AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523
BIBLIOGRAPHIC INPUT SHEET

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Batch 70

1. SUBJECT CLASSIFICATION
A. PRIMARY: Food production and nutrition — AE10-0000-G732
B. SECONDARY: Agricultural economics--Philippines

2. TITLE AND SUBTITLE
The calibration of instruments for collecting farm level data

3. AUTHOR(S)
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4. DOCUMENT DATE	5. NUMBER OF PAGES	6. ARC NUMBER
1976	26p.	ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS
IRRI

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)
(In IRRI paper no.76-32)

9. ABSTRACT
When agricultural economists are conducting field research, they have two basic options in collecting data on farm size, farm labor time, and crop yields. They can collect information supplied them by the farmer, or they can make direct measurements of those data. This paper describes a study designed to establish whether consistent relationships exist between the data collected by those two means. The crops involved in the study were upland rice, field corn, glutinous corn, sorghum, mung, cowpea, peanut, soybean, and sweet potato. Thirty-nine farmers were studied in Batangas province, the Philippines, during the 1974-1975 crop season. The results of the study showed consistent relationships between measured and farmer-reported data. The farmers overestimated their parcel sizes by about 8% if they owned or leased their land, and by about 30% if they rented the land. They also consistently overestimated their labor time and underestimated their crop yields. They study results can be used to develop realistic labor requirements and labor costs for small-scale agronomic trials. They can also be used for transforming data obtained from farmers' reports into data more accurate for economic analyses.

10. CONTROL NUMBER
PN-AAE-507

11. PRICE OF DOCUMENT

12. DESCRIPTORS
Agglomeration
Calibration
Data
Farms
Measurement
Philippines

13. PROJECT NUMBER

14. CONTRACT NUMBER
AID/ta-G-1074 GTS

15. TYPE OF DOCUMENT

AID 590-1 (4-74)

AID/ta-G-1074 GTS
IRRI
PN-AAE-507

Paper No. 76-32

THE CALIBRATION OF INSTRUMENTS FOR COLLECTING FARM LEVEL DATA

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September 1976

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Nicanor Roxas, Dennis Garrity and Edwin Price[1/]

Introduction

The accuracy of instruments used for gathering information is of utmost importance in any scientific investigation. Different instruments usually vary in accuracy and in the expense incurred in using them. If a less accurate instrument costs less, it is useful to determine the degree of inaccuracy of the inferior instrument compared to the better one so that a more knowledgeable choice between accuracy and cost can be made. Also, if consistent biases in the error of the inferior instrument are found, the bias can perhaps be estimated and used to adjust the measurements obtained from the inferior instrument.

In socio-economic studies, farmers' estimates of variables are often substituted for direct measurements because farmers' estimates can be obtained more cheaply. Three types of farmer-reported data are widely used in cropping systems research. These are farmers' estimates of their labor time in different field operations, estimates of their farm area, and estimates of their crop yields. This study is intended to compare farmers' reports of these three types of data with controlled measurements made by researchers, to determine if there were consistent relationships between the two methods of gathering each type of data. If consistent biases were present then mathematical relationships could be developed for estimating measurements from farmers' reports. In other work, such a relationship may be useful in determining what the farmers' report would have been when a set of controlled measurements are made.

The basic question is whether consistent relationships exist between data gathered by the two methods, and this will be explored separately for these three important types of farm-level data in the sections that follow.

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PART A

A Comparison of Farmers' Reports and Stopwatch Estimates of Labor Time Required for Various Operations

Information on the relative labor requirements of different crops is important in the evaluation of alternative cropping patterns. Labor data is necessary in working out the costs and returns for each pattern being tested, and also to see how the pattern fits into the overall cropping system. For this reason the Cropping Systems Program needed a strong set of labor data for the 8 basic field crops under farmers' management. The most convenient method of obtaining such data would be to have cooperating farmers record each day their estimate of their time spent on each field operation. But if this was to be done we were also interested in knowing how these estimates would compare with accurate measurements of the same operations made by researchers using a stopwatch.

This study was made in conjunction with a series of trials that were conducted to evaluate eight alternative field crop patterns based on upland rice during the 1974-75 crop season in northeastern Batangas province (Garrity et. al. 1975). The site is part of the most concentrated upland rice-producing area in the Philippines. It has a gently rolling topography with the farms averaging about one and one-half hectares in size, each usually compared of several separate parcels, The soils are medium-textured and easily managed under the farmers' animal power (Samson et. al., 1975).

Timing Field Operations

In each of the eight cropping patterns tested the first crop was upland rice. The timing of field operations covered each of the alternative crops following rice, which included field corn, glutinous corn, sorghum, four legumes (mung, cowpea, peanut, soybean) and a sweet potato/corn intercrop.

Thirty-nine farmers were involved in the research, each farmer managing three of the cropping patterns on a portion of his farm. The area for each pattern was approximately 0.1 ha. The farmer received a record form on which he recorded his daily field operations on each of the test crops. Staff of the Economics Department supervised the record keeping by visiting the farm twice weekly. A more complete analysis of farm labor utilization and the costs and returns for each cropping pattern were reported by Garrity and others (1975).

In addition to the farmers' report, each field operation on every crop was separately timed by a field researcher using a stopwatch.

The operations were timed repeatedly over small areas of the field then averaged and expanded to a per hectare basis. The researcher did not inform the farmer he was timing his operations, kept his distance from the field, and did not talk with the farmer while the work proceeded.

In this method only the time during which the farmer was actively working was measured. This excluded the farmers' preparation for fieldwork, walking to and from the field, rest time, and any disruptions of operations, all of which were presumably included in the farmers reports of their total time spent on the operation. Thus, the stopwatch estimate could be viewed as the time taken only to physically conduct the operation.

After the timing data was gethered by both methods, linear regression analysis was used to estimate the quantitative relationship between the farmers' reports and stopwatch estimates. The equation estimated was:

$$FR = a(SE) + b$$

Where FR is the farmer's time report, SE is the stopwatch estimate, a is a coefficient expressing the relationship between measurements of the two instruments, and b is a constant. The data used in the regression are the average labor requirements for every operation on each crop that were measured by both instruments and are given in Table 10.

Results and Discussion

Difference between farmers' estimates and stopwatch time. The farmers' reports of labor time for each field operation were consistently higher than the stopwatch estimates. Tables 1-9 compare the results of the two timing methods for each individual crop. Table 10 summarizes the comparative data for all crops.

The stopwatch estimates of the required time for all operations generally fell between 55 and 70 percent of the farmers' reports of the time required. The range was from 63 percent in the case of field corn to 82 percent for glutinous corn. The farmers' inclusion of rest time and other disruptions probably accounts for much of the difference. However, the differences between estimates appear to be greatest on those operations which required the least time by stopwatch estimate. This suggests that the inclusion of preparation time and walking to and from the field amounted to a considerable bias for operations of shorter duration.

For each crop the percentage of the total labor requirement was also computed for each individual operation (see Tables 1-9). The proportion of total labor time for any given operation is very similar between the stopwatch estimates and the farmers' reports. This indicates a consistency in the overestimation inherent in the farmers reports.

Functional relationship between instruments. A linear regression of the form Y = ax + b was estimated which yielded the relationship:

$$\text{Farmers' Report} = 1.67\ (\text{Stopwatch Estimate}) + 0.33$$

The correlation was highly significant, confirming a consistent relationship between the measurements of the two instruments. The relationship is graphed in Figure 1. The constant term (0.33) may be interpreted to indicate that for each operation approximately 0.33 mandays is spent by the farmer in preparing for field work and traveling to and from the field. The coefficient 1.67 represents the upward adjustment that is necessary to account for that portion of the farmers' field time that he is not actively performing the operation (rest time, performing repairs, etc).

One might then view the farmers' report of time spent on a field operation to be composed of three segments: (1) His preparation and travel time to and from the field (0.33 mandays), (2) the time spent at the field engaged in the operation (the SE), and (3) the time spent at the field but not actively performing the operation (0.67 x SE).

It should be pointed out that the equation does not measure the bias of the farmer's report to the "actual" total time which it took him to do his field operations. Measuring this would have required stopwatch measurements of the total time spent for the operations (including preparation, travel, etc.) not just the active performance of the operation. Farmers' reports may not be unbiased but they reflect more accurately the "actual" time than do stopwatch estimates. In computing the costs and returns of the patterns tested, it was the farmers' reports of time that were used to determine the labor requirements and labor costs.

The above equation may be applied to the problem of estimating realistic labor requirements for operations in small scale field plot experiments. The time taken for operations conducted in small plots may be easily measured but is obviously not reflective of a farmers' total time in conducting the operation over an entire field. But this plot measurement is conveniently converted to a per-hectare-basis stopwatch measurement. From here the equation may be used to yield a reason-

able estimate of what the farmers' report would be for the operation. If applied under soil and crop conditions similar to those under which the equation was derived, this should enable the computation of fairly accurate labor cost estimates for superimposed trials and such types of experiments.

PART B

A Comparison of Farmers' Reports and Crop Cut Estimates of Crop Yield

The most accurate way of determining crop yield over a 0.1 hectare farmer's field undergoing a cropping pattern trial is to harvest and weigh the production of the entire field. Two other less exhaustive methods are much more commonly used, however, which each give somewhat less accurate estimates of actual yield. One is the harvest of a selected number of small sample plots within the field to determine average yield (a standard agronomic practice). The other is to ask the farmer the total production of the field after harvest (a standard method of economics research).

In cropping systems work these two techniques are used side by side by the agronomy and economics teams at the test sites, but they cannot be assumed to give identical estimates. If, however, there exists a consistent bias in the results of one method versus the other, a mathematical relationship could be used to allow results derived by one method to be transformed into the other. This study attempted to investigate the possible relationship between results of the two techniques. It uses data from the trials conducted at the same northeastern Batangas test site that is described in Part A.

Methodology

The crops in this study included the five grain crops which were tested at the outreach site during the late wet season, 1974-75. These were field corn, sorghum, mung, peanut, and soybean. Each field was approximately 0.1 hectare in size, and planted and managed by the cooperating farmer with guidance from the IRRI researcher.

The crop cut samples for estimating the yield of the field were made from three sample plots of a standard size of 5 m long x 4 crop rows wide. The row-width varied slightly from one farmer's field to another so the sample plot size varied also. Since the average row width was approximately 0.60 m the sample plot sizes ranged around 5m x 2.4 m or 12m^2. The three sample plots were distributed in a stratified

pattern through the long narrow fields as shown in figure 2. Harvest samples were dried, threshed, and weighed at IRRI and then returned to the farmer.

A researcher of the economics section interviewed the farmer shortly after his harvest to obtain the production quantity for whole field. Since there were superimposed management trials in each field, as shown in figure 2, which were harvested by the agronomy researcher, the area corresponding to the farmer's production report covered only the portion outside management trials.

Correlation and regression analyses were run from the yield data obtained by the two different methods on a total of 58 fields. The form of the regression equation relating the crop cut estimates to the farmers' report was:

$$cc = a(FR) + b$$

where cc is the crop cut estimate, FR the farmers' report, "a" is a coefficient, and b the intercept.

Results and Discussion

There is generally a strong predictable relationship between the yields estimated from the researcher's crop cut sampling and the yields estimated from the farmers' production reports. Table 11 summarizes the results for all of the crop studies.

Eight sets of correlation and linear regression analyses were conducted. In six cases the correlation between the crop cut estimates and farmer's reports were highly significant, with correlation coefficients ranging from 0.80 to 0.95. The exception was the case of the orange flint variety of field corn for which the correlation coefficient was non-significant at 0.45.

Crop cut estimates of yield are almost always higher than the farmers' reports of yields on the same fields. The mean yields estimated by crop cuts averaged over 400 kg/ha. higher than the farmers' reports for sorghum. For the legumes this difference was much lower, 40 kg/ha for mung, and 20 kg/ha for all legumes (mung, peanut, and soybean combined).

The orange flint field corn showed much greater variability in results than any of the other crops. This is probably due to a unique problem in obtaining accurate farmers' reports for this crop. The other test crops were being grown only on a 0.1 ha experimental field on each

farm, and their production was easily isolated, but the farmer's corn crop was not only being grown on a 0.1 hectare experimental field but also outside the experimental field on the same parcel, and on other parcels as well (refer to the field layout in Figure 3). Accurate estimation of production under these conditions was more difficult for the farmer because the produce of the experimental area was been mixed with that of other fields.

Because crop cut yield estimates tend to be biased upwards of farmers' reports, the agronomist who is doing an economic analysis of field trials and needs to adjust his yields in accordance with the farmer's whole field production reports needs to adjust his yields downward. The opposite is true for the economist in determining what crop cut yield would be given the farmers' report data.

The correlation and regression analysis for all 58 fields for the five crops combined is shown at the bottom of Table 11. Mean yields from the crop cuts were 140 kg above those from farmers' reports. The results of the two techniques were highly significantly correlated (r = .89**). For the linear regression, where the farmers' report estimate is considered the independent variable, its coefficient is just slightly above one (1.02), indicating a slight upward revision to adjust farmers' report yield estimates in obtaining crop cut estimates. Such revisions of data may be very useful in comparing results and standardizing results between separate studies using the two different methods.

PART C

A Comparison of Farmers' Estimates and Actual Measurements of their Farm Size

When small-scale farmers are asked the size of their farms do their estimates tend to be biased above or below their actual farm size and to what extent? This question was investigated in a study conducted among the lowland rice farmers of six barrios in the town of Manaoag, Pangasinan, an outreach site of the IRRI Cropping Systems Program.

Methodology

Forty-seven farmers were interviewed during early 1975 and were asked the area of every parcel they farmed.[1/] The same farmers were those included in the Economics-Cropping Systems record-keeping studies at the outreach site.

[1/] A parcel is defined as a contiguous area of land operated under a single tenure arrangement.

Shortly after the interviews each parcel was measured using a steel tape. Since parcels were generally flat and rectangular, more complicated methods were not needed.

Results and Discussion

Farmers tended to overestimate the actual size of their farms in all of the six barrios (Table 10). Farm size as measured by steel tape averaged 2.22 ha but farmers' estimates were higher than that by 8.1 percent.

Parcel sizes ranged from as small as 0.02 ha up to 1.82 ha. Figure 2 is a frequency distribution of parcel size showing that parcels between 0.2 and 0.4 hectares were most common. The farms comprised an average of 3.9 parcels each, but ranged from one to 10 parcels (Table 12). There was no clear relationship detected between parcel size and the degree of error committed in estimating parcel size.

Tenure appeared to have an important effect on the farmers' tendency to over estimate their parcel sizes. Table 13 shows the breakdown of the sample farms by form of tenure. Under share tenancy, ownership and leasehold, the overestimates of parcel size were quite similar, at 6.8, 7.1, and 9.8 percent respectively. But among farmers who rented their land the average overestimate of parcel size was 30 percent (See Table 14). Since land rents are based solely on parcel size it is perhaps possible that such high overestimates may be due to the practice of the landlords exploiting the renter by stating larger than actual parcel sizes to obtain maximum rent.

Overall Summary and Conclusions

The results of the three studies were similar in the sense that the farmer's reports of data were in every case related to the researcher measurements in a consistent relationship. This lends confidence to the belief that mathematical relationships between the results of different data-collection methods may be developed for these and other types of farm-level data on a wider scale.

From the labor time study the development of a linear relationship between stopwatch estimates of labor and the farmers' reports can be used to develop realistic labor requirements and labor costs for small-scale agronomic trials.

From the yield estimate study it was seen that crop cut estimates are consistently higher than yield estimates from farmers' reports on the same fields, regardless of the crop. The existence of a strong linear relationship between the results of the crop cut method and the farmers' reports enables data derived by the use of one technique to be transformed to the other. Thus agronomic data may be made more "realistic" for economic analysis.

From the last study on farm area it was found that sample farmers consistently overestimated their farm size. Their tenure arrangement appears to be a major influence on how great their overestimate may be (with renters overestimating to a far greater extent than other tenurial groups).

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Table 1. Comparison of labor time required by field corn as estimated by stopwatch and as estimated by from farmers' reports.

Operations	Estimated by stopwatch		Estimated by farmers' reports		Stopwatch est x 100 Farmers' est	Percentage of total labor requirement	
	Observations (no.)	Av. time (manday/ha)	Observations (no.)	Av. time (manday/ha)		Stopwatch	Farmers' rept.
Plowing (2x)	30	3.6	35	3.9	92	18	12
Harrowing (3x)	35	1.2	35	2.2	54	6	7
Furrowing	16	1.2	35	2.5	48	6	8
Planting	18	3.8	35	6.0	63	19	19
Fertilization (2x)	28	2.6	35	4.4	59	13	14
Off-barring		2.2	35	2.6	84	11	8
Hilling-up	15	1.8	35	2.1	86	9	7
Harvesting	11	3.6	35	7.9	46	18	25
All operations		20.0		31.6	63	100	100

Table 2. Comparison of labor time required by sorghum as estimated by stopwatch and as estimated from farmers' report.

Operations	Estimated by stopwatch		Estimated by farmers' reports		Stopwatch est x 100 farmers' est	Percentage of total labor requirement	
	Observation (no.)	Av. time (manday/ha)	Observation (no.)	Av. time (manday/ha)		Stopwatch	Farmers rept.
Plowing (2x)	12	4.1	11	6.1	67	12	13
Harrowing (3x)	5	0.9	11	2.3	39	3	5
Furrowing	8	1.4	11	1.9	74	4	4
Planting	6	3.6	11	5.7	63	11	12
Fertilization	8	1.6	11	4.2	61	8	8
Hilling up	6	1.3	11	1.5	87	4	3
Off-barring	2	1.7	11	2.9	59	5	6
Harvesting	4	18.6	11	23.5	79	54	49
All operations	51	34.2	88	48.1	71	100	100

Table 3. Comparison of labor time required by mung beans as estimated by stopwatch and as estimated from farmers' reports.

Operations	Estimated by stopwatch		Estimated from farmers' reports		Stopwatch . x 100/ farmers' est.	Percentage of total labor requirement	
	Observations (no.)	Av. time (manday/ha)	Observations (no.)	Av. time (manday/ha)		Stopwatch	Farmers' rept.
Plowing (2x)	12	3.9	15	6.5	60	6	9
Harrowing (3x)	10	0.9	15	1.9	47	1	2
Furrowing	9	1.3	15	1.8	72	2	2
Planting	7	4.7	15	5.4	86	8	7
Fertilization	7	1.9	15	2.9	65	3	4
Spraying	20	3.3	15	5.8	56	5.3	8
Hilling up	6	2.4	15	3.0	80	4	4
Harvesting	5	43.4	15	48.0	-	70	64
All operations		61.8		75.3	82	100	100

Table 4. Comparison of labor time required by peanuts as estimated by stopwatch and as estimated from farmers' reports.

Operation	Estimated by stopwatch		Estimated by farmers' reports		Stopwatch est. x 100/ farmers' est.	Percentage of total labor requirement	
	Observations (no.)	Av. time (manday/ha)	Observations (no.)	Av. time (manday/ha)		Stopwatch	Farmers' rept.
Plowing (2x)	6	2.3	3	2.9	79	12	3
Harrowing (3x)	6	1.8	3	3.8	47	9	4
Furrowing	3	1.4	3	1.6	88	7	2
Planting	3	9.3	3	12.5	75	46	14
Fertilization	3	1.5	3	3.2	47	7	3
Hilling-up	3	3.7	3	4.6	80	18	5
Harvesting	-	-	3	63.7	-	-	69
All operations		20		28.6[1/]	22	98.5	100

[1/] Does not include harvesting.

Table 5. Comparison of labor time required by soybeans or estimated by stopwatch and as estimated from farmers' reports.

Operations	Estimated by stopwatch		Estimated from farmers' reports		Stopwatch est. x 100 farmers' est	Percentage of total labor requirement	
	Observations (no.)	Av. time (manday/ha)	Observations (no.)	Av. time (manday/ha)		Stopwatch	Farmers' rept.
Plowing (2x)	5	3.9	5	4.8	81	13	12
Harrowing (3x)	4	1.2	5	3.2	37	4	8
Furrowing	5	1.2	5	1.3	92	4	3
Planting	5	4.9	5	5.0	98	16	13
Fertilization	5	1.5	5	2.9	51	5	7
Spraying	5	1.2	5	0.2	600	4	1
Hilling-up	4	1.7	5	3.0	57	6	8
Harvesting	3	14.4	5	19.0	75	48	48
All operations		30		39.4	76	100	100

Table 6. Comparison of labor time required by cowpea as estimated by stopwatch and as estimated from farmers' reports.

Operations	Estimated by stopwatch		Estimated from farmers' report		Stopwatch est. x 100/ farmers' est.	Percentage of total labor requirement	
	Observations (no.)	Av. time (manday/ha)	Observations (no.)	Av. time (manday/ha)		Stopwatch	Farmers rept.
Plowing (2x)	20	4.5	17	6.6	68	4	5
Harrowing (3x)	18	1.2	17	3.8	31	1	3
Furrowing	9	1.7	17	1.7	100	2	1
Planting	10	5.0	17	6.7	75	5	5
Fertilization	9	2.0	17	2.1	95	2	1
Spraying	38	8.3	17	13.6	61	1	10
Hilling-up	6	1.5	17	1.3	115	78	1
Harvesting	15	86.6		105.8	81		74
All operations		110.8		141.6	78	100	100

Table 7. Comparison of labor time required by sweet potato-corn intercrop as estimated by stopwatch and as estimated from farmers' reports.

Operations	Estimated by		Estimated from farmers' report		Stopwatch est. x 100/ farmers' est.	Percentage of total labor requirement	
	Observations (no.)	Av. time (manday/ha)	Observations (no.)	Av. time (manday/ha)		Stopwatch	Farmers' rept.
Plowing (2x)	12	4.6	13	4.7	98	19	13
Harrowing (3x)	8	1.2	13	4.3	27	5	12
Furrowing	7	1.1	13	3.3	33	5	9
Planting	9	9.8	13	14.0	70	41	38
Fertilization (2x)	13	3.4	13	5.8	59	14	16
Hilling-up	6	2.0	13	2.6	77	8	7
Off-barting	4	1.8	13	2.0	90	8	5
Harvesting			13	-	-	-	-
All observations	59	23.9	104	36.7	65	100	100

Table 8. Comparison of labor time required by glutinous corn as estimated by stopwatch and as estimated from farmers' reports.

Operations	Estimated by stopwatch		Estimated from farmers' report		Stopwatch est. x 100/ farmers est.	Percentage of total labor requirement	
	Observations (no.)	Av. time (manday/ha)	Observations (no.)	Av. time (manday/ha)		[illegible]	Farmers rept.
Plowing (2x)	9	3.6	9	4.2	86	15	14
Harrowing (3x)	5	1.2	9	2.8	14	5	9
Furrowing	5	1.1	9	1.3	85	5	4
Planting	6	4.9	9	5.8	84	20	19
Fertilization (2x)	9	2.8	9	4.7	59	12	15
Off-barring		2.0		2.2	91	8	7
Hilling-up	4	1.9	-	2.3	-	8	8
Harvesting	4	6.6	9	7.2	92	27	24
All operations		24.1		30.5	82	100	100

Table 11. The relationship between crop cut yield estimates and yield estimates from farmers' production reports for 5 grain crops, Northeastern Batangas, late wet season, 1974-75.

Crop/Crop combination	No. of observations	Crop cut kg/ha	Farmer report kg/ha	Correlation analysis		Linear regression[1/]
				r	R^2	
Sorghum	11	2922	2499	0.80**	0.64	CC = 1.03(FR) + 349
Sorghum + Ratoon sorghum	15	2529	2112	0.88**	0.78	CC = 1.10(FR) + 414
Mung	12	472	432	0.85**	0.72	CC = 0.91(FR) + 79
All legumes[2/]	21	573	553	0.85**	0.72	CC = 0.79(FR) + 134
Popcorn	7	1464	1237	0.95**	0.91	CC = 1.13(FR) - 83
Field corn (orange flint)	10	806	1863	0.45^{ns}	0.20	CC = 0.29(FR) + 1263
All corn[3/]	22	1793	1728	0.53**	0.28	CC = 0.54(FR) + 860
All crops	58	1542	1402	0.89**	0.79	CC = 1.02(FR) + 116

1/CC = Crop cut yield estimate; FR = Farmers report of production.

2/Includes mung, soybean, and peanut

3/Includes four varieties of field corn: orange flint (10 fields), popcorn (7), UPCA variety (3) and white flint (2).

Table 12. Total cultivated land area between the farmer's estimate and actual measurement on 47 farms in 6 barrios, Manaoag, Pangasinan.[1]

Barrio	Number of sample farms	Total cultivated land area of sample farms(ha)[2]		Farmers' error	
		Farmers estimate	Actual measurement	Abs.	Percent
Caaringayan East	10	22.71	21.32	1.39	6.5
Caaringayan West	7	14.31	13.71	0.60	4.4
Anis	10	21.79	21.66	0.13	0.6
Pao	9	24.91	22.43	2.48	11.1
Lipit Sur	4	9.43	9.09	0.34	3.7
Lipit Norte	7	19.66	16.16	3.50	21.7
All farms	47	112.81	104.37	8.44	8.1
Average		2.40	2.22		

[1] Average per parcel

[2] Cultivated Land Area (CLA) is the total land area cultivated in a given parcel specifically defined by a certain cropping pattern over a period of one year.

Table 13. Average parcel size by number of parcels per farm[1/].

No. of parcels on the farm	Number farms	Total No. of parcels	Total area of parcels (ha.)	Ave. size of parcels (ha)
1	4	4	3.57	0.89
2	12	24	16.55	0.69
3	5	15	9.93	0.66
4	12	48	30.69	0.63
5	5	25	14.31	0.57
6	4	24	12.11	0.50
7	1	7	3.35	0.47
8	2	16	5.99	0.37
9	1	9	3.22	0.35
10	1	10	4.65	0.46
All farms	47	182	104.37	0.57
Average		3.9		

Table 14. Frequency distribution of land tenure of all parcels on six barrios, Manaoag, Pangasinan.

Barrios	Forms of tenure				
	Share tenancy	Owner-ship	Lease-hold	Rental	Total
Caaringayan East	25	3	4	3	35
Caaringayan West	10	10	1	1	22
Anis	25	15	1	0	41
Pao	27	3	4	2	36
Lipit Sur	14	2	1	1	18
Lipit Norte	17	6	3	4	30
TOTAL	118	39	14	11	182

Table 15. Correlation of tenure and error.

Form of tenure	No. of parcels	Size		Error	
		Farmers Estimate	Actual Measurement	Absolute	Percent
Share tenant	110	74.32	69.64	4.7	6.8
Owned	51	23.41	21.86	1.6	7.1
Leased	11	9.21	8.39	0.8	9.8
Rented	10	5.82	4.48	1.3	30.0
TOTAL	182	112.86	104.37	8.4	8.1

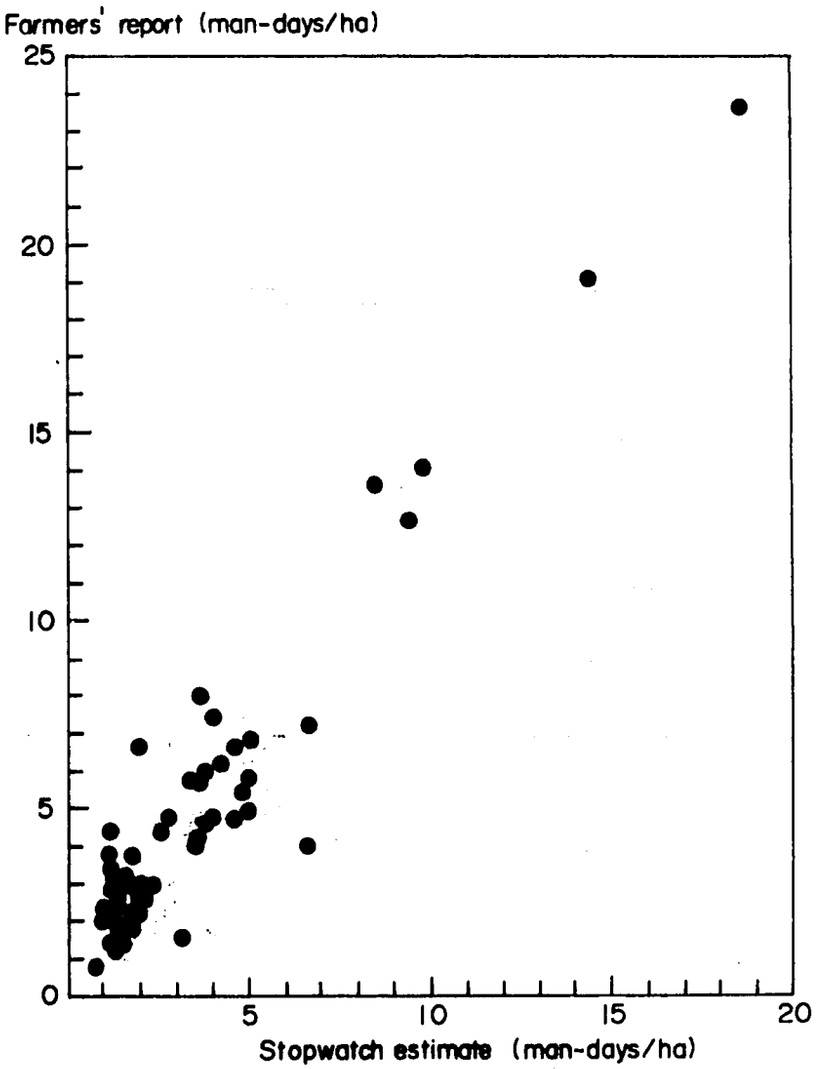

Fig. 1. The relationship between the average labor time for major operations on eight field crops as estimated by farmers' report and by stopwatch, northeastern Batangas, 1974-1975.

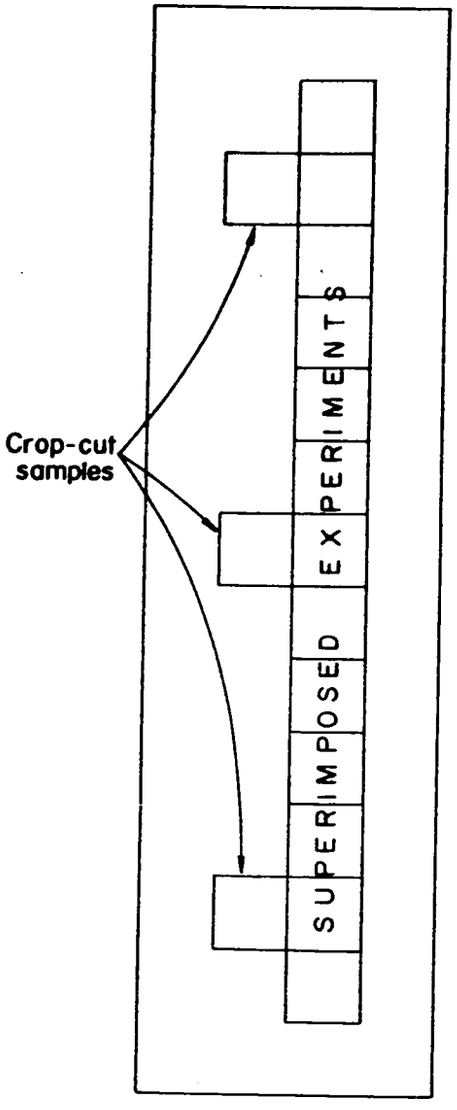

Fig. 2. Location of the crop-cut sample plots in the test crop field.

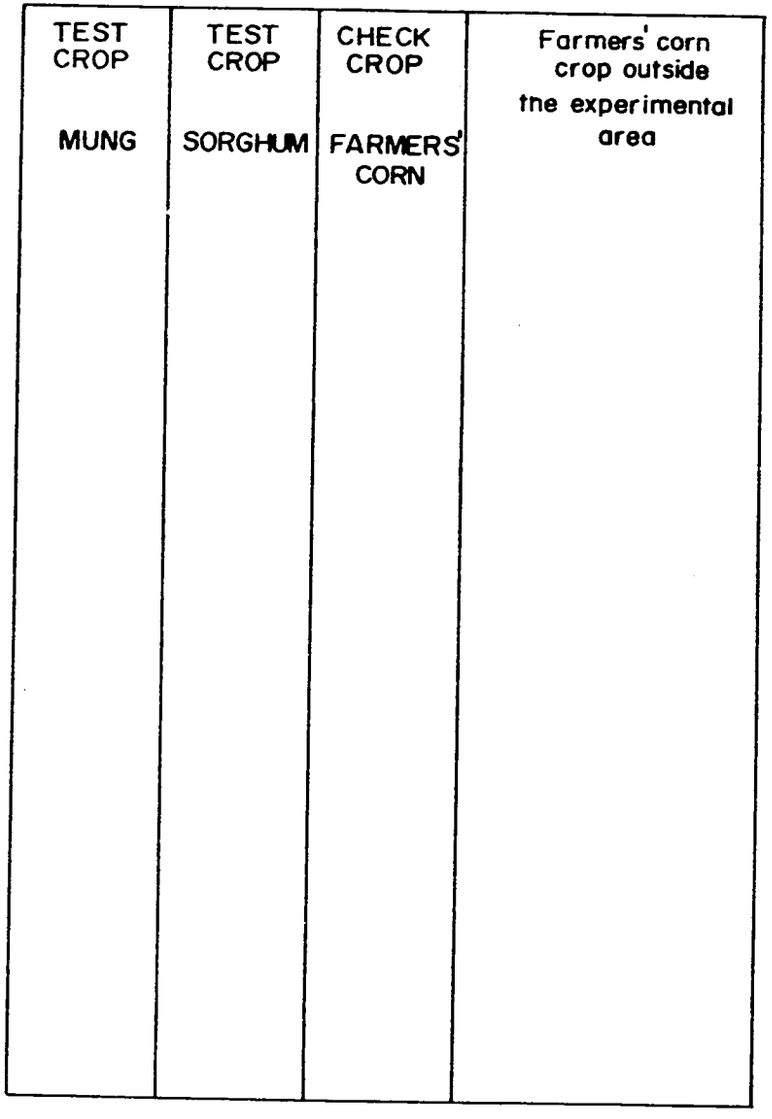

Fig. 3. Layout of three cropping patterns within a cooperating farmer's parcel.

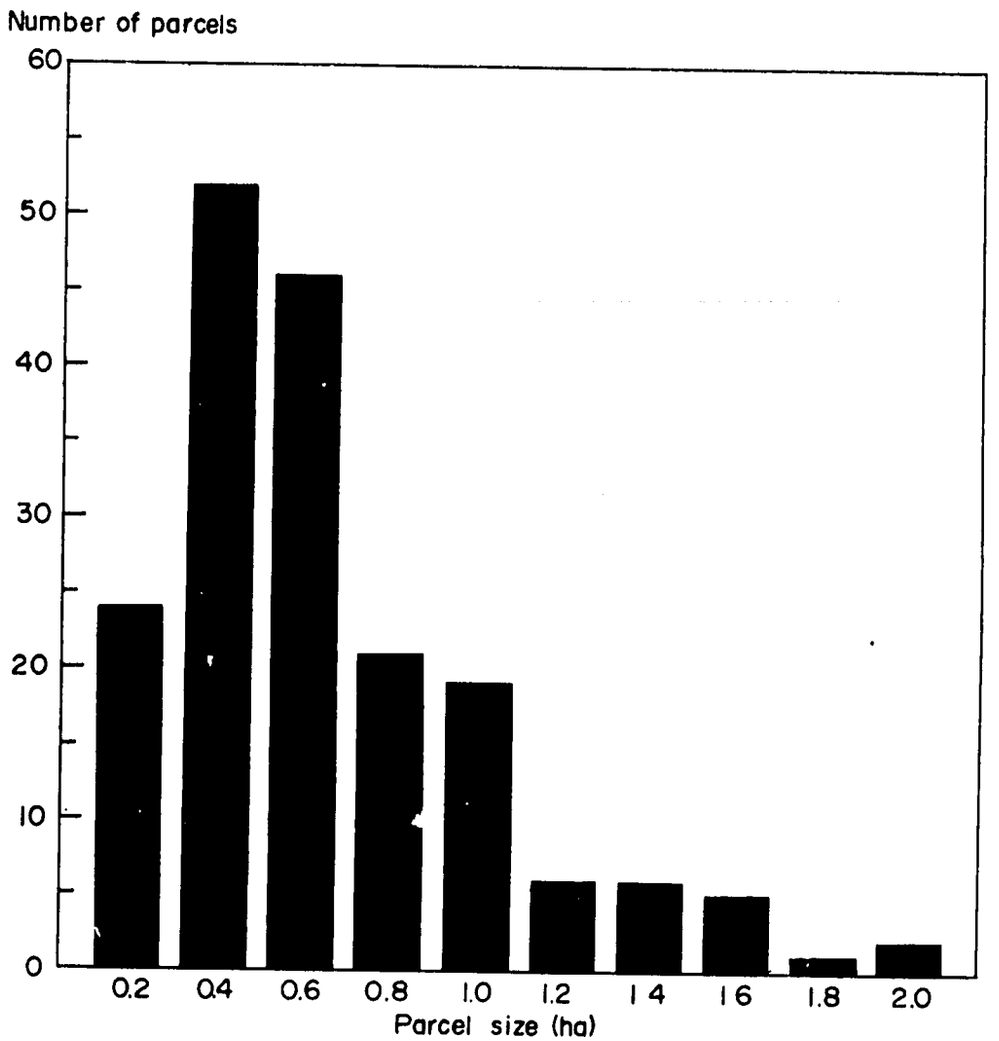

Fig. 4. Frequency distribution of parcel size among 48 farmers, Manaoag, Pangasinan.