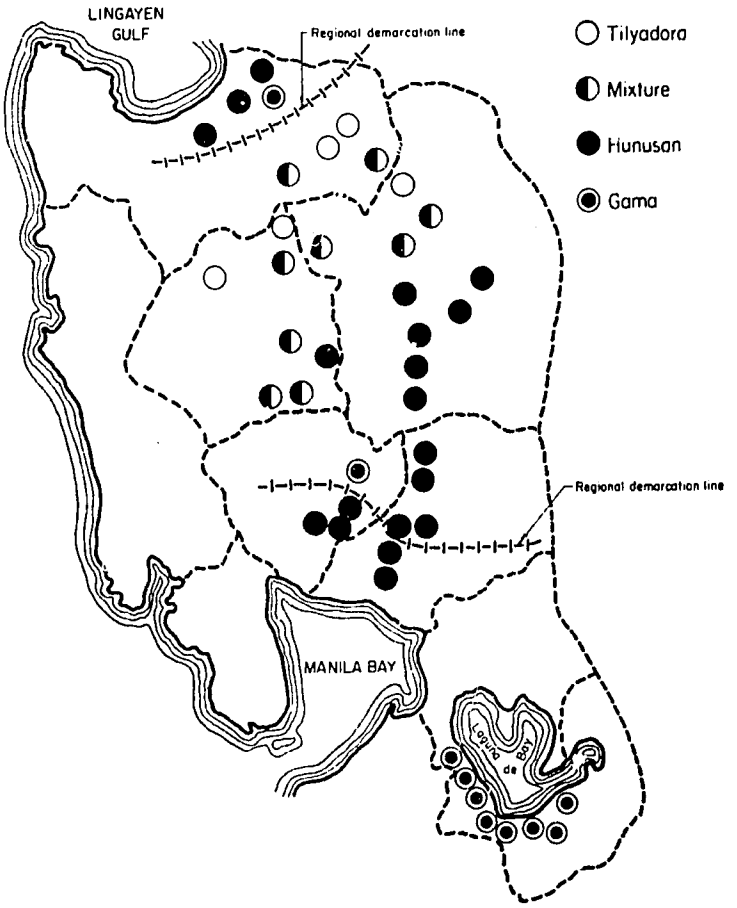

Fig. 4. Regional distribution of different harvesting systems commonly used by municipalities in the survey areas in 1978. Source: Appendix A.

all observations in our sample from northern Bulacan and south-central Nueva Ecija are located on the line, implying that most farmers shifted from *tilyadora* to *hunusan* in the year of their tenure change.

Sample observations from northern Nueva Ecija and Tarlac are located above the 45-degree line in Figure 4, indicating time lags in the shift from *tilyadora* to *hunusan*. A regression equation was estimated with the year of adoption of *hunusan* (H) as a dependent variable and with the year of tenure change (T) and regional dummies (D_n for northern Nueva Ecija and D_t for Tarlac) as independent variables. The least-square estimation with the 40-farmer sample for which data are available resulted in

$$H = \underset{(8.43)}{4.78} + \underset{(0.117)}{0.942T} + \underset{(0.587)}{1.614D_n} + \underset{(0.916)}{4.606D_t}, \quad R^2 = 0.683$$

where the figures inside the parentheses are the standard errors of the estimated parameters, and R^2 is the coefficient of determination.

Table 2. Changes in rice harvesting arrangements in Central Luzon and Laguna, Philippines, between 1968 and 1978.[a]

	Coastal Region		Inner Central Luzon		Total	
	No.	%	No.	%	No.	%
1968						
Tilyadora	0	0	68	96	68	72
Output-sharing system:						
Hunusan	20	83	3	4	23	24
Gama	4	17	0	0	4	4
Mixture	0	0	0	0	0	0
Total	24	100	71	100	95	100
1978						
Tilyadora	0	0	25	33	25	25
Output-sharing system:						
Hunusan	11	44	36	48	47	47
Gama	14	56	8	11	22	22
Mixture	0	0	6	8	6	6
Total	25	100	75	100	100	100

[a] In the *tilyadora* system, harvesting is done by hired labor with fixed wage (either *upahan* or *pakyaw*) and threshing is done by *tilyadora*. In the output-sharing system, harvesters get a percentage of total rice output as wage in kind. If a farmer adopts the output-sharing system in the wet season and the *tilyadora* in the dry season, he is classified under *mixture*. The total number of samples in 1968 is less than that in 1978 because five samples started farming after 1968.

Table 3. Changes in the number of adopters of *gama* and *hunusan* rice harvesting-threshing in Central Luzon and Laguna, Philippines, 1965-78.

	Adopters (no.)							
	Coastal Region				Inner Central Luzon			
	Gama	*Hunusan* for 2 seasons	*Hunusan* for wet season	Total	*Gama*	*Hunusan* for 2 seasons	*Hunusan* for wet season	Total
1965	3	13	8	24	0	1	0	1
1970	5	11	8	24	0	5	3	8
1975	12	8	5	25	6	15	14	35
1978	14	7	4	25	9	25	16	50

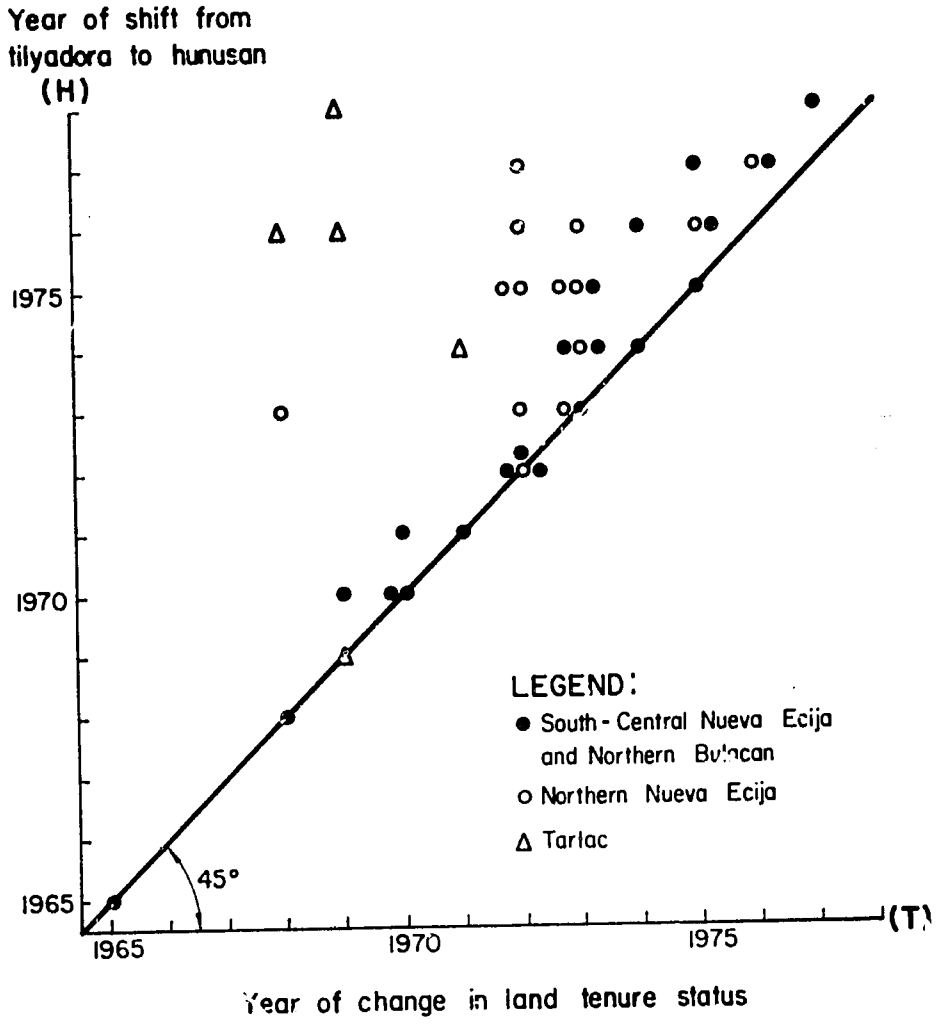

Fig. 5. Relation between the year of shift in the harvesting system to the year of change in land tenure status. Central Luzon, Philippines.

The results of the regression analysis show that the intercept is not significantly different from zero and T's coefficient is not significantly different from one at conventional levels of significance. The results support the hypothesis that the relation between H and T is the 45-degree line. In other words, the estimated relation between H and T implies that the shift from *tilyadora* to *hunusan* occurred as soon as the tenure status changed, except for regional time lags. The coefficients of D_n and D_t indicate that the shift in the harvesting system lagged behind the tenure change an average of 1.6 years for farmers in northern Nueva Ecija and 4.6 years for farmers in Tarlac.

The regional differences in the diffusion for Inner Central Luzon, as observed in Figures 4 and 5, and also identified by the regression analysis, seem to reflect the geographic route and direction in the

diffusion of *hunusan*. According to information gathered during our survey interviews, the concept of *hunusan* that diffused in Inner Central Luzon during the past decade came from Laguna and southern Bulacan.

The concept was diffused primarily through seasonal migrant workers. Most farmers interviewed said that the workers from the south who migrated to their farms at harvesting season, or the workers in their villages who returned from harvesting work in the south, asked the local farmers to adopt *hunusan*.

Because of the geographical affinity to the origin, the diffusion of *hunusan* first began in the eastern part of Inner Central Luzon and then moved north and west, as illustrated in Figure 6. It appears that the direct diffusion of *hunusan* from southern Pampanga to Tarlac was blocked by the sugarcane belt. The diffusion from the coastal area of Pangasinan southward was not significant, perhaps because of the lack of large-scale migration for harvest labor.

The speed with which farmers in Bulacan and Nueva Ecija shifted from *tilyadora* to *hunusan* after the land tenure change may be partly explained by the farmers' dislike of *tilyadora* as a symbol of the hacienda that exploited them. It must be recognized, however, that technological developments in rice production had made the use of *tilyadora* less efficient before land reform. First, during the 1960s the area under irrigation expanded greatly, especially in Nueva Ecija after construction of the Upper Pampanga River System. Second, in the late 1960s a dramatic diffusion of modern rice varieties began. Those two developments made the double-cropping of rice a common practice.

In the traditional single-cropping system, with traditional photoperiod-sensitive varieties, the rice crops matured after November when the day length was short and the rainy season had ended. Harvested crops were stored in the fields until *tilyadoras* arrived without the danger of spoilage. In the double-cropping system, however, the modern varieties mature before the end of the rainy season. Because the heavy *tilyadoras* cannot enter wet fields, the harvested crops must be hauled for a long distance to available dry spots. The risk of crop damage is also high because of possible delay in the arrival of the *tilyadora*.

Despite such conditions, the farmers were held to the *tilyadora* system by the haciendas. It seems reasonable to hypothesize that the accumulated frustration of farmers helped promote the immediate switch to hand threshing after land reform.

As a test of this hypothesis, we estimated a regression equation with the dependent variable as the time interval between the years of shift from *tilyadora* to hand threshing (H) and of change in the tenure status (T), and the independent variable as the time interval between T and the year of introduction of the rice double-cropping system (M). We expect that the longer the interval between T and M, the more clearly farmers can recognize the inefficiency of the *tilyadora* and, thereby, the shorter the interval between H and T.

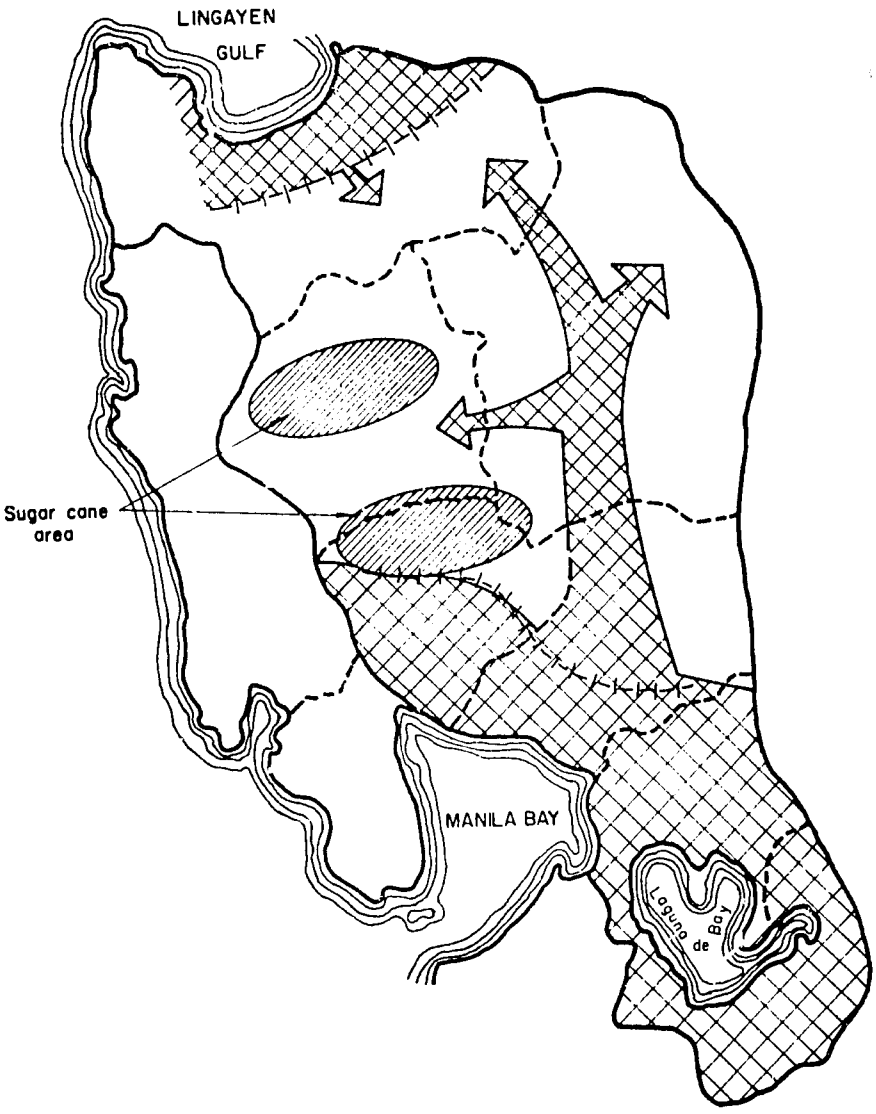

Fig. 6. The pattern of diffusion of *hunuban*. Central Luzon and Laguna province, Philippines.

The least-square estimation based on the 26-farmer sample for which data were available resulted in

$$(H - T) = \underset{(0.248)}{0.506} - \underset{(0.113)}{0.846}\ (T - M),\ R^2 = 0.573$$

where the figures in parentheses are the standard errors of the coefficients and R^2 is the coefficient of determination. The results are consistent with our hypothesis, showing the significant effect of the time interval between the tenure change and the introduction of double-cropping on reducing the time lag between the tenure change and the shift in the harvesting arrangement.

Shift from hunusan to gama

Although *hunusan* was newly adopted in Inner Central Luzon, it was replaced rapidly by the *gama* system in the Coastal Region. The shift from *hunusan* to *gama* was not uniform within the Coastal Region.

The shift was complete in Laguna province by 1978 but in other areas, *hunusan* is still a common practice.

Detailed analysis of some villages in Laguna province shows that *gama* can be considered an institutional innovation for reducing wage rates under the traditional *hunusan* (Kikuchi et al 1977, 1978). Earlier, when rice yields were low and labor was scarce, the one-sixth share of output under *hunusan* would have been the wage rate fairly close to the marginal productivity of labor for harvesting work. However, as the rice yield per hectare increased and the labor supply became more abundant, the one-sixth share has become substantially higher than the marginal productivity of labor.

In such a situation, farmers would increase their incomes by replacing *hunusan* by the labor of daily fixed-wage workers (*upahan*). However, it would cause substantial social friction to change such a long-established custom as *hunusan* in the village community. Also, although labor is normally abundant, there is a crop loss risk for an individual farmer who may not be able to find a sufficient number of daily-wage harvesters at the right time.

Gama is another way of reducing the wage rate, because the one-sixth share covers the costs of both weeding and harvesting. Besides, the availability of labor at harvest time is guaranteed by contract. For the employee, *gama* is more secure.

Because of its merits, *gama* developed and diffused rapidly in Laguna where the increase in rice yields was especially rapid because of better irrigation and earlier and more complete diffusion of modern rice technology. *Gama* seems to still be in an early stage of diffusion in southern Bulacan and Pampanga.

HARVESTING ARRANGEMENTS AND RURAL WELFARE

Because harvesting and threshing represent the major employment opportunity in rice monoculture areas, the choice of technology and contract for those tasks has critical effects on income distribution in the rural sector.

The dramatic changes in rice harvesting arrangements during the past decade reflect not only the choice of farmers but social interactions in communities, especially those among farmers and landless workers. A system was chosen not simply because it was more profitable for individual farmers but also because it was acceptable in terms of the social and institutional environments of the communities.

In the village where traditional customs often overrule formal laws and police forces, the cost of enforcing a labor contract could be high if the

contract was of a nature that violated the sense of fairness or justice based on the community principles of mutual help and income-sharing. In the village characterized by a high degree of social interaction, -- where one's utility function is not independent of others' -- the well-to-do farmers would prefer a contractual form that promoted the patron-client relationship with the poor. At least, the farmers would avoid the use of a contract that could create antagonism among the poorer members of the community.

Such considerations would have not been so important for powerful elites like the hacienda owners who lived outside the community and relied on legal means and police forces for the enforcement of contracts. However, for elites within a community, such as farmers who gained the status of leaseholders or amortizing owners by recent land reform, the choice of specific system of harvesting cannot be independent of the reaction of the landless workers in the same community.

It seems reasonable to hypothesize that the changes in harvesting arrangements of the past decade were based, to a significant extent, on the sense of obligation of the new, small elites in the rural communities to increase labor employment and thus maintain the income of the poor. Such consideration may be based partly on altruism, but is probably more strongly motivated by the village elite's desire to protect and promote their status.

To test the hypothesis, we compared the costs of harvesting and threshing for *tilyadora*, *hunusan*, and *gama* (Table 4). In the 1970 wet season, which was an early stage of a shift in the harvesting method, the costs for the *tilyadora* and for the *hunusan* with its output-sharing rate of one-sixth did not significantly differ. In the early stage of the diffusion of *hunusan* in Inner Central Luzon, the one-sixth share was brought in from the Coastal Region as part of the new system. But, probably because the system was new and had not been sanctified by tradition as in the Coastal Region, the share rates were allowed to decrease to one-seventh and to one-eighth in response to yield increases. As a result, despite the yield increase, the *hunusan* cost was at the same level as the *tilyadora* cost in 1978.

In our calculation, we could not incorporate such costs as crop damage in the wet season due to the late arrival of the *tilyadora*. Therefore, the advantage of *hunusan* over the *tilyadora* in the wet season might have been much larger than our calculation shows. However, it does not appear that *hunusan* had much advantage over the *tilyadora* in the dry season. It appears necessary to consider the social interactions within the community and the pressures from the landless to understand the introduction of *hunusan* at least for the dry season.

From Table 4, it is clear that the adoption of *gama* resulted in a large cost saving if the one-sixth share was maintained as was the case in Laguna province. But, if the share rate had been lowered to one-eighth, as in Inner Central Luzon, there would have been no merit for the Laguna farmers to adopt *gama*. The fact was that *gama* enabled the farmer employers to reduce hired wage rates without involving social frictions and to promote patron-client relationships with landless workers.

Table 4. The costs of harvesting and threshing for three systems.[a/] Central Luzon and Laguna province, Philippines, 1970-78.

	1970	1978	
	Wet season	Wet season	Dry season
Rice yield (t/ha)	2.20	3.08	3.52
Rice price (US$/t)	61.69	168.83	168.83
Tilyadora system			
Labor requirement for harvesting[b/] (days/ha)	20	24	24
Wage rates for harvesting[c/] (US$/day)	0.64	1.57	1.57
(1) Harvesting cost (US$/ha)	12.86	37.71	37.71
(2) Threshing cost[d/] (US$/ha)	6.86	26.00	29.71
(3) Total cost (US$/ha) = (1) + (2)	19.71	63.71	67.43
Hunusan system			
(4) Output share of 1/6 (US$/ha)	22.57	86.71	99.00
(5) Output share of 1/8 (US$/ha)	17.00	65.00	74.29
(4.1) (4) - (3)	2.86	23.00	31.57
(5.1) (5) - (3)	-2.71	1.29	6.86
Gama system			
Labor requirement for weeding (days/ha)	10	20	20
Wage rates for weeding[c/] (US$/ha)	0.43	1.14	1.14
(6) Imputed wage for weeding (US$/ha)	4.28	22.86	22.86
(7) Imputed costs for harvesting and threshing (US$/ha) = (4) - (6)	18.29	63.85	76.14
(7.1) (7) - (4)	-4.3	-22.80	-22.80
(7.2) (7) - (5)	1.29	-1.14	1.85

[a/] Converted at 1 cavan = 44 kg and ₱7.00 = US$1.00.

[b/] Includes labor for reaping, bundling, hauling and making mandala.

[c/] Includes food served to workers.

[d/] Assumes the *tilyadora* threshing fee of 5 kg/100 kg threshed. The fee includes wages for machine operators.

Possible effects of the choice of harvesting system on income distribution in the community are demonstrated in Table 5. With *tilyadora*, about 30% of the total harvesting and threshing cost is paid to capital (machine) and about 70% to labor. With the adoption of *hunusan* for the wet season alone, the share of labor increases to more than 80%; with the adoption of *hunusan* for two seasons the share goes up to 100%.

An equally important effect is the change in the composition of labor's share. With the *tilyadora*, family labor is commonly used for bundling and *mandala* making, and machine operators' labor is required; thus only 40% of the total cost becomes the earning of hired workers. But with *hunusan* the whole cost becomes the earning of hired harvesters. Because most harvesters belong to the landless class -- the lowest income class in the community -- the shift from the *tilyadora* to *hunusan* would have the effect of increasing the equity of income distribution in the rural sector.

Table 5. The shares of labor and capital in the costs of harvesting and threshing at 1978 prices.[a] Central Luzon and Laguna province, Philippines.

	Costs (US$/ha per year)		
	Tilyadona	*Mixture*[c]	*Hunusan*
Labor:			
Family	25 (19)[b]	13 (9)	0 (0)
Hired	50 (38)	90 (68)	139 (100)
Machine operators	13 (10)	7 (6)	0 (0)
Total	88 (67)	110 (83)	139 (100)
Capital	43 (33)	23 (17)	0 (0)
Total	131 (100)	133 (100)	139 (100)

[a] Converted at ₱7.00 = US$1.00.

[b] Figures inside the parentheses are percentages.
The assumptions made in the computation follow:
1) Farmers grow two crops of rice in a year.
2) Yield: 3.08 tons/ha for wet season; 3.52 tons/ha for dry season.
3) Labor requirement for harvesting activities:
reaping = 16 days/ha (hired)
bundling, hauling and making *mandala* = 8 days/ha (family and exchange labor) for both wet and dry seasons.
4) Wage rate for the harvesting activities: US$1.57/day.
5) Price of rice: US$168.83/ton.
6) Rental rate for threshing machine: 220 kg/4400 kg threshed.
7) Wage rate for threshing machine operators US$ 8.57/4400 kg threshed.
8) Harvesters' share for *hunusan*: 1/8.

[c] Assume *hunusan* for wet season and *tilyadona* for dry season.

In an economy where population pressure on limited land resources increases the number of landless agricultural workers and decreases their wage rates, a *regressive* shift from the large machine system to the manual system in rice harvesting and threshing can be considered a blessing in terms of social equity and justice. In addition, considering the fact that the labor of landless workers has a much lower opportunity cost than machine capital, the shift to *hunusan* will produce a net social gain; however, several technical aspects, such as the grain recovery rate, should be examined further.

It must be remembered that the basic factor underlying the change was the dissolution of the *hacienda* by land reform. Despite all criticisms on the shortcomings of the land reform program in the Philippines, the dissolution of *haciendas* and the conversion of *kasama* sharecroppers into leaseholders and amortizing owners have benefited not only the direct beneficiaries but, also the landless workers through a *regressive* shift in the harvesting system. The improvement in irrigation systems and the development and diffusion of modern rice varieties have prepared the technical conditions for the change. Further technical innovation, in the form of a small, low-capital-cost mini-thresher, may result in further changes in the harvesting institutions if such equipment is widely adopted.

It is important to recognize that the new systems represent an institutional innovation based on the indigenous organizational principles of the rural community. That suggests strongly that the effective design of rural development to promote social equity and stability should begin with the study of organizational principles at the grassroots.

REFERENCES CITED

Africa, A. A. 1920. A preliminary survey of the comparative costs of different methods of harvesting rice. Philipp. Agric. 8: 8-9.

Anderson, J. A. 1964. Land and society in a Pangasinan society. Pages 171-193 in S. C. Espiritu and C. L. Hunt, eds. Social foundations of community development. R. M. Garcia Publishing Co., Manila.

Cheung, S. N. S. 1969. Transaction costs, risk aversion, and the choice of contractual arrangements. J. Law Econ. 12: 23-42.

Dalisay, A. M. 1937. Types of tenancy contracts on rice farms of Nueva Ecija. Philipp. Agric. 26 (2): 159-198.

Hayami, Y., and V. W. Ruttan. 1971. Agricultural development: an international perspective. Johns Hopkins University Press, Baltimore and London.

Hayami, Y. M. Kikuchi, P. F. Moya, L. M. Bambo, and E. B. Marciano. 1978. Anatomy of a peasant economy. International Rice Research Institute, Los Baños, Philippines.

Hester, E. D., and P. Mabbun. 1924. Some economic and social aspects of Philippine tenancies. Philipp. Agric. 12 (9): 367-444.

Kikuchi, M., L. M. Bambo, and Y. Hayami. 1977. Evolution of land tenure system in a Laguna village. Agricultural Economics Dep. Pap. 77-11. International Rice Research Institute, Los Baños, Philippines.

Kikuchi, M., N. Fortuna, L. M. Bambo, and Y. Hayami. 1978. Polarization of a Laguna village. Paper presented at the Workshop on Village-Level Studies at the International Rice Research Institute, 17-18 March, 1978.

Larkin, J. 1972. The Pampangans: colonial society in a Philippine province. University of California Press, Berkeley, Los Angeles, and London.

McLennan, M. S. 1969. Land and tenancy in the Central Luzon Plain. Philipp. stud. 17 (4): 651-682.

Pelzer, K. J. 1945. Pioneer settlement in the Asiatic tropics. American Geographical Society, New York.

Rivera, G. E., and R. T. McMillan. 1954. An economic and social survey of rural households in Central Luzon. Cooperative Research Project of the Philippine Council for United States Aid and the United States of America Operations Mission to the Philippines, Manila.

Scott, J. C. 1976. The moral economy of peasant: revellion and subsistence in Southeast Asia. Yale University Press, New Haven, Conn.

Umehara, H. 1974. A hacienda barrio in Central Luzon: a case study of Philippine village. The Institute of Developing Economies, Tokyo.

Appendix A_1. Number of adopters of different harvesting systems in the samples, by municipality.

	Sample size	Adopters[a/] (no.)							
		1968				1978			
		T	M	H	G	T	M	H	G
Nueva Ecija									
Lupao	3	3				3			
San Jose City	6	6				3		2	1
Nampicuan	1	1					1		
Muñoz	6	6				1		5	
Bongabon	1	1						1	
Palayan City	1	1						1	
Talavera	5	5						5	
Cabanatuan City	6	5		1				5	1
San Leonardo	5	5						3	2
Gapan	5	3		1			1	3	1
Total	39	36		2		7	2	25	5
Bulacan									
San Miguel	5	5						3	2
San Ildefonso	1	1						1	
San Rafael	1			1				1	
Pulilan	1	1						1	
Plaridel	1			1				1	
Guiguinto	2			1				2	
Total	11	7		3				9	2
Pampanga									
Sta. Ana	1	1							1
San Simeon	1			1				1	
Minalin	1			1				1	
Apalit	4			4				3	1
Total	7	1		6				5	2

(continued on next page)

Appendix A continued

	Sample size	Adopters[a/] (no.)							
		1968				1978			
		T	M	H	G	T	M	H	G
Pangasinan									
Sison	1			1				1	
Pozorrubio	2			1	1				2
Calasiao	1			1				1	
San Jacinto	1			1				1	
Sta. Maria	1	1				1			
Tayug	3	2				3			
Villasis	1	1					1		
Umingan	3	3				2		1	
Total	13	7		4	1	6	1	4	2
Tarlac									
San Manuel	2	2				2			
Moncada	4	2				3		1	
Mayantoc	6	6				6			
Tarlac	3	3				1	1	1	
La Paz	1	1						1	
Capas	2	2					1	1	
Concepcion	1	1					1		
Total	19	17				12	3	4	
Laguna									
San Pedro	1				1				1
Biñan	3			3				3	
Cabuyao	1			1					1
Calamba	2			2					2
Los Baños	1			1					1
Bay	1				1				1
Calauan	1			1					1
Pila	1				1				1
Total	11			8	3				11

[a/] T = tilyadora, M = mixture, H = hunusan, G = gama.

Other papers in this series

No. 1 Recent studies on the rice tungro disease at IRRI

No. 2 Specific soil chemical characteristics for rice production in Asia

No. 3 Biological nitrogen fixation in paddy field studies by in situ acetylene-reduction assays

No. 4 Transmission of rice tungro virus at various temperatures: A transitory virus-vector interaction

No. 5 Physicochemical properties of submerged soils in relation to fertility

No. 6 Screening rice for tolerance to mineral stresses

No. 7 Multi-site tests environments and breeding strategies for new rice technology

No. 8 Behavior of minor elements in paddy soils

No. 9 Zinc deficiency in rice: A review of research at the International Rice Research Institute

No. 10 Genetic and sociologic aspects of rice breeding in India

No. 11 Utilization of the Azolla-Anabaena complex as a nitrogen fertilizer for rice

No. 12 Scientific communication among rice breeders in 10 Asian nations

No. 13 Rice breeders in Asia: A 10-country survey of their backgrounds, attitudes, and use of genetic materials

No. 14 Drought and rice improvement in perspective

No. 15 Risk and uncertainty as factors in crop improvement research

No. 16 Rice ragged stunt disease in the Philippines

No. 17 Residues of carbofuran applied as a systemic insecticide in irrigated wetland rice: Implications for insect control

No. 18 Diffusion and adoption of genetic materials among rice breeding programs in Asia

No. 19 Methods of screening rices for varietal resistance to *Cercospora* leaf spot

No. 20 Tropical climate and its influence on rice

No. 21 Sulfur nutrition of wetland rice

No. 22 Land preparation and crop establishment for rainfed and lowland rice

No. 23 Genetic interrelationships of improved rice varieties in Asia

No. 24 Barriers to efficient capital investment in Asian agriculture

No. 25 Barriers to increased rice production in eastern India

No. 26 Rainfed lowland rice as a research priority – an economist's view

No. 27 Rice leaf folder: Mass rearing and a proposal for screening for varietal resistance in the greenhouse

No. 28 Measuring the economic benefits of new technologies to small rice farmers

No. 29 An analysis of the labor-intensive continuous rice production system at IRRI

No. 30 Biological constraints to farmers' rice yields in three Philippine provinces

The International Rice Research Institute
P.O. Box 933, Manila, Philippines

Stamp

ISSN 0115-3862