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ALIWALAS TO RICE GARDEN: A CASE STUDY OF THE INTENSIFICATION OF RICE FARMING IN CAMARINES SUR, PHILIPPINES

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ABSTRACT

Frustration with the failure to achieve national development goals, caused by population growth rates exceeding those of food production, promotes the idea that agriculture in developing countries is static. Close examination often shows exactly the opposite, however. Population growth, technological change, irrigation investments, and land reform are dynamic introductions that have all but eliminated *traditional agriculture* in the lowland rice areas of Asia. Land reform encourages farmers to become more intensive; modern technology and irrigation permit them to grow rice year around. But the learning process as farmers adapt to these changes takes time.

In the Philippines' Bicol region (the southern extreme of Luzon), the traditional system of rice cultivation called *aliwalas* involved little effort. Rice was transplanted and harvested with little farmwork activity between. After land reform and technological change, some farmers began to intensify their production systems. This case study traces the intensification process for one farmer who began with the *aliwalas* system in the 1950s and was growing rice continuously by the 1970s. He now employs about twice as much labor as most conventional rice farmers and generates an annual net income of more than ₱7,000 (US$950)/ha.

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A limited area of land and a seasonal or year-round surplus of labor are basic problems in many Asian countries. Many economists suggest intensified use of labor in farming to alleviate these problems. Intensification offers an effective means of enlarging a farm business that has limited land resources. However, the technology to fully utilize the available land and labor resources that would increase total output per person and per unit of land, reduce unit cost of production, and diversify income sources is needed.

The continuous rice production system -- the rice garden -- tested by IRRI is one method of intensifying rice farming (Morooka et al 1979). The system offers several advantages:

- seasonal labor peaks are dispersed into constant year-round labor use that generates employment opportunities throughout the year;
- risk of insect attacks or typhoon damage is minimized because rice in each plot is in a different stage of growth; and
- the continuous flow of cash from weekly sales allows the farmer to finance the farm operation himself and eliminates the need for financing.

On the other hand, the continuous production system has rather stringent requirements for successful implementation.

- Control over a dependable year-round water supply is essential.
- Rice in all stages of growth in a small area, and the continued use of insecticides, may bring about insect resistance to insecticides quicker than in other less intensive systems.
- A high degree of management ability is needed.

Rice farmers may also face resistance from laborers or neighbors if they try to modify their rice farming to use the continuous system.

This report examines how one farmer settled the difficulties involved in adopting the system and the management problems remaining on his farm. The case study farmer with the continuous rice production system is contrasted with two neighboring farmers using less intensive systems.

The study area

The continuous rice production system can be used only on farms with water supplied throughout the year. Camarines Sur province, Bicol region, was selected as the research area because it is characterized by the absence of a definite dry season. Rainfall is relatively abundant, typhoons often hit the area, and there are many small-scale irrigation dams. Farmers grow rice as well as corn, banana, sugar cane, coconut, and other crops. The Ministry of Agrarian Reform has sponsored intensive rice farming projects with the objective of providing year-round employment to about 30 cooperating farmers in the province.

Selection of study farms

Three farmers in one village were selected for our study. The village has a private gravity irrigation system, which was mainly constructed by village farmers. Water is available throughout the year, so the timing of planting varies among farmers in the village depending on the availability of labor, field conditions, and farmers' preferences. This is further complicated by use of early- , medium- , and late-maturing rice varieties.

Farmers' systems of planting were classified as *staggered* planting, in which the planting date differs for each plot or block, and *simultaneous* planting in which a farmer's whole paddy area is planted within a few days. The former is increasing in popularity but the latter is still predominant among Camarines Sur farmers. Three farmers in our study village were selected for the study. Farmers A and C practiced staggered planting and Farmer B did simultaneous planting (Fig. 1). Characteristics of the three farms are summarized in Table 1.

Farmer A was the only farmer in the village using the continuous rice production system with weekly planting and harvesting. He had kept farm records on the dates, amount of seeds, number of applications, amounts of fertilizers and chemicals, expenses for hired labor, and yield by crop season and by plot since 1973. His records were relatively accurate, but information on current inputs (seeds, fertilizers, herbicides, and insecticides) was not complete and had to be obtained by interview. His use of family labor and hired labor was not always clear so it also was clarified.

Farm B is adjacent to Farm A. Farmer B's application of current inputs was lower than Farmer A's and almost all tasks were done by hired labor under traditional labor arrangements. Farmer B was typical of many rice farmers in the village.

Farm C was a short distance from the other two farms. Farming was difficult for him because the depth of soil differed among his 15 plots and 1 block was easily flooded by heavy rains. To manage each plot carefully, Farmer C divided his farm into 4 blocks

and planted each 7-10 days after the previous block. Like Farmer B he cultivated his farm with simple equipment but used current inputs at a higher and relatively more constant level than Farmer B.

Survey period

To collect basic data on farm management, the three farms were surveyed periodically from 1 July 1977 to 30 September 1978. Figure 1 shows the cropping pattern in the farms. We visited the 3 farmers about every 45 days. In addition, the senior author stayed at Farmer A's house for 3 months to get detailed information on labor utilization.

INTENSIFICATION OF RICE FARMING ON FARM A

In the early 1950s, Farmer A was a share tenant with 1 ha of wetland rice. His water supply was not adequate to assure a good crop, even during the wet season. He planted late-maturing rice varieties only once a year. Cultivation on his farm was by an extensive method called *aliwalas*. Land preparation was by carabaos rented from other farmers. Weeds were controlled by hand under a contract labor arrangement. No fertilizer was used and insect control was unknown. Rats were controlled by inserting several bands of *tagbak*, a rank-smelling grass, between rows and hills.

The *aliwalas* system has decreased gradually with the diffusion of various advanced technologies but several farmers still adopt it. The average rice yield with *aliwalas* is estimated at 0.4-1.5 t/ha. Yield levels depend mainly on the weather.

Aside from working in the field, *aliwalas* farmers work on coconut farms within the areas or as temporary workers in constructing irrigation systems for extra income.

Intensification during the 1960s and 1970s

Double cropping in the village started in the early 1960s. Wetland rice was planted in the early part of June but sometimes as late as September. A second crop was planted a few weeks after the first crop was harvested. The yield was 0.8-2.2 t/ha. The rather low yield was attributed to poor methods of preparing the land, traditional rice seeds, and lack of appropriate water control. The standard wetland varieties grown were Ramelon, Milagrosa, Raminad, and the BPI

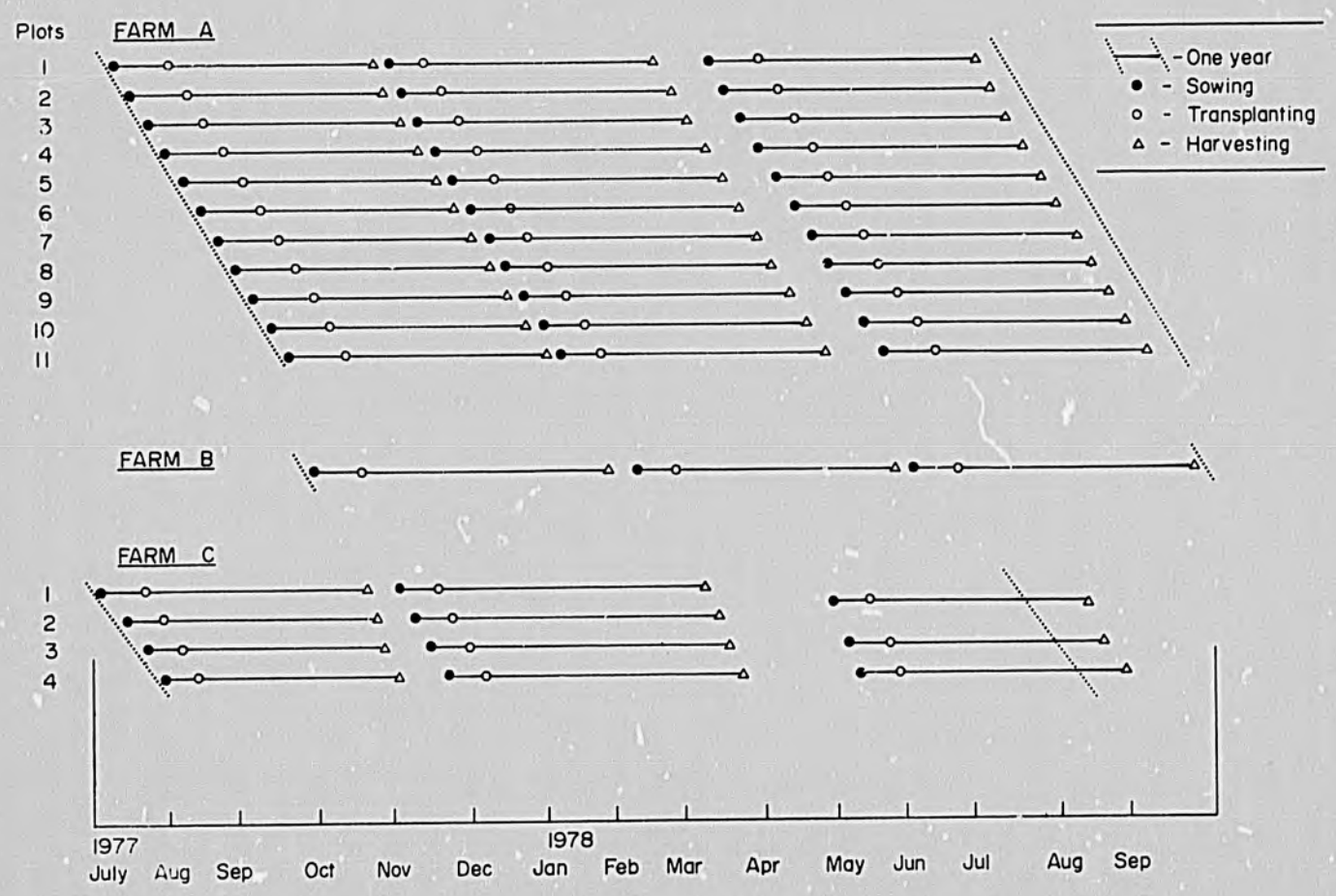

Fig. 1. Cropping patterns on the three case study farms, Camarines Sur, Philippines.

Table 1. Profiles of three rice farms in a study of a continuous rice production system, Camarines Sur, Philippines, 1978.

	Farm A	Farm B	Farm C
Similarities			
Status	Amortizing owner		
Irrigation	Gravity		
Cultivation method			
Seedbed	Semi-dapog		
Transplanting and harvesting	1/8		
Dissimilarities			
Age of operator	50+	40+	30+
Children (no.)	8	7	2
Area (ha)	2.5	1	1
Blocks	2	1	4
Plots	11	13	15
Soils			
pH	6.2	6.2	5.9
EC	0.15	0.08	0.12
CEC	17.5	14.5	14.0
Available P	10.8	3.8	2.9
Organic C	2.7	1.8	2.3
C-N ratio	11.3	9.7	10.0
Production system	Three crops a year Staggered (weekly)	Simultaneous	Five crops in 2 years; Staggered
Varieties	IR36	IR36	IR36 and C12
Weeding	Herbicides	Rotary weeding by hired labor	Rotary weeding by operator
Yield (t/ha per crop)	5.0	3.4	4.1
Machine owned	Power tiller	None	None
Equipment owned	Sprayer	Sprayer	Rotary weeders

series. A few rice farmers used a half to one bag (50 kg) of urea/ha as a basal fertilizer. Modern varieties became available late in the 1960s.

In 1972, an agrarian reform program was extended to cover all tenanted rice and corn land. Farmer A received his certificate of land transfer as an amortizing owner in 1973. According to a yield survey to determine a provisional leasehold rental by the Ministry of Agrarian Reform, the 1968-71 average rice yield in the village was 1.5 t/ha during the wet season and 1.6 t/ha during the dry season. IR and C series rice varieties were popular among farmers.

Yields of Farmer A increased gradually from 1.3 t/ha in 1970 to about 2.5 t/ha in 1973. He began his farm-record keeping in September 1973. Figure 2 shows changes in his 1973-78 land use and yields by crop season based on his records. Yields further increased from 2.5 t/ha to nearly 6 t/ha in 1976. The increase was due to proper land preparation, newly developed varieties, chemical weed control, and increased fertilizer application. In the 1976 dry season, farmer A's rice yield increased to 5.9 t/ha, the highest recorded.

Seasonality of labor utilization

Farmer A produced relatively high yields of rice with his staggered system of planting during 1975 and 1976. However, the foremost management problem was the seasonality of labor use on his farm. With the diffusion of the idea of double cropping and using early-maturing varieties, competition for hired labor frequently occurred among farmers because labor intensive practices such as land preparation, transplanting, weeding, and harvesting came at the same time. This competition was particularly serious when many farmers need to replant, repair dikes, or harvest rapidly after a typhoon. Besides, it was hard for Farmer A to work one entire block at a time because the fields were far from his house (Fig. 3). Rice hauling and drying particularly required a lot of time and workers preferred to work for farmers closer to the village.

Land preparation. At first, Farmer A tried to reduce labor intensity for land preparation by using a 7-hp tiller, which he bought for ₱3,800[2] in 1972 using farm profits from the previous year. The tiller reduced time used for land preparation but it was used in combination with carabao. The tiller frequently did the initial plowing and the carabao, the final harrowing. (Many farmers consider the

[2] ₱7.35 equals about US$1.00.

carabao superior to a power tiller for final harrowing and land leveling.)

Weeding. In the region, the common weeding labor contract is popularly called *agui-agui*, an arrangement in which laborers weed without immediate payment in exchange for the right to join in the harvesting and threshing operation and receive a harvester's share of output. The *agui-agui* arrangement is the same as *gama* in Laguna province (Kikuchi 1978) and *aagod* in Iloilo province (Ledesma 1978).

In the early 1970s, weeding on Farm A was done under *agui-agui* but it was troublesome for the farmer to segment his paddy field for the many laborers who wanted to participate. Eleven plots were too few for the number of laborers and plots of 1,500 to 3,000 m^2 were too large for 1 family. Depending on the number of families or participants, Farmer A had to provide a portion for each *agui-agui* laborer by counting the rows in each plot. In addition, the techniques of rotary weeding were not uniform among them. Some weeded carefully but some were careless. Farmer A worried about yield reduction because of different weeding practices.

The most troublesome problem occurred when some of the *agui-agui* laborers could not harvest on the appointed days. When that happened, substitutes called *upahan* laborers usually harvested. However, the arrangement was not always smooth. In general, when *agui-agui* laborers did not appear to harvest on the appointed day, the farmer waited 2 to 3 days before allowing the *upahan* workers to harvest the plot. Although this was the custom among rice farmers in the village, trouble still remained between farmers and *agui-agui* workers who believed they should retain the right to harvest.

Weed control became possible with much reduced labor input with low-cost chemicals that effectively control as much as 90% of the weeds. Instead of *agui-agui*, Farmer A began using herbicides.

Adaptation of the continuous rice production system

Farmer A began a continuous rice production system on his farm in September 1976. He got the idea from a newspaper report of a daily planting and harvesting system on Lorenzo P. Jose's farm in Pampanga province, which reported that 1.5 ha could produce 43.2 t/year or 28.8 t/ha per year. That was equivalent to the combined production of 18 ha of land as cultivated by an average Filipino farmer (Ranit and Drilon 1977).

Farmer A modified two points of the system based on his own ideas. One was to maintain normal production methods and depend on hired labor as is common on rice farms in the Philippines. Customarily, 60-80%

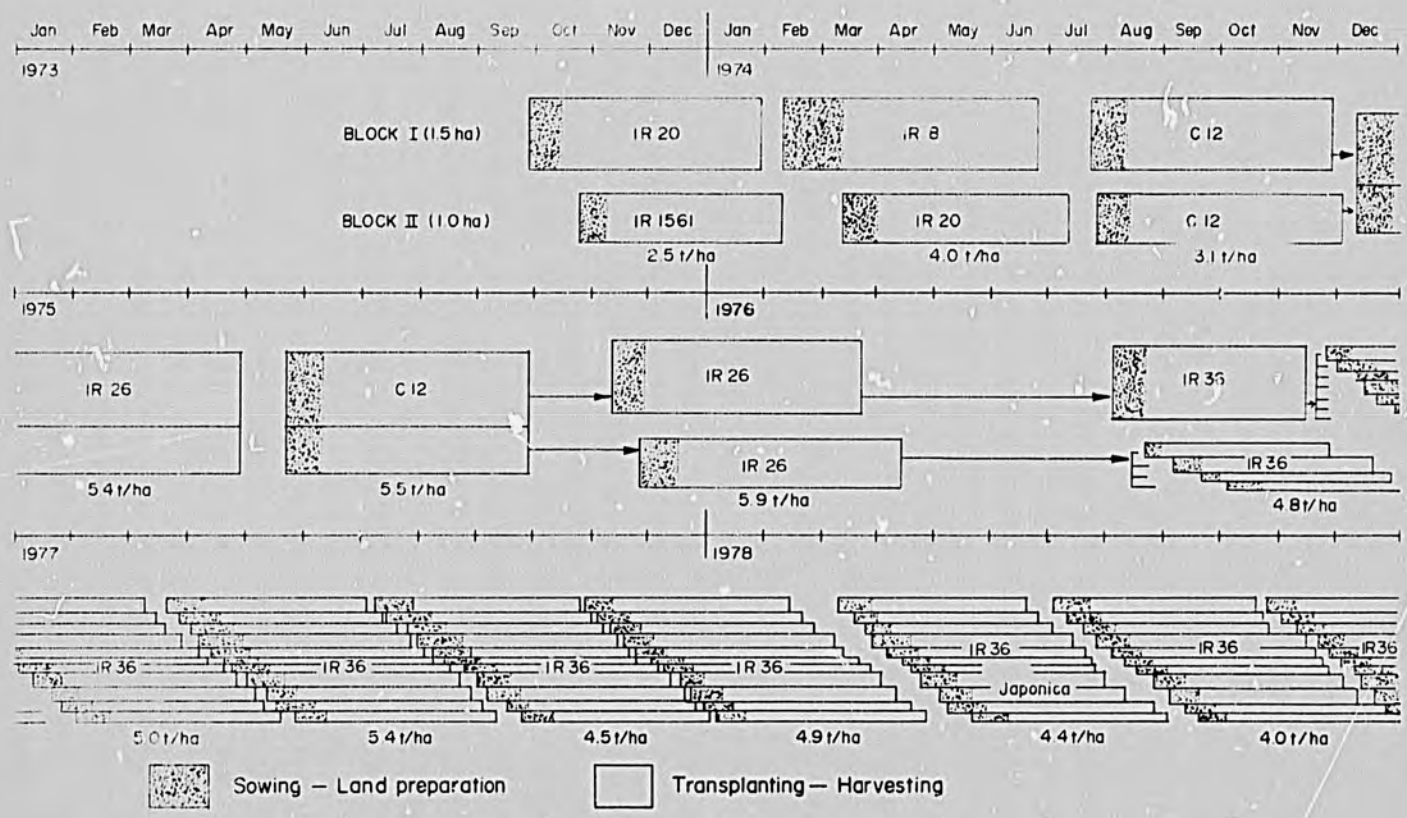

Fig. 2. Changes in land utilization on Farm A, 1973-1978.

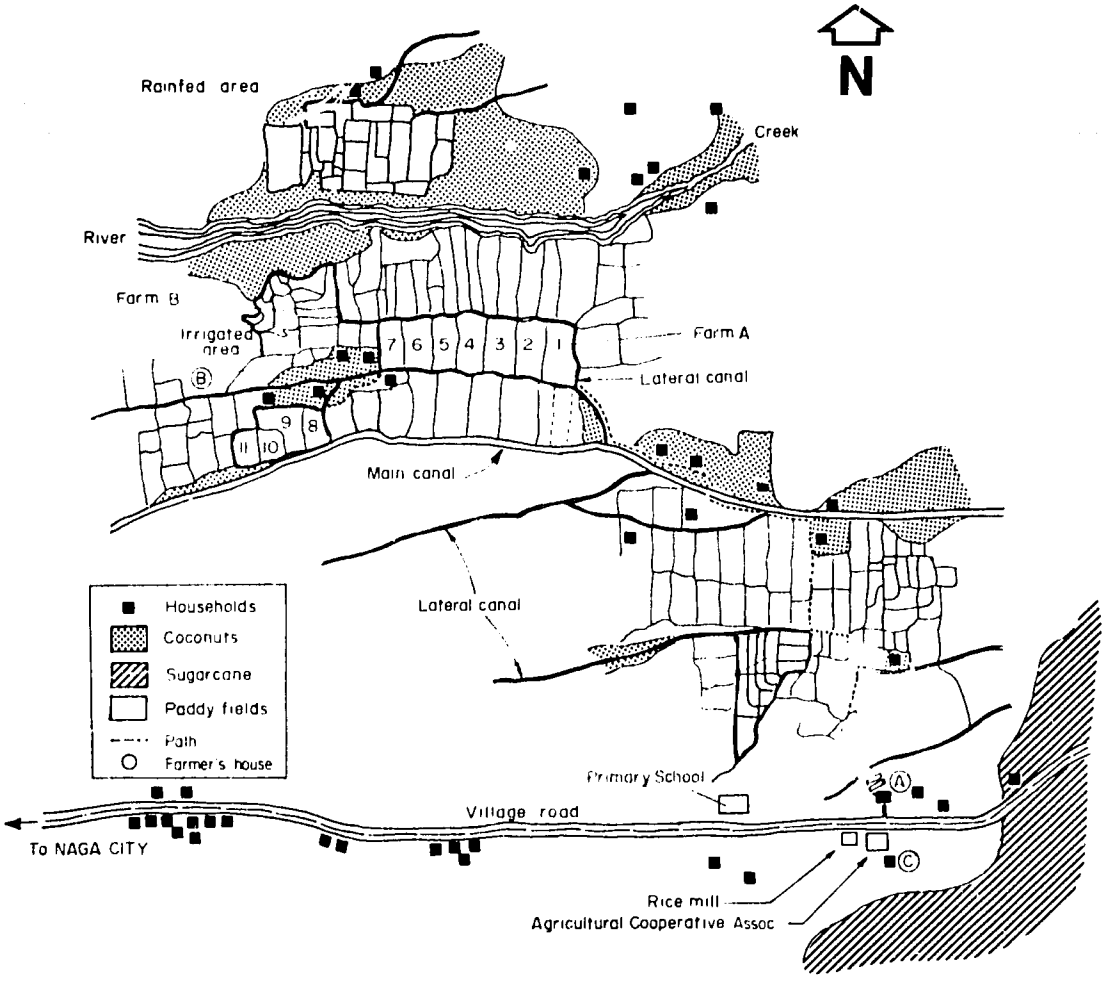

Fig. 3. Setting of Farm A, the continuous rice production farm, showing the 11 separate plots.

of the total labor inputs are contributed by hired labor. Farmer A believed that the maximum use of family labor, as on Jose's farm, was not always practical. The second modification was to leave the number of plots unchanged. The complicated crop schedule that would result from segmenting the field into many small plots worried him.

Farmer A aimed to stabilize yields per hectare rather than maximize them. His yield goal was to achieve 4.5-5.3 t/ha per crop throughout the year.

IR36 was selected for the continuous rice production system because it was popular among farmers as a disease- and insect-resistant variety. It matures 110 days after sowing or about 90 days after transplanting. Thirteen plots would be necessary for a 4-crop continuous production system with IR36 transplanted weekly.

Farmer A considered the problems that might arise with the continuous cropping system, based on his long experience. One of the most important problems was how to maintain soil fertility, which he thought might be reduced by continuous land utilization. Therefore, he decided to cultivate rice 3 times a year under a weekly transplanting and harvesting system to fallow each plot for about 1 month after harvesting. According to his initial plan, each plot was transplanted in a different week. Seedlings were raised by a semi-dapog method on a portion of a recently harvested plot. Land preparation (plowing and harrowing) was done in the 3 weeks between sowing the seedbed and transplanting.

Using this new production system, Farmer A tried to distribute the seasonal peaks of labor from transplanting and harvesting, and at the same time, generate employment opportunities throughout the year.

LABOR UTILIZATION ON THREE FARMS

Labor arrangements differed considerably among the three farms.

Farm A

To maintain an appropriate number of hired laborers for transplanting and harvesting, Farmer A made an arrangement in which regular transplanters got the right to participate in harvesting and threshing, and to receive a one-eighth share of the harvest. The arrangement was similar to the *agui-agui* system except that Farmer A paid cash to workers for transplanting, in addition to the harvester's share.

Fifteen workers' families expressed interest in participating in this new labor arrangement (Table 2). After a discussion between them and Farmer A, the weekly transplanting and harvesting production system started in December 1976. Saturday was selected as the regular day for transplanting, and Monday for harvesting.

Transplanting. In the experimental IRRI continuous rice garden system, labor input for transplanting on 1,000-m^2 plots, excluding the pulling of seedlings, was 200 hours/ha by 4 workers. Actual working hours per plot per worker was about 1.7 for 250-m^2 plots and 6 for 1,000-m^2 plots. With the same recording method, labor input for transplanting on Farm A was 283 hours/ha (Table 3). With 25 workers, which included temporary workers, actual working hours was about 3 hours/workers per lot.

Wages for transplanting were contracted at ₱3/worker for 5 hours (0700-1200). Most farmers in the village

Table 2. Profile of regular workers for transplanting and harvesting on Farm A.

Household no.	Age	Education[a]	Children (no.)	Transplanters and harvesters[b]	Status[c]
1	40+	HS	8	Wife and 2 daughters (Daughter and son)	PL
2	40+	HS	7	Wife and daughter (Daughter, sons, and relative)	PL
3	50+	ES	9	Wife and daughter (Acquaintance)	PL
4	40+	ES	6	Wife and daughter (Husband)	PL
5	60+	-	-	The worker himself (relative)	LW
6	30+	ES	6	Wife (relatives)	AO
7	40+	ES	7	Daughter (sons)	AO
8	40+	ES	4	Wife	PL
11[d]	30+	ES	2	Wife (relatives)	PL
12	40+	ES	6	Wife (husband)	AO
13	20+	ES	1	Wife (husband and relatives)	AO
14	40+	ES	4	Wife (daughter)	AO
15	40+	ES	8	Wife (daughter and husband)	LW
16	30+	C	3	Wife (son and relatives)	LW
17	30+	ES	5	Wife (husband)	PL

[a]HS = high school, ES = elementary school, C = college. [b]Parentheses indicate substitutes who participated in transplanting and harvesting practices. [c]PL = permanent lessee, AO - amortizing owner, LW = landless worker. [d]Households 9 and 10 did not participate in both practices during the last two crop seasons because of family affairs.

Table 3. Family and hired labor input (hours/ha) by activity on three rice farms, June-September 1978.

Activity	Family and hired labor input		
	Farm A	Farm B	Farm C
Land preparation	84	55	80
Seedbed preparation	51	36	43
Transplanting	283	238	253
Fertilizing	18	3	10
Insect control	10	2	8
Weed control	22[a]	105[b]	61[c]
Irrigation	94	22	53
Harvesting	316	231	281
Miscellaneous[d]	150	60	90
Total (hours)	1026	752	879
(days)	129	94	110

[a]Application of herbicides. [b]Hand weeding under *agui-agui* arrangement. [c]Rotary weeding. [d]Includes farm practices such as farm observation, rat and bird control, and transportation of farm materials from house to field.

pay wages of about ₱6/day, including snacks, for 9.5 hours (0700-1200 and 1330-1800).

Transplanting on Farm A began regularly at 7 every Saturday morning. On the 2,500-m^2 plot, it ended around 1030, allowing a snack break. Plowing and leveling were done Fridays. Farmer A asked the workers to weed other plots by hand when there was time left (until 1200).

Harvesting and threshing. The working households and amounts of rice harvested and threshed by each family were recorded between 24 October 1977 and 2 September 1978. Farmer A used each plot 3 times during the period. Data are in Table 4. Farmer A usually allocated 25 rows/plot for each regular household (1-13). When there were extra rows, he shared them with temporary workers (households 19-24). All temporary workers were neighbors. The number of regular workers was increased during the second cropping (13 February to 24 April 1978) to include households 14-18.

During the third cropping from 18 June to 2 September 1978, the number of participants increased rapidly because Farm A had relatively high and constant rice yields. Even though regular workers had the priority in harvesting, they were obliged (socially) to decrease their number of rows harvested from 25 to 20 to give opportunity to more temporary workers. Most temporary workers were farmers from the same village, but some came from outside. Because of the Filipino spirit of helping one another voluntarily, especially during harvesting (*nagbibigayan*), Farmer A and his regular workers could not ignore the temporary workers' proposal to help.

Household 1 threshed an average 188 kg/plot for the first crop. By the third crop this had decreased to 141 kg/plot because of the increase in number of workers. Harvesting required 316 hours/ha according to Farmer A's records. An average of 28 persons worked at harvesting the 2,500-m^2 plots. This means they could have finished harvesting and threshing within 3 hours if they had worked efficiently. However, the threshing machine was not used efficiently because it was moved for each worker household's harvest.

Daily wage for cutting the crop was about ₱13/worker in the village. Actual harvest working time on Farm A was around 3 hours in the morning. Assuming that 1 kg of rice grain was worth ₱1.00, a household with 3 workers earned from ₱6 to ₱11/worker for 3 hours work/plot during the study period. Harvesting on Farm A was, therefore, more profitable than working on other farms.

CULTIVATION PRACTICES ON FARMS B AND C

Farmer B controlled weeds on his 1 ha rice farm under the *agui-agui* labor arrangement. The *agui-agui* arrangement saved Farmer B expenses for weeding and secured hired workers for harvesting. With *agui-agui*, the workers benefited from less competition to harvest the crop, and a more stable source of income.

Figure 4 illustrates shape and area of each plot on Farm B. Labor contracts were made during the 3 weeks between transplanting and weeding. *Agui-agui* workers indicated their preference for plots, but Farmer B made the final allocation of plots to each family after considering family circumstances, plot size, and preferences. As a rule, this arrangement was renewed every cropping season, although some workers participated in the arrangement continuously. Nine families obtained contracts, identified in Figure 4 as plots *a* to *i*. Weeding was done 10-20 July using rotary weeders owned by workers or borrowed from other workers.

Farmer B reserved two plots (*b* in Fig. 4) for his children and his wife's brother who lived in another village. They also weeded their plots in the same way as other *agui-agui* farmers. Another reserved family plot was turned over to four temporary workers (*j*, *k*, *l*, and *m*) after the four appealed to the farmer for harvesting rights. They were able to harvest palay for the same share without participating in weeding. With 19 workers participating, weeding took about 105 hours/ha.

Harvesting was on 14 and 18 September 1978. With 30 workers, time for harvesting on Farm B was estimated at 7.7 hours/worker. The sharing arrangement of the produce was 7/8 for Farmer B and 1/8 for harvesters (Table 5). Almost all workers rented Farmer A's thresher at ₱1/46 kg of palay threshed. Worker *b* threshed his palay by hand.

Farmer C divided his farm into 3 or 4 blocks and staggered planting time to spread his labor use (Fig. 5). He stopped weed control under the *agui-agui* arrangement 2 years ago for some of the reasons cited by Farmer A. He weeded all the field himself with a push-type wooden rotary weeder. Planting time on each block was separated by about a week.

About 60 hours/ha was required for weeding Farm C. IRRI data show that under average conditions, and where adequate control of water is available, it takes 70 hours/ha to weed by rotary weeder (the rotary weeder functions effectively only in soft mud). Other farming activities on Farm C were carried out using conventional techniques.

Labor allocation and imputed family labor costs

The case study farmers kept records of their activities but their records of labor were not completed accurately because of their unfamiliarity with such procedures. As an alternative, farm practices on the three farms were observed daily by the senior author during June through September 1978. Actual working time was recorded.

Labor input on a per hectare basis was 1,028 hours/ha on Farm A and 879 hours/ha on Farm C. On Farm B it was 752 hours/ha (Table 3). For Farm A, family labor provided 23% of the total labor input, a permanent hired laborer provided 19%, and other hired laborers provided 58%. Compared with the other farms the proportion of family labor and permanent hired labor was higher because Farmer A did land preparation and seedbeds (Appendix Table 1-1). Farmer B depended on hired and contract labor for 86% of his total input. On Farm C hired labor provided 70% of the total.

According to the labor input obtained from the daily records kept on 30-40 sample farms at Camarines Sur province by the IRRI Agricultural Economics Department average labor input was 762 hours/ha during the 1975 wet season, and 859 hours/ha during the 1976 dry season.

These data indicate that labor input per hectare per season on Farms B and C were almost the same as the average for the area. Farm A's were slightly higher

Table 4. Participation in harvesting practices and amount harvested on Farm A by laboring households, October 1977-September 1978.

Household	First crop		Second crop		Third crop		Total
	(no.)	(kg)	(no.)	(kg)	(no.)	(kg)	(kg)
1	6	1,128	11	2,145	11	1,553	4,826
2	6	886	6	527	6	564	1,977
3	5	934	10	1,591	4	592	3,117
4	7	1,107	11	1,463	10	1,059	3,629
5	4	341	5	698	1	63	1,102
6	4	588	7	788	3	459	1,835
7	7	736	9	1,294	7	695	2,725
8	0	0	0	0	5	278	278
9	0	0	0	0	0	0	0
10	5	637	0	0	0	0	637
11	5	396	5	365	5	432	1,247
12	0	0	3	319	2	135	454
13	1	89	11	1,086	11	973	2,148
14	0	0	11	882	4	504	1,590
15	0	0	4	231	9	1,105	1,336
16	0	0	10	849	10	1,009	1,858
17	0	0	1	88	5	394	482
18	0	0	3	196	0	0	196
19	1	50	6	430	2	118	598
20	0	0	1	74	0	0	74
21	3	422	0	0	0	0	422
22	1	113	0	0	0	0	113
23	4	376	4	278	5	447	1,101
24	1	122	2	94	2	120	336
25	0	0	0	0	3	230	230
26	0	0	0	0	4	294	294
27	0	0	1	36	6	315	351
28	0	0	3	194	0	0	194
29	0	0	1	68	4	232	300
30	0	0	0	0	1	69	69
31	0	0	0	0	1	124	124
32	0	0	1	66	5	621	687
Total	-	12,686[a]	-	13,762	-	12,385	38,833

[a]Includes missing data for each household's harvest from Block 11. Total amount of rice threshed at plot nos. 8 to 11 in Block 11 were: 1,069 kg, 1,254 kg, 1,165 kg, and 1,273 kg, respectively.

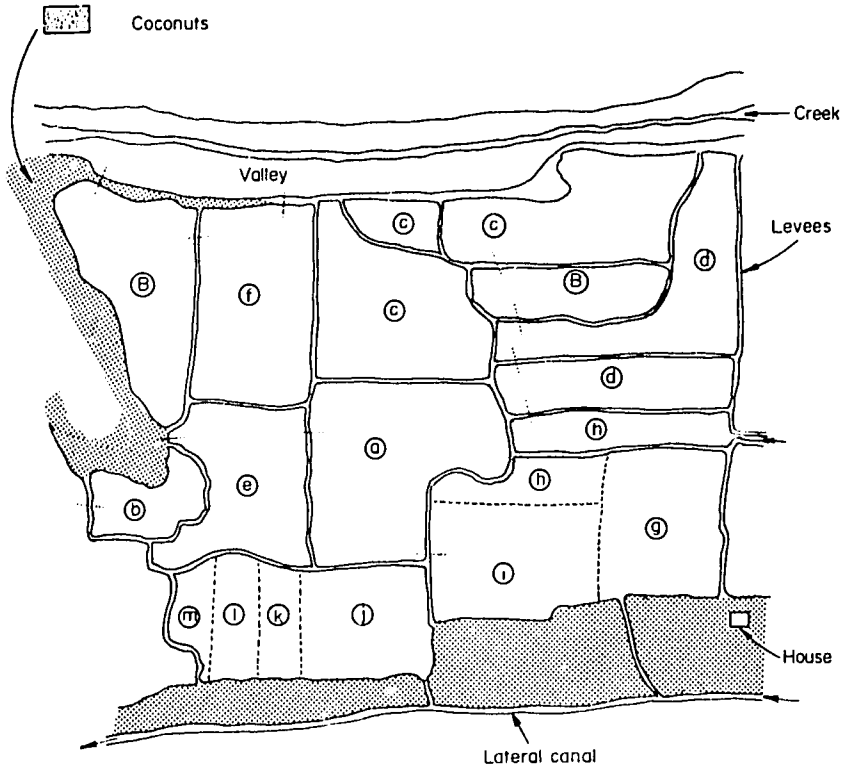

Fig. 4. Shape and area of each plot on Farm B (1.0 ha). Letters indicate assignments to various worker households under *agui-agui* contracts.

Table 5. Rice harvested and payment received by participants in the *agui-agui* harvesting arrangement on Farm B.

Family	Workdays per family[a]	Palay harvested (kg)	Harvesters' share (kg)	Thresher rental (kg)	Net share to harvesters (kg)
			Under agui-agui arrangement		
a	4	470	59	10	49
b	1	125	16	*b*	16
c	6	966	121	21	100
d	3	405	51	9	42
e	5	523	65	11	54
f	3	490	61	11	50
g	2	622	78	14	64
h	1	400	50	9	41
			Temporary harvesters		
i	3	301	38	7	31
j	1	182	23	4	19
k	1	120	15	3	12
m	1	93	12	2	10
			Farmer's family		
B	3	345	43	8	35
Total	34	5042	632	109	523

[a]The entire harvest was completed in 2 days. [b]Threshing was by hand.

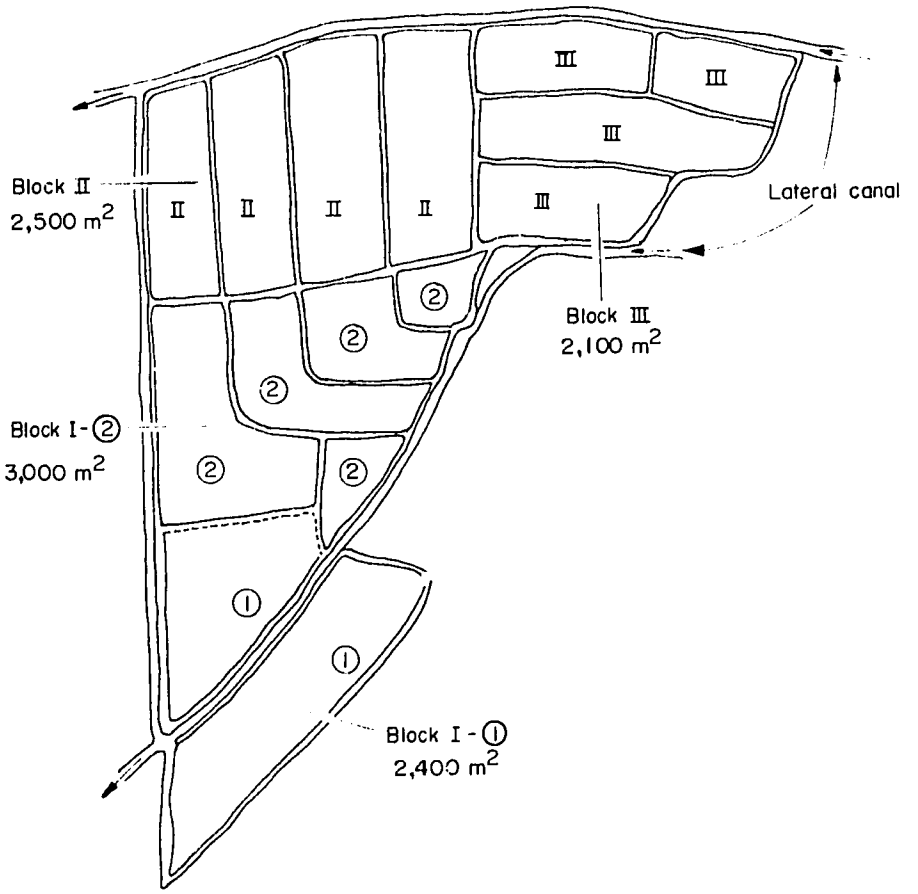

Fig. 5. Shape and area of each plot on Farm C (1.0 ha).

(Table 3). In the IRRI experimental continuous rice system, labor input was 152 days/ha per crop on the 250-m^2 trial and 132 days/ha per crop on the 1,000-m^2 trial (Morooka et al 1979). Compared with those trials, the labor input on Farm A was slightly lower, perhaps because of dependence on hired labor, plot size, and technology used.

Imputed family labor costs are summarized in Table 6. The standard wage rates used for imputing labor costs were obtained by interviewing regular workers on Farm A. The wage rate varied depending on the practice.

CAPITAL UTILIZATION

Capital utilization by the three farmers are detailed in Tables 7-11.

Fertilizer application

During the observation period, Farmer A broadcast and incorporated 14-14-14 at the rate of 186 kg/ha to his first crop and 194 kg/ha to his third crop. No basal fertilizer was applied to the second crop. Urea was applied as 2 topdressings giving a nitrogen input equivalent to 78 kg/ha on the first crop, 110 kg/ha on the second, and 94 kg/ha on the third. The basal fertilizer was usually applied 1 day before transplanting; urea was applied 20 days after transplanting (first topdressing), and 6 to 7 days before panicle initiation (second topdressing). Farmer A varied the amount of fertilizer by plot depending on crop conditions (Table 7).

Farmer B did not know exactly how much fertilizer should be applied. Also, he could not afford to buy commercial fertilizer whenever he thought he needed it. During the period he was observed, Farmer B applied 37 kg N/ha on his first crop, 59 kg/ha on the second, and 81 kg/ha on the third. He had to apply more fertilizer to the second and third crops because it often rained hard just after application. As a result, his third crop yields increased and he learned that fertilizer increased yields.

Farmer C maintained the application of nitrogen at 60-75 kg/ha throughout the year based on his own idea. These rates were almost the same as the calculated optimum levels of nitrogen.

Farmer A applied a relatively high level of fertilizer to his farm compared with his neighbors. To determine the fertilizer application level on other farms in the village, 11 rice farmers working as

regular laborers on Farm A were interviewed. The equivalent of 60 kg N/ha was used on 6 farms. The other five farmers did not use any fertilizer. The highest yield among them was 4.8 t/ha and the lowest was 0.9 t/ha. Yield average for the 11 farms was about 2.9 t/ha during the season.

Table 6. Imputed family and permanent hired labor cost per hectare per crop on three rice farms.

Practices	Daily rate (₱)	Farm A Family labor (₱)	Farm A Permanent hired labor (₱)	Farm B family labor (₱)	Farm C family labor (₱)
Land preparation					
Plowing and harrowing	12	45.0	-	-	-
Levee making and maintenance	8	-	12.5	4.0	-
Seed/seedbed preparation	8	1.1	37.4	1.5	1.5
Transplanting	6	-	-	-	-
Application of fertilizer	8	5.9	11.8	3.0	10.2
Insect control	8	3.4	6.8	2.0	7.7
Weed control	6	0.8	4.3	-	45.3
Irrigation	6	14.1	56.5	16.3	39.9
Harvesting					
Cutting	13	-	-	-	-
Threshing	10	47.3	-	-	-
Hauling and drying	6	35.6	-	11.6	28.7
Miscellaneous	5	65.5	29.0	37.8	56.7
Total		218.7	158.3	76.2	190.0

Table 7. Fertilizer application and costs[a] on three case study farms.

Farm and plot	1st crop 14-14-14 Amount (kg)	1st crop 14-14-14 Cost (₱)	1st crop 45-0-0 Amount (kg)	1st crop 45-0-0 Cost (₱)	2d crop 14-14-14 Amount (kg)	2d crop 14-14-14 Cost (₱)	2d crop 45-0-0 Amount (kg)	2d crop 45-0-0 Cost (₱)	3d crop 14-14-14 Amount (kg)	3d crop 14-14-14 Cost (₱)	3d crop 45-0-0 Amount (kg)	3d crop 45-0-0 Cost (₱)
Farm A												
1	50	72	38	66	-	-	64	111	56	81	38	66
2	50	72	35	61	-	-	65	113	50	72	34	59
3	44	63	33	57	-	-	61	106	50	72	37	64
4	50	72	38	66	-	-	70	122	56	81	27	47
5	32	46	17	30	-	-	42	73	34	49	17	30
6	32	46	16	28	-	-	49	85	33	48	17	30
7	30	43	15	26	-	-	47	82	-	-	32	56
8	50	72	26	45	-	-	52	90	50	72	50	87
9	52	75	26	45	-	-	60	104	50	72	58	101
10	44	63	22	38	-	-	63	110	44	63	22	38
11	30	43	22	38	-	-	37	64	61	88	38	66
Total	464	667	288	500	-		610	1060	484	698	370	644
Per ha	186	267	115	200	-		244	424	194	279	148	258
Farm B												
Per ha	100	144	50	87	100	144	100	174	250	360	100	174
Farm C												
1	10	14	20	35	40	58	20	35	100[b]	152	50	87
2	60	86	38	66	60	86	30	52				
3	50	72	25	44	50	72	25	44	50	76	25	44
4	40	58	25	44	50	72	25	44	50	76	25	44
Per ha	160	230	108	189	200	288	100	175	200	304	100	175

[a]Based on prices as of 1977 in Camarines Sur. [b]Used nitric phosphate (16-20-0).

Table 8. Amounts of insecticide applied and costs[a] on three rice farms.

Farm	Chemicals	Price/bag or bottle (₱)	1st crop Amount (bag or bottle)	1st crop Cost (₱)	2d crop Amount (bag or bottle)	2d crop Cost (₱)	3d crop Amount (bag or bottle)	3d crop Cost (₱)
Farm A	Herbicides							
	Machete	113/25 kg	2	226*	1	113		
	2,4-D	68/25 kg			1.7	114	2.5	174
	Insecticides							
	Niram	26/473 ml	10	260	10.5	279		
	Furadan	113/16.7 kg	3	339			2	226
	Gusathion	28/473 ml			1.2	34	4.5	126
	Total			825		540		526
	₱/ha			330		216		209
Farm B	Insecticide							
	Gusathion	28/473 ml	2	56	2	56	2	56
Farm C	Insecticides							
	Niram	26/473 ml	2	52	2	52		
	Furadan	113/16.7 kg	1	113			1	113
	Gusathion	28/473 ml	2	56	1	28	2.5	70
	Total			221		80		183

[a]Cost figures are rounded to nearest whole number.

Table 9. Operation hours of thresher and amount of grain threshed by each worker on two plots at Farm A.

	Plot 2			Plot 3		
Area	2,500 m²			2,400 m²		
Harvesting date	25 June 1978			3 July 1978		
Weather	Fine			Cloudy and rainy		
	Minutes	Grain (kg)	Worker	Minutes	Grain (kg)	Worker
	6	72	2	6	58	19
	12	181	1	7	71	26
	8	122	17	5	48	27
	8	86	4	6	55	7
	7	85	8	6	59	4
	7	86	13	5	43	15
	10	174	7	5	40	25
	5	69	30	11	193	2
	4	57	25	3	40	29
	3	55	29	2	36	8
	3	40	11	10	158	1
	5	60	19	10	157	11
	15	200	15	10	135	16
				8	111	13
Total	93	1287		94	1204	
Kg/hour		830			768	
Av			799 kg/hour			

Weed and insect control

Farmer A usually applied herbicides within 1 week after transplanting. He also used water to control weeds. In addition, several of his regular workers carried out weeding when there was time after transplanting. His expenditure on 2 kinds of herbicides was ₱628/2.5 ha or ₱250/ha a year (Table 8).

Several insecticides were sprayed and broadcasted on Farm A, where the amount of insecticides and timing of application were varied carefully according to symptoms on the rice leaves. Farmer B applied the same insecticide every season. At Farm A insects damaged relatively few plots, which indicates that it is possible for rice farmers to minimize risk or damage caused by insects and diseases even while adopting the continuous rice production system.

The main cause of crop damage on all farms was rats. They lived inside dikes and on coconut land adjacent to the farms. The farmers stopped using rat bait after compound 1080 (Na-monoflour acetate) was prohibited. They believed others had no effect. Farmer A sometimes sprayed insecticides mixed with machine oil on the dikes surrounding his plots to kill the rats through their habit of licking their body after eating.

Machine use

When workers used the traditional thresher (*hampasan*) farmers were always late in threshing, winnowing, and hauling of grain. Farmer A bought a 7-hp thresher, which markedly increased the speed of threshing. The machine threshed the rice harvested from plots 2 and 3 in 1 day each. Detailed data were gathered on the operation (Table 9).

Thirteen families participated in harvesting of plot 2. After harvesting each family hauled the grain

Table 10. Fuel consumption per hectare by farm machinery used at Farm A.

Item	Hours of operation (hours/ha)	Gasoline used (liters/hour)	Gasoline price (₱/liter)	Cost of fuel consumption ₱/ha per crop	₱/ha per year
I. Power tiller					
Plowing	16.9[a]	3	1.6[b]	81.12	243.36
Harrowing	10.1	3	1.6	48.48	145.44
II. Thresher					
Threshing for					
1st crop	6.3[c]	3	1.6	30.24	93.12
2d crop	6.9	3	1.6	33.12	
3d crop	6.2	3	1.6	29.76	
Total					481.92

[a]Plowing and harrowing usually use two workers. Hence, working hours of a power tiller is half the labor hours. In addition, the actual working hours of the power tiller was estimated at 90% of the stated time for calculating fuel consumption. [b]Gasoline price at the 1977 level. [c]The thresher at Farm A threshed about 800 kg/hour. Operating hours of the thresher was derived by dividing the yield per hectare by that value.

Table 11. Annual costs of farm machinery and equipment on farms A, B, and C.

Item	Purchase price (₱)	Repair and maintenance[a] (₱)	Years of life[b]	Depreciation (₱)	Repair + depreciation (₱)	Interest at 12% (₱)
Farm A						
Machinery						
Power tiller	3800	190	5	760	950	456
Thresher	3000	150	5	600	750	360
Equipment						
Sprayers (2)	1000		3	333	333	
Shovels (2)	70		2	35	35	
Buckets (3)	45				45	
Others[c]	140				140	
Total					2253	
Farm B						
Equipment						
Sprayer	350		3	117	117	
Shovels (2)	70		2	35	35	
Harrows (2)	110		2	55	55	
Plow	30		2	15	15	
Others[d]	50				50	
Total					272	
Farm C						
Equipment						
Rotary weeder	40		2	20	20	
Shovel	35		2	18	18	
Bucket	40				40	
Others[d]	80				80	
Total					158	

[a]Estimated at 5% of the value of machinery. [b]Straight-line depreciation based on 5 years for machinery, 3 years for sprayer, and 2 years for rotary weeder. [c]Pallet for seedbed making, knife for weeding at dike, knife for harvesting, bamboo basket for winnowing, etc, and so on. [d]Number of tools lesser than for Farm A.

from the plot to the threshing floor where it was piled separately. The machine threshed the 1,287 kg harvested from plot 2 in 93 minutes of actual machine time -- about 830 kg/hour. Weather slowed harvesting and threshing of plot 3, which was harvested a week after harvest of plot 2, to 768 kg/hour.

Fuel consumption by power tiller and thresher

The cost of fuel for the power tiller on Farm A was estimated at ₱81/ha for plowing and ₱49/ha for harrowing (Table 10). Farmer A rented his tiller to other farmers when he was not using it at ₱10 per hour for machine and operator. One example was observed by the senior author. It took 31 labor hours for Farmer A's son and another hired laborer to complete plowing for the third crop of 1 ha on Farm B. Farmer B paid ₱155 to Farmer A as rental charges for 15.5 hours of tiller work. Farmer A paid ₱23 to the hired laborer, leaving a balance of ₱132. The time requirement for plowing depended on the land and weather conditions.

Harrowing and leveling for the third crop on Farm B were done by 4 hired laborers with 4 water buffalo 2 days before transplanting. Total time requirement was 20 hours -- 4 hours for harrowing and 16 for leveling. The operation was done from 0645 to 1200 hours. Farmer B paid each hired laborer ₱15 for his half-day work.

As previously explained, it was possible to thresh about 800 kg grain/hour. Operating hours of the machine per hectare was derived by dividing the yield per hectare by 800. The cost of fuel consumption was thus estimated at ₱93/ha per year.

Based on ₱1/kg grain, Farmer B paid Farmer A ₱109 as rental for the threshing machine for the third crop. Cost of fuel for threshing 4,917 kg was ₱30 and the remaining (₱79) was earned by the 2 operators and as a return to the machine. Total time for threshing was 55.2 hours/ha. Imputed value of labor for the 2 operators was estimated at ₱46. Therefore, about ₱33 was the return to the thresher.

The costs of capital items on the three farms are summarized in Table 11. Straight line depreciation, a constant proportion of original cost for repairs, and a return to capital of 12%/year were assumed on Farm A.

RICE YIELDS ON THE THREE FARMS

Threshed rice was measured on a scale operated by the office of the farmers' association. Moisture content of the grain was not considered in the yield survey. In general, 1 kg of grain just after threshing had a value of ₱1 in cash.

Farmer A produced about 30 t on 2.5 ha or 15.6 t/ha per year. Farmer B produced 10.2 t/ha per year. Farmer C produced 13.9 t/ha during the period covering 3 crops on Farm A, but on a yearly basis, it was estimated at 11.6 t/ha.

At an IRRI experiment, total production of the 250-m^2 continuous rice production trial was 23.6 t/ha per year. This would have equaled 17.7 t/ha if the land had been used only 3 times a year -- slightly higher than the 15.6 t/ha yield of Farmer A.

These yields on three farms compare favorably with yields of conventional systems, but are not spectacular. For example, according to a Camarines Sur survey conducted by the IRRI Agricultural Economics Department during the 1977 crop season, the average yield of 59 rice farmers was 3.6 t/ha during the dry season and that of 66 farmers was 2.8 t/ha during the wet season. Assuming that all were double cropping, the average yield per year would be 6.4 t/ha, half that of Farmer C, and 40% that of Farmer A.

Significant disease and insect damage was not observed on the three farms, but some damage was caused by rats. There was also some loss from shattering of the rice. The farmers had no effective means of protecting rice from those problems. Damage by stem borers was controlled by insecticides. In November 1977 and August 1978, strong typhoons hit the area. As a result, Farmer B had to replant rice in certain plots for the first crop and advance the harvesting time of his third crop. Farmers A and B had damage in some plots but not in others. Typhoon damage differed depending on the growth stage of the crop. Thus, the staggered system had the advantage of minimizing damage caused by typhoons.

ECONOMIC EVALUATION OF THE SYSTEMS

Farmer A had an annual land amortization payment of ₱2,500 (₱1,000/ha) for 15 years at 6% interest. This land value had been determined by assuming that amortizing owners could produce about 5.5 t/ha per year even though normal harvests for 3 years preceding land reform had been 1.5 t/ha during the wet season and 1.6 t/ha during the dry season. With those yields, the legal leasehold rental was 375 kg/ha during the wet season and 400 kg/ha during the dry season or 775 kg/yr (₱775 at ₱1/kg). Thus, land had an exorbitant cost compared with the normal harvest at the time land reform was initiated. However, with land reform as a turning point, the three farmers made efforts to increase their land productivity thereby making the rental tolerable.

Cost and return analysis

At the prevailing price of ₱1/kg of grain, Farmer A had gross returns of ₱15,553/ha from rice production (Table 12). In addition, he received about ₱884 as thresher rental from hired laborers who harvested on his farm. Oil consumption, maintenance, and labor cost for operating the thresher were not separated from other production costs because they are difficult to itemize. Therefore, thresher rental income was included in the cost and returns analysis.

The results indicate that Farm A's net farm income was more than ₱7,000/ha per year, including a return of ₱660 for imputed family labor. Return to capital and management (imputed labor cost subtracted from farm income) was ₱6,689/ha per year.

Table 12. Cost and return analysis of rice production (₱/year) on three study farms.

	Farm A		Farm B	Farm C
	2.5 ha	Per ha	(per ha)	(per ha)
Production (kg/yr)	38,833	15,553	10,190	11,558
Thresher rental[a]	844	338	0	0
Gross returns (₱/ha per yr)	39,727	15,891	10,190	11,558
Variable costs (₱)				
Seed	534	214	210	181
Fertilizer	3,569	1,428	1,083	1,122
Herbicides	628	251	0	0
Insecticides	1,263	505	168	393
Fuel, oil	1,205	482	0	0
Hired labor	8,287[b]	3,315	2,398	2,841
Irrigation	1,125	450	450	375
Gross margin	23,116	9,246	5,881	6,646
Land cost	2,500	1,000	1,000	1,000
Capital cost[c]	2,253	901	272	158
Net farm income	18,363	7,345	4,609	5,488
Imputed value of family labor	1,640	656	229	475
Return to capital and management	16,723	6,689	4,380	5,013
Imputed return to capital (12%)	816	326	0	0
Return to family labor and management	17,547	7,019	4,609	5,488
Days of family labor	234	94	40	82
Family labor return (₱/workday)	75	75	115	67
Shares (%)				
Net farm income as % of gross return	46	46	45	47
Value added as % of gross return	79	79	81	82
Share of labor in value added	32	32	32	35
Share of land in value added	8	8	12	11
Residual share in value added	60	60	56	54

[a]Rentals to workers harvesting on the same farm. Fuel included in costs listed below. [b]Includes 1,187 for one permanent hired laborer. [c]Depreciation plus repairs.

Value added from the rice production system, calculated by subtracting current intermediate inputs (seeds, fertilizer, chemicals, irrigation, fuel, and oil) from output value, was 79% of total output value. Results of a survey in Laguna province for 1975-76 crop year showed an average value added for a small sample of rice farmers of 84% (Hayami et al 1978). These results indicate that the ratio of current inputs to total returns was almost the same on Farm A as with conventional production systems, although Farmer A cultivated rice three times a year under the continuous rice production system. Return to family labor and capital made up 44% of total returns and 56% total value added.

Farmer B obtained a farm income of ₱4,600/ha per year. He contributed only 40 days of family labor/year to his farm. Therefore, farm income per day worked was about ₱115, whereas for Farm A it was estimated at ₱75 because family members worked about 94 days a year. Family labor productivity on Farm B, therefore, was 1.5 times that on Farm A, but net farm income per hectare was 1.5 times more on Farm A than on Farm B.

Net farm income of Farm C was ₱5,500. Farmer C grew 2.5 crops/year but his farm income was higher than Farmer B's because of higher yields. Farmer C and his family worked on his farm about 82 days a year. Therefore, farm income per day worked was ₱67.

The ratio of net farm income to total returns varied from 46 to 48% on the 3 farms; the ratio of net farm income to value added varied from 53 to 56%. According to our estimates farm income as a percent of total return and as a percent of value added ranged from 20 to 40% for Laguna farmers (Morooka et al 1979). Compared with those results the ratios on our three case study farms were higher.

The results of the factor share analysis show that the share of management and capital (i.e., the residual) was high whereas the share of land was low. This was because land rent became relatively small when the intensity of land use increased. The share of labor was about one-third of the output on these farms.

Stability of job opportunity for hired laborers

Farmer A paid about ₱2,800/ha for hired laborers in addition to ₱475/ha for a permanent hired laborer during the year (Table 13). Farmer B paid about ₱2,400 and Farmer C ₱2,800. Farm A thus generated the highest productive employment opportunities of the 3 farms -- about ₱3,200 of labor income/ha per

Table 13. Hired labor costs by operation on three farms.

Operation	Hired labor costs (₱/ha per year)		
	Farm A	Farm B	Farm C
Land preparation	258	585	857
Transplanting	637	540	539
Weeding	-	-	-
Harvesting	1946	1273	1445
Paid-out cost of operator to hired laborers	2841	2398	2841
Threshing cost of hired laborers	338	213	253
Real income of hired laborers	2503	2185	2588

year. Farm B generated ₱2,600/ha per year and Farm C, ₱3,100/ha per year. Thus, both the intensity of land use and the intensity of complementary inputs affect the amount of labor that can be productively employed.

Harvesting and threshing represent a major employment opportunity for landless workers and for small farmers whose income from farming are insufficient to meet their subsistence needs. Therefore, the choice of technology and contractual arrangement with respect to the use of labor and capital for rice harvesting and threshing are critical determinants of the income and the well-being of the rural poor. Farmer A paid his hired laborers about ₱1,950/year in kind, Farmer B ₱1,300, and Farmer C ₱1,450. However, hired laborers paid rental charges for a threshing machine out of their shares. Net harvesting shares were ₱1,600 for Farm A, ₱1,100 for Farm B, and ₱1,200 for Farm C. Hired labor costs varied with productivity on each farm. Also, cost for weeding was incorporated with the harvesting share on Farm B.

The *agui-agui* system has the advantage for farmer employers of reducing hired wage rates without involving social frictions and of promoting favorable patron-client relation with workers. It is thus a standing paradox that hired laborers both want and do not want the *agui-agui* system. They want the *agui-agui* rights to an exclusive area for harvesting -- as a form of security in the face of increasing competition from other workers -- but they do not want to do the weeding free. For example, earnings of harvesters on Farms A and C were ₱17/work day but workers on Farm B under the *agui-agui* system earned ₱10/workday for weeding and harvesting (Table 14).

No significant differences in total hired labor costs were observed among the three planting methods because transplanting cost was fixed at about ₱6/day and the sharing arrangement for harvesting was fixed at 1/8. However, many hired laborers showed a preference for the continuous rice production system on Farm A with its labor arrangement, which combined transplanting and harvesting practices. The weekly planting and harvesting under this system provided a stable job opportunity for hired laborers. Laborers could receive wages for transplanting and shares for harvesting almost every week, whereas work opportunity on Farm B was not as regular.

To those concerned with the problems of man-land relationships, available data and inferences from these data indicate that the critical issue is that of farmer-cultivator vs farm laborers. The problem is whether or not there will be adequate crop land to provide enough productive work for all laborers. Increases in the rural labor force would increase competition in establishing a right to cultivate or to work as hired laborers on the limited land area.

Intensification or diversification, or both, are effective means of enlarging farm business from the limited available farm land. However, there are many variations on how to intensify rice farming even in a pure rice farm.

The incomes of the three case study rice farmers generally increased as a result of the changes that have taken place in rice production where there is assured irrigation water. There have, however, been important differences in both the choice of inputs by farmers, yields, and profits. Farmer A is in the forefront in the use of modern technology and systematic cultivation method. He cultivated rice on a relatively large area, used farm machines, and received the highest surplus. The surplus could have been further increased with increases in the productivity of land through improvement of the irrigation system and the use of agricultural technology

Table 14. Costs of harvesting and threshing for different systems.

Item	Farm A	Farm B	Farm C
Yields (kg)	15,553	10,190	11,558
Labor requirements			
1. Weeding	-	39	-
2. Harvesting	97	66	70
3. 1 + 2	97	105	70
4. Threshing	21	21	18
5. 1 + 2 + 4	118	126	88
Labor costs			
6. Harvesters' share	1,608	1,060	1,192
7. Threshers' share	338	213	253
8. 6 + 7	1,946	1,273	1,445
Wages per day worked			
Harvesters			
6/2	17	17	17
6/3	17	10	17
Threshers			
7/4	17	10	14

to grow four crops a year. Production on Farm B faced the risk of climatic variation, which could reduce or eliminate profit from the new technology. Farmer C tended to fall between other farms in terms of yield and input levels and income. The results of this comparative study of three farms using technology that is more labor-absorbing as well as land- or capital-saving than the usual Philippine practices can be stated as:

- intensive rice production, as in Farm A, brought about an absolute increase in production per hectare per year and an increase in absolute labor income per hectare per year;
- intensive rice production also insured a more stable employment opportunity for hired laborers throughout the year;
- the factor shares of labor on the three farms were relatively similar (30-34%); the operators residuals for Farmers A, B, and C were 49-51% of the total value added, regardless of the degree of intensification; and
- the factor shares in value added of hired labor were 22-29% and that of land were 8-12%.

SUMMARY AND CONCLUSION

We make five observations on advantages of the system adopted by Farmer A.

1. The labor-intensive continuous rice production system is practical for the individual farm in a well-irrigated area.

2. A farmer can disperse seasonal labor peaks into constant year-round labor use that generates employment opportunity throughout the year. For example, on Farm A, about 24% of the total labor input/ha was by family members and the rest was performed by hired laborers. To maintain appropriate numbers of hired laborers during transplanting and harvesting, he established a labor arrangement. This refers to the arrangement in which regular participants for transplanting practice can have the right to join in harvesting and threshing, and to receive one-eighth of the harvester's share in kind. Hired laborers had constant work throughout the year. Farmer A's production system, with its relatively high and constant yields, is becoming popular among hired laborers. The weekly staggering methods also favored hired laborers who could space their work among different parcels.

3. Farmers may be able to minimize risk of diseases and insect attack or damage caused by typhoons because the stage of crop growth is different in each plot.

4. The continuous flow of cash from weekly sales will permit the farmer to finance the farm operation himself and eliminate the need for credit.

5. Turnaround time on small plots can be reduced to a day, making it possible to use all the land every day of the year. Hence income and production are maximized. Farmer A planted IR36 three times a year on 2.5 ha of paddy with 11 plots and produced about 18 t/ha earning ₱7,000 of farm income per hectare.

On the other hand, we note several disadvantages.

1. It is hard for farmers without appropriate facilities to control a year-round water supply.

2. Continuous use of insecticides may bring about pest resurgences or pest resistance to insecticides quicker than in other less intensive systems.

3. The small plot size leads to greater labor intensity per hectare. Also, small plot size may limit or decrease job opportunity for hired laborers because it will be easier to manage it by family members or a few hired laborers.

4. A high level and intensity of management is required.

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Appendix Table 1-1. Labor input (hours/ha) by operation, by family and nonfamily labor on three farms, June to September 1978.

Operation	Farm A				Farm B				Farm C		
	Family labor	Permanent hired labor	Hired labor	Total	Family labor	Hired labor	Contract labor	Total	Family labor	Hired labor	Total
Land preparation											
Plowing and harrowing by power tiller	30.0	-	30.0	60.0	-	34.9	-	34.9	-	51.8	51.8
Leveling by carabao	-	-	6.4	6.4	-	16.0	-	16.0	-	12.9	12.9
Levee making	-	12.5	5.3	17.8	4.0	-	-	4.0	-	15.5	15.5
Seed/Seedbed preparation	1.1	37.4	12.2	50.7	1.5	34.5	-	36.0	1.5	41.9	43.4
Transplanting	-	-	283.1	283.1	-	238.0	-	238.0	-	253.0	253.0
Fertilizing	5.9	11.8	-	17.7	3.0	-	-	3.0	10.2	-	10.2
Insect control	3.4	6.8	-	10.2	2.0	-	-	2.0	7.7	-	7.7
Weed control	1.0	5.7	15.0	21.7	-	-	105.0	105.0	60.4	-	60.4
Irrigating	18.8	75.3	-	94.1	21.7	-	-	21.7	53.2	-	53.2
Harvesting	66.3	-	230.9	297.2	15.5	215.5	-	231.0	38.2	243.0	281.2
Miscellaneous	104.0	46.0	-	150.0	60.0	-	-	60.0	90.0	-	90.0
Total	230.5	195.5	582.9	1008.9	107.7	538.9	105.0	751.6	261.2	618.1	879.3
%	23	19	58	100	14	72	14	100	30	70	100

Appendix Table 1-2. Labor input (hours/ha per crop) by operation on three farms.

Activities	Farm A	Farm B	Farm C
A. Land preparation			
1. Plowing	37.5	30.9	34.5
2. Harrowing	22.5	4.0	17.3
3. Levee making/ maintenance	17.8	4.0	15.5
4. Leveling	6.4	16.0	12.9
Total	84.2	54.9	80.2
B. Seed/Seedbed preparation			
1. Soaking and incubating	1.1	1.5	1.5
2. Constructing seedbed	6.2	5.0	4.3
3. Sowing seeds	2.8	1.5	3.5
4. Pulling seedlings	40.6	28.5	34.1
Total	50.7	36.0	43.4
C. Application of fertilizers			
1. Basal	8.8	1.0	5.7
2. Topdressing	7.9	2.0	4.5
Total	17.7	3.0	10.2
D. Weed control			
1. Herbicides	3.2		
2. Hand weeding	18.5	105.0	
3. Rotary weeding			60.4
Total	21.7	105.0	60.4
E. Insect control			
1. Insecticides	10.2	2.0	7.7
Total	10.2	2.0	7.7
F. Planting			
1. Transplanting	283.1	238.0	253.0
Total	283.1	238.0	253.0
G. Irrigation			
1. Watering/Draining	94.1	21.7	53.2
Total	94.1	21.7	53.2
H. Harvesting			
1. Cutting	102.7	91.3	138.7
2. Hauling	70.9	50.3	15.2
3. Threshing	56.7	55.2	57.0
4. Winnowing	38.4	13.4	32.8
5. Packing/Drying	38.5	14.9	36.2
6. Weighting	8.9	5.9	2.0
Total	316.1	231.0	281.2
I. Miscellaneous	150.0	60.0	90.0
J. Total (Labor hours)	1027.8	751.6	879.3
(Labor days)	129	94	110

Appendix Table 2-1. Dates of farming operations, costs of current inputs and hired labor, and yields by plot, Farm A, first crop.

Item	Block I							Block II				Total	Average
	1	2	3	4	5	6	7	8	9	10	11		
Area planted (ha)												2.5	1.0
Varieties				IR36					IR36				
Date	1977										1978		
Sowing	7/11	7/18	7/25	8/1	8/8	8/16	8/24	8/31	9/7	9/15	9/22		
Transplanting	7/30	8/6	8/13	8/20	8/27	9/3	9/10	9/15	9/24	9/30	10/8		
Harvesting	10/24	10/31	11/8	11/15	11/21	11/26	12/6	12/12	12/19	12/26	1/2		
Costs (₱)													
Current input													
Seed	20	18	18	20	13	8	12	20	21	18	15	183	73
Fertilizer	138	133	120	138	76	74	69	117	120	101	81	1167	467
Insecticide	64	64	67	67	45	42	38	67	56	44	39	598	239
Herbicide	25	23	20	25	16	16	14	23	25	20	20	227	91
Subtotal	247	238	225	250	150	140	133	227	222	188	135	2175	870
Hired labor													
Land preparation	25	24	20	22	14	14	14	22	23	19	17	214	86
Transplanting	46	44	39	65	34	49	38	40	37	45	35	465	186
Weeding	-	-	-	-	-	-	-	-	-	-	-	-	-
Harvesting	184	186	172	179	104	89	77	134	157	146	159	1587	635
Subtotal	255	254	231	269	152	142	129	196	217	210	211	2266	906
Threshing cost	32	32	30	31	18	15	13	23	27	25	28	274	110
Yields													
Palay threshed (kg)	1474	1488	1374	1432	831	711	615	1069	1254	1165	1273		
Palay dried (cavans)	29	30	27	29	17	14	12	21	25	23	25	252	101
Remarks													

Appendix Table 2-2. Dates of farming operations, costs of current inputs and hired labor, and yields by plot, Farm A, second crop.

Item	Block I							Block II				Total	Av
	1	2	3	4	5	6	7	8	9	10	11		
Area planted (ha)												2.5	1.0
Varieties				IR36					IR36				
Date	1977-78												
Sowing	10/28	11/4	11/11	11/18	11/25	12/2	12/9	12/16	12/23	12/30	1/6		
Transplanting	11/12	11/29	11/26	12/3	12/10	12/17	12/24	12/31	1/7	1/14	1/21		
Harvesting	2/13	2/20	2/27	3/6	3/13	3/20	3/27	4/3	4/10	4/18	4/25		
Costs (₱)													
Current input													
Seed	15	14	14	15	10	10	9	15	16	14	11	143	57
Fertilizer	111	113	106	122	73	85	82	90	104	110	64	1060	424
Insecticide	19	34	34	38	27	27	27	34	27	23	23	313	125
Herbicide	13	13	12	15	8	8	29	29	47	33	20	227	91
Subtotal	158	174	166	190	118	130	147	168	194	180	118	1743	697
Hired labor													
Land preparation	22	20	20	22	14	14	14	22	23	19	17	207	83
Transplanting	42	40	44	61	30	40	50	57	55	50	54	523	209
Weeding													
Harvesting	137	149	170	192	131	103	116	179	189	180	181	1727	691
Subtotal	201	209	234	275	175	157	180	258	267	249	252	2457	983
Threshing cost	24	26	30	33	23	18	20	31	33	31	31	300	120
Yields													
Palay threshed (kg)	1094	1190	1358	1537	1050	827	926	1435	1515	1436	1448		
Palay dried (cavans)	22	24	27	31	21	17	19	29	30	29	29	278	111
Remarks													

Appendix Table 2-3. Dates of farming operations, costs of current inputs and hired labor, and yields by plot, Farm A, third crop.

Item	Block I							Block II				Total	Av
	1	2	3	4	5	6	7	8	9	10	11		
Area planted (ha)												2.5	1.0
Varieties			IR36				Japonica 7041, 40, and 39			IR36			
Date	1978												
Sowing	3/9	3/16	3/25	4/1	4/6	4/13	4/17	4/24	5/2	5/9	5/16		
Transplanting	3/25	4/1	4/8	4/19	4/22	4/29	5/6	5/13	5/20	5/27	6/10		
Harvesting	6/18	6/25	7/3	7/14	7/19	7/24	7/25	8/1	8/13	8/25	9/2		
Costs (₱)													
Current input													
Seed	23	18	18	20	13	12	16	24	27	17	20	208	83
Fertilizer	147	131	136	128	79	78	56	159	173	101	154	1342	537
Insecticide	10	10	-	16	52	34	34	46	59	44	47	352	141
Herbicide	19	18	16	18	11	11	11	18	20	14	18	174	70
Subtotal	199	177	170	182	155	135	117	247	279	176	239	2076	831
Hired labor													
Land preparation	25	21	21	24	15	14	14	22	26	19	22	223	89
Transplanting	55	55	54	56	42	45	51	72	70	47	58	605	242
Weeding													
Harvesting	138	161	151	171	128	119	73	134	135	191	148	1549	620
Subtotal	218	237	226	251	185	178	138	228	231	257	228	2377	951
Threshing cost	24	28	26	30	22	21	13	23	24	33	26	270	108
Yields													
Palay threshed (kg)	1104	1287	1204	1370	1023	952	583	1068	1081	1524	1185		
Palay dried (cavans)	22	26	24	27	20	19	12	21	22	30	24	247	99
Remarks							REIMEI	TOYONISHIKI	TODOROKI-WASE				

Appendix Table 3. Dates of farming operations, costs of current inputs and hired labor, and yields by crop, Farm B.

Item	1st crop	2d crop	3d crop	Total	Av
Area (ha)	1	1	1		
Varieties	IR36	IR36	IR36		
Date	1977-78				
Sowing	10/1	1/30	5/28		
Transplanting	10/20	2/15	6/15		
Harvesting	1/24	5/19	9/14		
	1/26	5/21	9/18		
		5/23			
Costs (₱)					
Current input					
Seeds	70	70	70	210	70
Fertilizers	231	318	534	1,083	361
Insecticides	56	56	56	168	56
Herbicides	-	-	-	-	-
Subtotal	357	444	660	1,461	487
Hired labor					
Land preparation[a]	185	185	215	585	195
Transplanting[b]	180	168	192	540	180
Weeding[c]	-	-	-	-	-
Harvesting	290	353	630	1,273	424
Subtotal	655	706	1,037	2,398	799
Threshing costs	46	58	109	213	71
Yields					
Palay threshed (kg)	2,322	2,826	5,042	10,190	3,397
Palay dried (cavans)	46	57	101	204	68
Remarks					

[a]Paid ₱10.00/hour for rental charge of power tiller (15.5 hours x ₱10.00) and ₱15.00/worker for leveling practice with 4 carabaos. [b]Paid ₱6.00 with snacks to each worker. [c]Under the *agui-agui* arrangement without payment and snacks.

Appendix Table 4. Dates of farming operations, costs of current inputs and hired labor, and yields by plot, Farm C.

Item	1st crop				2d crop				3d crop		
	1	2	3	4	1	2	3	4	1 + 2	3	4
Area planted (ha)											
Varieties											
Date	1977										
Sowing	7/4	7/11	7/18	7/24	11/1	11/10	11/14	11/19	4/25	4/30	5/6
Transplanting	7/21	7/28	8/4	8/11	11/17	11/24	12/1	12/8	5/12	5/19	5/26
Harvesting	10/19	10/22	10/27	11/2	3/9	3/15	3/20	3/25	8/7	8/10	8/21
Costs (₱)											
Current input											
Seed	20	26	20	18	14	20	15	14	38	15	15
Fertilizer	49	152	116	102	93	138	116	116	239	120	120
Insecticide	49	53	52	67	23	17	15	25	81	44	58
Herbicide	-	-	-	-	-	-	-	-	-	-	-
Subtotal	118	231	188	187	130	175	146	155	358	179	193
Hired labor											
Land preparation	90	91	81	81	69	113	77	67	187	92	97
Transplanting	55	60	50	45	40	60	55	50	115	60	73
Weeding	-	-	-	-	-	-	-	-	-	-	-
Harvesting	127	192	158	145	101	149	149	135	287	154	136
Subtotal	272	343	289	271	210	322	281	252	589	306	306
Threshing cost	22	33	28	25	18	26	26	24	50	17	24
Yield											
Palay threshed (kg)	1018	1532	1265	1158	810	1191	1194	1083	2298	1228	1088
Palay dried (cavans)	20	31	25	23	16	24	24	22	46	25	22
Remarks											

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