3.2 Extension groupings

Production considerations under the three crop types, (a) rainfed lowland, (b) irrigated wet season, and (c) irrigated dry season, are so diverse as to require, *a priori*, that the three types be individually analyzed. The primary grouping of farmers is therefore by crop type.[4] The secondary grouping is by extension category: Group I, consisting of program cooperators and farmers in special projects; Group II, consisting of non-cooperators in program areas; and a residual Group III. Table 3.2 contains the sample sizes under the primary and secondary groupings, classified by adoption or non-adoption of new rice varieties in crop year 1968.

A tertiary grouping by soil quality-rank was also attempted, with soil quality alternatively represented by soil series rank and by soil texture rank.[5] However, this grouping was nearly always rejected by Chow tests as not significant for either rainfed farms or irrigated wet

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[4]Farms are almost always either totally irrigated or totally rainfed. If irrigated, the main crop is almost always the wet season crop. Some farmers plant a second irrigated crop in the dry season; these farmers are represented in *both* crop types (b) and (c). Thus the crop type groupings involve 412 + 454 = 866 *farmers*, and 866 + 206 = = 1,072 sample units (Table 3.2).

[5]The ranks are in Appendix 3.

season farms[6]; *similar tests for irrigated dry season* farms did not seem worthwhile.[7] The results were identical for both 1968 adoption and 1969 planned adoption. It was then concluded that the available soil information did not warrant the estimation of diffusion functions separately by soil categories. The derivation from secondary sources of the soil data may have been mainly responsible for the lack of significance in any of the soil groupings.

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[6]This test presupposes that homoscedasticity exists within the error covariance matrix of the pooled sample . An F-test can be made to verify this assumption, based on the ratio of the residual variances of the two separate samples. If the assumption is not supported by this test, a strict approach would be to apply generalized least squares instead to the pooled sample, using the residual variances to transform the data beforehand, before proceeding with the Chow test. This strict approach is however relatively costly in terms of calculations, and I decided to apply the Chow test regardless of the result of the prior F-test for homoscedasticity. It would seem likely that the Chow-conclusion using OLS would be the same as that using GLS, even though the F-test indicates GLS as more appropriate. At any rate, the F-test for homoscedasticity was always applied, and instances in which the assumption was rejected were very few.

[7]Turning back to the case in Fig. 3.2, we find that, for most nitrogen levels permitting a comparison, the better-variety yield advantage of the better soil is less in the dry than in the wet season.

To test the agricultural extension groupings, the following procedure was applied. Regressions were run to estimate probability/discriminant functions, i.e., with dependent variable (referring to new variety adoption) taking values either zero or one. Since the adoption rates for crop year 1967 were almost always zero, the dependent variables were limited to NEW1(68), referring to actual adoption in crop year 1968, and NEW2, referring to planned adoption for crop year 1969. Then the Chow test ($\alpha = .01$) was applied on the basis of four specifications of explanatory variables per dependent variable. In these specifications, the variables AGE, AIN (area planted), NPK1 (fertilizer), CH (chemicals), LN (loan value) and INTRST (interest rate) were always carried[8]; additional variables were SCHOOL or EXPERT and MQ3 or MQ4, the combinations of which account for the four specifications. The results of the tests are summarized in table 3.4.

The initial test-results on Rainfed Lowland farms were not consistent. They stated that Group III might be

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[8]When the meaningfulness of CH was questioned by rice scientists, CH had already been used in Rainfed Lowland and Irrigated Wet Season regressions; but it was omitted from Irrigated Dry Season regressions. Later, NPK1 and LN were also rejected as explanatory variables when it was pointed out (Dr. G. Castillo, Dr. R. Barker) that many farmers simultaneously adopted new varieties and employed increased amounts of purchased inputs. But the Chow tests were not repeated as there seemed little basis to expect different results.

Table 3.4

RESULTS OF CHOW TESTS (a = .01) FOR VALIDITY OF POOLS ACROSS EXTENSION GROUPS, SEPARATELY FOR DEPENDENT VARIABLES NEW1(68) AND NEW2[a]

	NEW1(68)			NEW2		
	I	II	I & II	I	II	I & II
Rainfed Lowland						
II	No	-	-	No	-	-
III	Yes	Yes	Yes	Yes	Yes	Yes
II & III	No	-	-	Yes	-	-
Irrigated Wet Season						
II	Yes	-	-	Yes	-	-
III	No	Yes	No	Yes	Yes	Yes
II & III	No	-	-	Yes	-	-
Irrigated Dry Season						
II	Yes	-	-	Yes	-	-
III	Yes	Yes	Yes	Yes	Yes	Yes
II & III	Yes	-	-	Yes	-	-

[a]For combinations of independent variables, see text.

pooled with either Group I or Group II; but Group I might not be pooled with Group II. The results were the same for both dependent variables. Subsequent tests indicated that, for variable NEW2, Group I might be pooled with the joint Group II-III, and Group III might be pooled with the joint I-II; on these grounds all groups are pooled when the dependent variable is NEW2.

On the other hand, when the dependent variable is NEW1(68), one test indicated that Group I might not be pooled with the joint Group II-III, while another indicated that Group III might be pooled with the joint Group I-II. It was concluded that there is a greater similarity, coefficient-vectorwise, between Groups II and III than between Groups I and II, such that the more appropriate grouping is I versus II-III, i.e., program cooperators versus all other farmers, whether in program areas or not.

For Irrigated Wet Season farms in the case of NEW1(68), the initial tests indicated that Group II might be pooled with either Group I or Group III; but Group I might not be pooled with Group III. Subsequent tests indicated that pools of I with II-III or I-II with III would be similarly invalid. It was then decided that the grouping pattern already established for Rainfed Lowland farms would probably be more relevant: Group I was kept separate, and the other two groups were pooled.

Further tests indicated that complete pooling would be valid for NEW2 functions of Irrigated Wet Season farms, and for both NEW1(68) and NEW2 functions of Irrigated Dry Season farms.

The difference in the test results between the two dependent variables suggests that the propensity of farmers to respond to other factors besides the agricultural extension service is much less affected by the distribution of this service in later stages of the diffusion process. It seems reasonable to expect that the diffusion of knowledge complementary to a technological innovation takes place with a speed directly related to the innovation's promise. In which case, the lack of direct contact with the agricultural extension service implies a lesser ability to respond to, say, cheaper credit only for a very short period of time.

For variable NEW1(68), the validity of completely pooling Irrigated Dry Season farms but not Rainfed or Irrigated Wet Season farms also fits this pattern. The profitability of shifting to the new varieties is clearly greatest for farmers with two-crop irrigation, and such farmers are the earliest adoptors. Hence differentiation by extension assistance will tend to lose validity earliest for Irrigated Dry Season farms.

3.3 Diffusion patterns

The patterns of acceptance of the new varieties over 1967-1969 of the extension groupings arrived at in the preceeding section are indicated by the cumulative use-ratios in Tables 3.5 and 3.6. These are ratios of farmers using new varieties to the total number of farmers in the group.

Table 3.5 indicates that general usage of the new varieties has increased at quite a rapid rate. From near-zero usage in 1966, usage among rainfed lowland farmers increased to a (planned) 33.7% in 1969; among irrigated wet season farmers it increased to a (planned) 66.3% in 1969, and among irrigated dry season farmers to a (planned) 68.4% in 1969. The increase in usage is seen to be more rapid among cooperators than among non-cooperators.

The use-ratios in the preceding table show the net result of some farmers <u>newly</u> adopting new varieties and others rejecting them after trial. Table 3.6 probes into the components of the use-ratios by indicating the extent of rejection by farmers who have used new varieties and also the extent of acceptance by farmers who were non-users in specific years. For instance, considering rainfed lowland cooperators, out of 9 specific farmers

Table 3.5

1967-1969 NEW VARIETY CUMULATIVE USE-RATIOS CLASSIFIED BY CROP TYPE AND FINAL EXTENSION GROUPING, CENTRAL LUZON SUB-SAMPLE, IN %

	1967	1968	1969[a]
RAINFED LOWLAND			
Cooperators	13.0	24.6	37.7
Others	3.8	7.0	32.9
Total	5.3	10.0	33.7
IRRIGATED WET SEASON			
Cooperators	14.7	33.5	71.1
Others	7.6	17.8	61.9
Total	11.0	25.3	66.3
IRRIGATED DRY SEASON	26.2	47.1	68.4

[a]Planned. Other years are actual.

Table 3.6

1967-1969 NEW VARIETY CUMULATIVE USE-RATIOS OF USERS CLASSIFIED BY YEAR OF USE AND OF NON-USERS CLASSIFIED BY YEAR OF NON-USE, CENTRAL LUZON SUB-SAMPLE, IN %

	USERS			NON-USERS		
	1967	1968	1969[a]	1967	1968	1969[a]
RAINFED LOWLAND						
Cooperators (69)[b]	(9)[b]	(17)	(26)	(60)	(52)	(43)
1967	100.0	47.1	19.2	0.0	1.9	9.3
1968	88.9	100.0	46.1	15.0	0.0	11.6
1969[a]	55.5	70.6	100.0	35.0	26.9	0.0
Others (343)	(13)	(24)	(113)	(330)	(319)	(230)
1967	100.0	54.2	9.7	0.0	0.0	0.9
1968	100.0	100.0	16.8	3.3	0.0	2.2
1969[a]	84.6	79.2	100.0	30.9	29.4	0.0
Total (412)	(22)	(41)	(139)	(390)	(371)	(273)
1967	100.0	51.2	11.5	0.0	0.3	2.2
1968	95.5	100.0	22.3	5.1	0.0	3.7
1969[a]	72.7	75.6	100.0	31.5	29.1	0.0
IRRIGATED WET SEASON						
Cooperators (218)	(32)	(73)	(155)	(186)	(145)	(63)
1967	100.0	37.0	19.3	0.0	3.4	3.2
1968	84.3	100.0	41.3	24.7	0.0	14.3
1969[a]	93.8	87.7	100.00	67.2	62.8	0.0
Others (236)	(18)	(42)	(146)	(218)	(194)	(90)
1967	100.0	35.7	11.6	0.0	1.5	1.1
1968	83.3	100.0	24.7	12.4	0.0	6.7
1969[a]	194.4	85.7	100.0	59.2	56.7	0.0
Total (454)	(50)	(115)	(301)	(404)	(339)	(153)
1967	100.0	36.5	15.6	0.0	2.4	2.0
1968	84.0	100.0	33.2	18.1	0.0	9.8
1969[a]	94.0	87.0	100.0	62.9	59.3	0.0
IRRIGATED DRY SEASON						
Total (206)	(54)	(97)	(141)	(152)	(109)	(65)
1967	100.0	48.5	29.8	0.0	6.4	1.8
1968	87.0	100.0	54.6	3.3	0.0	3.1
1969[a]	77.8	79.4	100.0	65.1	58.7	0.0

[a]Planned. Other years are actual.
[b]Numbers in parenthesis are sample sizes.

who used new varieties in 1967, 88.9% (or 8 farmers) continued to be users in 1968, and 55.5% (or 5 farmers) planned to be users in 1969. On the other hand, again considering rainfed lowland cooperators, out of 43 specific farmers who did not plan to use new varieties in 1969, 9.3% (or 4 farmers) had used them in 1967, and 11.6% (or 5 farmers) had used them in 1968. The rate of replacement of new varieties by traditional ones can be observed to some extent in all columns except the third and fourth.

The third and fourth columns are appropriate for observing patterns of new acceptance. Considering for instance irrigated dry season farmers, we note that 141 specific farmers planned to be users in 1969, and that of these 29.8% (or 42 farmers) had been users in 1967, while 54.6% (or 77 farmers) had been users in 1968. In the same category there were 152 farmers who were non-users in 1967; 3.3% (or 5 farmers) became users in 1968, and 65.1% (or 99 farmers) planned to be users in 1969.

Among rainfed lowland farmers, the rates of rejection are greater among cooperators than among non-cooperators. Since the extension service recommends the new varieties for irrigated rather than rainfed farms, this result is not unexpected. Among irrigated farms the rates of rejection are fair in size, but not quite as large as those of rainfed farms.

The table also gives more detailed information on the earliness of adoption by irrigated farms compared to rainfed farms. If we take groups which planned to use new varieties in 1969, we find that among rainfed farmers 11.5% had been users in 1967, whereas among irrigated wet season farmers 15.6% had been users in 1967, and among irrigated dry season farmers 29.8% had already been users in 1967. Conversely let us consider groups which were non-users in 1967. Among rainfed farmers 31.5% planned to be users in 1969; among irrigated wet and dry season farmers the cumulative planned use-ratios were 62.9% and 65.1% respectively.

3.4 Use of new varieties in 1968: estimated probability/discriminant functions

The problem of specification of independent variables is difficult to resolve. As earlier stated, the very first regressions, for purposes of the Chow tests, made use of (dated contemporaneously with the dependent variable) AGE, AIN, NPK1, CH, LN and INTRST plus SCHOOL or EXPERT and MQ3 or MQ4. SCHOOL and EXPERT were considered as competing, substitute indicators of farmer proficiency; whereas MQ3 and MQ4 were competing indicators of commercialization or market-orientation, the former representing operator-commercialization and the latter representing operator-and-landlord-commercialization.[9] The variable OWNER, PUMP and EXT1 were included in later regressions.

Specification decisions were based on the performance of a particular variable, across alternative specifications, in terms of agreement of the estimated sign of the coefficient with the a priori expectation and the computed t-ratio. It was assumed however that SCHOOL or EXPERT, AIN and OWNER formed a core of independent variables which might not be deleted. Given these three variables in the core, F_2 - tests for other variables did not turn

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[9] MQ3 represents the operator's marketed surplus ratio, whereas MQ4 represents the farm's marketed surplus ratio.

out significant at the .05 level; but this did not seem valid ground for rejecting all other variables, particularly if they consistently had the 'right' signs and had t-ratios of fair size. The results of the F_2 - tests might be kept in back of mind when viewing the computations.

Tables 3.7 to 3.11 contain the final set of estimated probability/discriminant functions, by crop year, where the dependent variable refers to the use of new varieties in crop year 1968. Some of the originally considered variables are no longer present. AGE was rejected fairly early as being of little significance to the diffusion functions. Its t-ratios were small and its sign was alternately positive and negative with no clear leaning either way. The t-ratios of SCHOOL were fair in size relative to other included variables, but dwarfed by those of EXPERT. At times negative SCHOOL coefficients were obtained. Thus, about midway in the analysis, SCHOOL was rejected from the specifications in favor of EXPERT. As expected, the degree of expertise in rice farming was found to be much more relevant to adoption of the new varieties than the level of formal schooling.

The validity of NPK1, CH and LN became doubtful when it was pointed out from independent observations that increased use of purchased inputs simultaneous with adoption was the rule rather than the exception, i.e., NPK1, CH, LN and the adoption dummy are probably co-determined variables. Considering also the necessary reservations with respect to the interpretation of NPK1 and CH as constructed here, it seemed necessary to delete all three variables from subsequent regressions. (The above objection would also apply to EXPERT, with respect to possible new learning of techniques, and possible shifts from zero to positive levels of CH and NPK1, since EXPERT is partly a function of CH and NPK1. To meet this argument, EXPERT(67) was used in place of EXPERT(68) when NEW1(68) functions were being estimated (thus lagging 'expertise' one year behind adoption), with very little diminution in the significance of the variable EXPERT.)

The significance of the estimated functions is best indicated by the statistic F_1. It is not unexpected that lends of R^2 should be low (less than. 20) by ordinary regression standards when the dependent variable employed is a zero-one dummy.

The regressions covering rainfed farms are much less significant than those covering irrigated farms. The F_1 values for rainfed cooperators are significant only at the 5% level; those for rainfed non-cooperators are all less than one and therefore non-significant. Corresponding values for irrigated farms are almost all significant at the 1% level. Among wet season farms, the F_1 values for cooperators are distinctly greater than those concerning non-cooperators. It is interesting to find that overall 'goodness of fit' is directly related to an a priori hierarchy of crop type and extension grouping according to likelihood of use of the new varieties.

Let us consider the performance of the independent variables across the several strata and the various function-specifications. The coefficient of EXPERT(67) is consistently positive, and its t-ratios and partial correlation coefficients are generally far larger than those of the other variables. Thus, given the crop type and extension grouping, it is clear that the pattern of diffusion of the new varieties among farmers is accounted for more by the extent of farmer expertise concerning rice farming than by any other of the variables tested.

It is not clear, however, that larger farms are always more likely to be users of new varieties than smaller farms. The coefficients of AIN are positive, with moderately large t-ratios, in the rainfed regressions (both for cooperators and non-cooperators) and in the regressions for irrigated wet season cooperators. But they are almost always negative with respect to the irrigated wet season non-cooperators and the irrigated dry season farms; in these cases the t-ratios are at the most scarcely larger than one. The 1968 means of hectarage planted of users versus non-users in the various strata are as follows:

	Users	Non-Users
Rainfed Lowland	2.38	1.79
Cooperators	3.06	2.06
Others	1.90	1.75
Irrigated Wet Season	2.67	2.30
Cooperators	3.04	2.39
Others	2.02	2.23
Irrigated Dry Season	1.95	2.00

We may note that the mean area planted is larger for users than for non-users except for the last two categories. Non-users among the irrigated wet season non-cooperators and the irrigated dry season farms had slightly larger farms than users.

Ownership of the land by the operator probably contributes positively to diffusion; but if so, the contribution is only moderately large. This is indicated by the coefficients of the variable OWNER, which are positive (except for some of the rainfed regressions) and generally non-significant. Since OWNER is a one-zero dummy, the coefficients may immediately be read off as the contribution of owner-operatorship to the total probability- or discriminant-points of the farmer.

Among irrigated wet season farmers, the coefficient of OWNER is estimated at either about .09 or .04 depending respectively on whether or not MQ4 is included in the specification of independent variables. This is true for both cooperators and non-cooperators. MQ4 itself -- the farm's marketed surplus ratio -- is a much more significant variable than MQ3 -- the operator's marketed surplus ratio. The increase in the size of the coefficient of OWNER consequent upon the addition of the variable MQ4 indicates that OWNER and MQ4 are negatively related, holding other included variables constant.[10] In other words, the share of total output which is marketed is greater among tenant farms (counting the landlord's rent as market-directed) than among owner-operated farms. Since the marketed surplus ratio, as an index of farm-commercialization, contributes positively to diffusion; since this ratio is negatively related to owner-operatorship; and since consideration of ownership without allowance for the marketed surplus ratio results in imputing the effect of both variables to owner-

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[10] See, e.g., Goldberger (1964), pp. 196-7, on consequences of specification bias in regression models.

ship alone; then the coefficient of OWNER is (erroneously) less when MQ4 is omitted from the specification.

Among irrigated dry season farmers there is also some variation in the size of the OWNER coefficient, depending on specification, but the probable correct location of the coefficient is not too clear. In this case the larger coefficients are obtained when MQ3 is specified. However both MQ3 and MQ4 perform very poorly: with negative signs and very large standard errors. Hence the 'better' specification is not clearly indicated.[11]

We have been led into an empirical evaluation of the relative merits of the variables MQ3 and MQ4. The performance of these variables was disappointing, with the important exception of the irrigated wet season regressions, already mentioned above, in which MQ4 turned out as anticipated to be superior to MQ3. In most of the other regressions the results were nonsignificant negatives. Hence the relevance of commercialization as a contributor towards diffusion is only partly substantiated.

In most cases, the estimated coefficient of the interest rate variable had the expected sign, i.e., negative.

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[11]Since the dry season farmers are a subset of the irrigated wet season farmers, one might tentatively set the OWNER coefficient at the same level as the 'preferred' level arrived at in the irrigated wet season regressions.

The only exceptions are the regressions for rainfed cooperator farms (t-ratios less than one). Among non-cooperator farms, whether rainfed or irrigated (wet season), the coefficients were not large absolutely and had rather small t-ratios. However, among irrigated wet season cooperators the coefficients are clustered about -.38; and among irrigated dry season farms they are clustered about -.61. The corresponding t-ratios are likewise respectable in size[12]. It may be concluded that a given decline in the cost of financing operating expenses contributes to the diffusion of new varieties, and that the size of this contribution is related to the initial favorability of the farmer's crop type and extension grouping.

The variable PUMP was included in the irrigated farm regressions to consider whether water control was a significant factor affecting diffusion. The results were quite consistent across specifications of the wet season functions: the coefficients clustered about .12, with t-ratios of about two. However, the variable was not as significant in the dry season functions, the coefficients

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[12]The sizes of these coefficients take on greater importance from the viewpoint of a discriminant function than from the viewpoint of a probability function, considering that the critical cut-off points for the discriminant function are less than .50. See note to Table 3.12.

being mostly negative, with t-ratios less than one. This result is somewhat surprising since it would seem a priori that the relative importance of pump irrigation would be greater in the dry than in the wet season. However, the proportion having pump irrigation was actually smaller among dry season farmers than among wet season farmers:

	Percentage of irrigated farms with pumps	
	Adoptors	Non-Adoptors
Wet season	27.0	15.6
Dry Season	11.3	11.9

Although pump irrigation is more preponderant among non-users of new varieties in the dry season, the difference is seen to be rather slight. Apparently a good number of farms having pumps did not grow a second crop of rice. They may have grown a different dry season crop. Since the dry season results are much less conclusive than those of the wet season, the tentative finding is that pump irrigation, in contrast with gravity irrigation, is a factor favorable to diffusion.

The Chow tests which indicated that coefficient-vectors would not be significantly different for irrigated dry season cooperators vis-a-vis non-cooperators implied that it would not be fruitful to have two separate strata, but did not necessarily imply that extension grouping would be an insignificant variable within a joint stratum. Hence EXT1 (one if the farmer is a 'cooperator', zero otherwise) was included among the irrigated dry season specifications. The result is a clustering of the coefficient at about .08, with t-ratios slightly greater than one. The coefficient compares favorably in absolute size with that of OWNER, i.e., the absolute contribution towards diffusion of priority extension aid is about as large as the contribution of owner-operatorship.

Let us now turn to a consideration of what seem to be 'preferred' selections among the various specifications tested under each stratum. In general, the regressions were rather unsuccessful with respect to the rainfed farms. F_1- values were rather low, a number of coefficients had 'wrong' signs and relatively large standard errors. The only variable which showed a clear contribution to diffusion was EXPERT. In view of these results no rainfed function was used in the discriminant analysis of Table 3.12.

For irrigated wet season cooperators, the specification chosen was selection 12, which in addition to EXPERT, AIN and OWNER includes INTRST and PUMP, and prefers MQ4 to MQ3. The same specification was chosen for the non-cooperators, i.e., selection 19. We may note that INTRST and MQ4 are more significant in the relation covering co-operators than in the one covering non-cooperators. The specification chosen for irrigated dry season farms was selection 9, which includes EXT1 but omits PUMP and the marketed surplus ratio on account of their negative signs. The results of the discriminant analysis for irrigated farms are summarized in Table 3.12. The variable means for users and non-users separately are in Table 3.13.

Of 73 new variety users among the 218 wet season cooperators in the sample, 46 are correctly individually identified; of 145 non-users, 107 are correctly individually identified. The correctness of individual identification is thus indicated by comparing diagonal elements of the actual/computed 2 x 2 table with the row totals. On this criterion we see that, over the three strata, roughly 60% of the individual farmers are correctly identified according to varietal acceptance.

However, a more interesting criterion for assessing the diffusion functions is accuracy in estimating the cumulative use ratio of the sample group. The estimated functions are more useful on this aggregative criterion than on the criterion of individual accuracy since some of the errors of classifying adoptors as non-adoptors are offset by errors of classifying non-adoptors as adoptors. We then find that the computed acceptance ratios for the sample wet season cooperators, wet season non-cooperators and dry season farms are respectively 38.5%, 32.2%, and 48%; on the other hand the actual acceptance ratios are respectively 33.5%, 17.8% and 47.1%. Thus on the aggregate criterion the validity of the diffusion functions for the first and third strata are verified. However, the function for the second stratum (wet season non-cooperators) leaves more to be desired.

Table 3.7

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
RAINFED LOWLAND
COOPERATORS, N = 69

Independent Variable	Selection 1	2	3	4	5	6
11 EXPERT(67)	.541 (.332)	.459 (.345)	.562 (.331)	.530 (.333)	.474 (.343)	.456 (.346)
22 AIN	.0746 (.0367)	.0722 (.0369)	.111 (.046)	.0948 (.0434)	.110 (.046)	.0907 (.0438)
12 OWNER	-.153 (.115)	-.166 (.166)	-.127 (.116)	-.225 (.142)	-.140 (.117)	-.230 (.142)
3 INTRST		.406 (.448)			.445 (.446)	.368 (.452)
36 MQ3			-.303 (.229)		-.318 (.230)	
37 MQ4				-.236 (.269)		-.213 (.271)
Constant	.0126	.0212	-.0032	.118	.0054	.116
R^2	.149	.160	.172	.160	.185	.168
F_1	3.808	3.054	3.325	3.039	2.860	2.552

Table 3.8

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
RAINFED LOWLAND
NON-COOPERATORS, (N = 343)

Independent Variable	Selection 1	2	3	4	5	6
11 EXPERT(67)	.108 (.097)	.116 (.097)	.0949 (.0978)	.114 (.097)	.102 (.098)	.121 (.097)
22 AIN	.0042 (.0103)	.0050 (.0104)	.0013 (.0108)	.0070 (.0108)	.0019 (.0108)	.0076 (.0108)
12 OWNER	.0162 (.0288)	.0124 (.0290)	.0169 (.0288)	-.0043 (.0368)	.0130 (.0290)	-.0070 (.0369)
3 INTRST		-.0869 (.0857)			-.0902 (.0858)	-.0839 (.0858)
36 MQ3			.0576 (.0610)		.0602 (.0610)	
37 MQ4				-.0573 (.0642)		-.0547 (.0642)
Constant	.0435	.0480	.0396	.0726	.0441	.0756
R^2	.005	.008	.008	.008	.011	.011
F_1	.620	.722	.688	.663	.772	.722

Table 3.9

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
IRRIGATED WET SEASON
COOPERATORS, (N = 218)

Independent Variable	Selection 1	2	3	4	5	6
11 EXPERT(67)	.762 (.147)	.729 (.149)	.763 (.147)	.724 (.147)	.752 (.146)	.729 (.149)
22 AIN	.0484 (.0160)	.0491 (.0160)	0.457 (.0168)	0.396 (.0166)	0.477 (.0160)	.0464 (.0167)
12 OWNER	.0456 (.0729)	.0406 (.0729)	.0377 (.0743)	.0960 (.0773)	.0473 (.0726)	.0324 (.0743)
3 INTRST		-.376 (.298)				-.378 (.298)
36 MQ3			.0656 (.1184)			.0678 (.1183)
37 MQ4				.286 (.153)		
30 PUMP					.121 (.077)	
Constant	.0181	.0436	.003	-.152	-.0004	.0279
R^2	.144	.151	.146	.158	.154	.152
F_1	12.040	9.460	9.080	10.010	9.710	7.610

Table 3.9 Cont'd.

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
IRRIGATED WET SEASON
COOPERATORS, (N = 218)

Independent Variable	Selection 7	8	9	10	11	12
11 EXPERT(67)	.692 (.149)	.717 (.148)	.753 (.146)	.716 (.147)	.717 (.149)	.682 (.149)
22 AIN	.0404 (.0166)	.0484 (.0160)	.0454 (.0167)	.0394 (.0166)	.0460 (.0167)	.0402 (.0166)
12 OWNER	.0906 (.0774)	.0422 (.0726)	.0404 (.0741)	.0954 (.0771)	.0350 (.0741)	.0898 (.0771)
3 INTRST	-.369 (.296)	-.391 (.297)			-.393 (.298)	-.383 (.296)
36 MQ3			.0576 (.1182)		.0596 (.1180)	
37 MQ4	.283 (.153)			.273 (.153)		.270 (.153)
30 PUMP		.124 (.077)	.119 (.077)	.113 (.077)	.122 (.077)	.116 (.077)
Constant	-.126	.026	-.014	-.162	-.012	.135
R^2	.164	.161	.155	.167	.162	.173
F_1	8.330	8.140	7.790	8.480	6.800	7.370

Table 3.10

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
IRRIGATED WET SEASON
NON-COOPERATORS, (N = 236)

Independent Variable	Selection 1	2	3	4	6	7
11 EXPERT(67)	.723 (.134)	.722 (.134)	.716 (.134)	.727 (.134)	.689 (.134)	.715 (.134)
22 AIN	-.0178 (.0128)	-.0178 (.0129)	-.0132 (.0137)	-.0230 (.0140)	-.0218 (.0129)	-.0131 (.0137)
12 OWNER	.0441 (.0517)	.0434 (.0519)	.0497 (.0520)	.0770 (.0626)	.0604 (.0520)	.0490 (.0522)
3 INTRST		-.0017 (.0061)				-.0015 (.0061)
36 MQ3			-.0956 (.0980)			-.0951 (.0983)
37 MQ4				.120 (.128)		
30 PUMP					.124 (.062)	
Constant	.079	.080	.098	.007	.066	.099
R^2	.115	.115	.118	.118	.130	.118
F_1	10.010	7.500	7.740	7.720	8.600	6.180

Table 3.10 Cont'd.

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
IRRIGATED WET SEASON
NON-COOPERATORS, (N = 236)

Independent Variable	Selection 8	10	12	14	17	19
11 EXPERT(67)	.727 (.134)	.689 (.134)	.685 (.134)	.694 (.134)	.685 (.135)	.693 (.135)
22 AIN	-.0230 (.0140)	-.0217 (.0129)	-.0180 (.0138)	-.0267 (.0140)	-.0179 (.0138)	-.0266 (.0141)
12 OWNER	.0768 (.0628)	.0598 (.0522)	.0641 (.0523)	.0914 (.0627)	.0636 (.0525)	.0912 (.0628)
3 INTRST	-.0020 (.0061)	-.0011 (.0060)			-.0010 (.0061)	-.0014 (.0061)
36 MQ3			-.0753 (.0981)		-.0750 (.0983)	
37 MQ4	.122 (.129)			.114 (.128)		.115 (.128)
30 PUMP		.124 (.063)	.119 (.063)	.123 (.062)	.119 (.063)	.122 (.063)
Constant	.006	.066	.081	-.003	.082	-.003
R^2	.118	.130	.132	.133	.132	.133
F_1	6.17	6.85	6.98	7.03	5.80	5.84

Table 3.11

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
IRRIGATED DRY SEASON (N =206)

Independent Variable	Selection 1	2	3	4	5	7
11 EXPERT(67)	.882 (.156)	.937 (.157)	.902 (.156)	.885 (.157)	.857 (.157)	.955 (.157)
22 AIN	-.0271 (.0291)	-.0924 (.0288)	-.0133 (.0305)	-.0255 (.0304)	-.0310 (.0292)	-.0163 (.0303)
12 OWNER	.0714 (.0741)	.0585 (.0737)	.0949 (.0756)	.0654 (.0812)	.0782 (.0742)	.0811 (.0752)
3 INTRST		-.619 (.288)				-.606 (.287)
36 MQ3			-.185 (.126)			-.176 (.125)
37 MQ4				-.0298 (.1609)		
18 EXT1					.0778 (.0671)	
30 PUMP						
Constant	.287	.303	.310	.304	.255	.325
R^2	.140	.159	.149	.140	.146	.168
F_1	10.96	9.52	8.80	8.19	8.57	8.05

Table 3.11 Cont'd.

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
IRRIGATED DRY SEASON (N =206)

Independent Variable	Selection 8	9	10	16	17	18
11 EXPERT(67)	.938 (.158)	.912 (.158)	.951 (.158)	.928 (.158)	.973 (.158)	.916 (.159)
22 AIN	-.0292 (.0302)	-.0333 (.0290)	-.0259 (.0292)	-.0189 (.0302)	-.0108 (.0308)	-.0308 (.0302)
12 OWNER	.0576 (.0806)	.0652 (.0738)	.0601 (.0738)	.0930 (.0755)	.0849 (.0754)	.0552 (.0805)
3 INTRST	-.619 (.289)	-.619 (.287)	-.620 (.288)	-.603 (.286)	-.605 (.287)	-.612 (.289)
36 MQ3				-.204 (.127)	-.190 (.126)	
37 MQ4	-.0042 (.1599)					-.0518 (.1645)
18 EXT1		.0776 (.0665)		.0947 (.0671)		.0828 (.0686)
30 PUMP			-.0778 (.1030)		-.0961 (.1033)	
Constant	.306	.271	.302	.289	.324	.299
R^2	.159	.165	.162	.176	.171	.165
F_1	7.58	7.90	7.72	7.08	6.85	6.57

Table 3.11 Cont'd.

ESTIMATED DIFFUSION FUNCTIONS FROM CENTRAL LUZON SUB-SAMPLE
DEPENDENT VARIABLE = NEW1(68)
IRRIGATED DRY SEASON (N =206)

Independent Variable	Selection 19	20	23	24
11 EXPERT(67)	.951 (.159)	.926 (.159)	.946 (.159)	.930 (.160)
22 AIN	-.0255 (.0306)	-.0296 (.0294)	-.0128 (.0308)	-.0266 (.0306)
12 OWNER	.0537 (.0807)	.0674 (.0739)	.0982 (.0757)	.0564 (.0806)
3 INTRST	-.619 (.290)	-.619 (.288)	-.602 (.286)	-.612 (.289)
36 MQ3			-.222 (.128)	
37 MQ4	-.0070 (.1601)			-.0576 (.1648)
18 EXT1		.0816 (.0667)	.101 (.067)	.0874 (.0689)
30 PUMP	.0778 (.1032)	-.0867 (.1031)	-.110 (.103)	-.0882 (.1034)
Constant	.306	.268	.286	.298
R^2	.162	.168	.180	.168
F_1	6.40	6.69	6.23	5.73

Table 3.12

DISCRIMINANT ANALYSIS: ACTUAL VS. COMPUTED
ADOPTION OF NEW RICE VARIETIES IN 1968

	ACTUAL	COMPUTED: Observation Counts: Non-adoptors	Adoptors	Row totals	Percentages: Non-adoptors	Adoptors	Row totals
Irrigated Wet Season Cooperators	Non-adoptors	107	38	145	49.1	17.4	66.5
	Adoptors	27	46	73	12.4	21.1	33.5
	Col. totals	134	84	218	61.5	38.5	100.0
Irrigated Wet Season Others	Non-adoptors	146	48	194	61.9	20.3	82.2
	Adoptors	14	28	42	5.9	11.9	17.8
	Col. totals	160	76	236	67.8	32.2	100.0
Irrigated Dry Season	Non-adoptors	76	33	109	36.9	16.0	52.9
	Adoptors	30	67	97	14.5	32.5	47.1
	Col. totals	106	100	206	51.4	48.5	100.0

Discriminant functions are from October 6-7, 1969 computations. Irrigated wet season, cooperators: selection 12, cut-off = .36349. Irrigated wet season, others: selection 19, cut-off = .22072. Irrigated dry season: selection 9, cut-off = .47569.

Table 3.13

USERS VS. NON-USERS OF NEW VARIETIES IN 1968, CENTRAL LUZON SUB-SAMPLE: MEAN LEVELS OF RICE OUTPUT, AREA PLANTED, EXPERTISE, OWNERSHIP, THE MARKETED SURPLUS RATIO, THE INTEREST RATE AND PUMP IRRIGATION

	Output Q		Area Planted AIN		Expertise EXPERT	
	1967	1968	1967	1968	1967	1968
A. <u>1968 USERS</u>						
Rainfed Lowland	110.8	120.9	2.35	2.38	.195	.263
Cooperators	157.5	172.0	3.01	3.06	.252	.294
Others	77.8	84.8	1.88	1.90	.155	.208
Irrigated Wet Season	129.9	162.9	2.55	2.67	.318	.457
Cooperators	147.6	186.4	2.93	3.04	.331	.429
Others	39.1	122.1	1.90	2.02	.295	.371
Irrigated Dry Season[a]	106.1	117.8	1.92	1.95	.328	.365
B. <u>1968 NON-USERS</u>						
Rainfed Lowland	75.2	30.0	1.79	1.79	.125	.138
Cooperators	93.5	96.8	2.04	2.06	.162	.170
Others	72.2	77.2	1.75	1.75	.119	.133
Irrigated Wet Season	106.7	109.8	2.31	2.30	.164	.193
Cooperators	107.3	111.1	2.39	2.39	.189	.219
Others	106.3	108.9	2.24	2.23	.145	.174
Irrigated Dry Season[b]	88.8	96.6	2.03	2.00	.176	.208

[a] EXT1 = .629 = proportion of users who are cooperators.

[b] EXT1 = .514 = proportion of non-users who are cooperators.

USERS VS. NON-USERS OF NEW VARIETIES IN 1968, CENTRAL LUZON SUB-SAMPLE: MEAN LEVELS OF RICE OUTPUT, AREA PLANTED, EXPERTISE, OWNERSHIP, THE MARKETED SURPLUS RATIO, THE INTEREST RATE AND PUMP IRRIGATION

	Ownership OWNER	Marketed Surplus Ratios MQ3	Marketed Surplus Ratios MQ4	Interest Rate INTRST		Pump Irrigation PUMP	
	1968	1968	1968	1967	1968	1967	1968
A. 1968 USERS							
Rainfed Lowland	.293	.258	.513	.051	.047	-	-
Cooperators	.118	.289	.631	.072	.071	-	-
Others	.417	.237	.429	.037	.029	-	-
Irrigated Wet Season	.313	.350	.676	.029	.052	.235	.270
Cooperators	.301	.402	.712	.028	.029	.233	.247
Others	.333	.259	.613	.030	.092	.238	.310
Irrigated Dry Season[a]	.289	.314	.654	.020	.025	.134	.113
B. 1968 NON-USERS							
Rainfed Lowland	.350	.187	.487	.250	.057	-	-
Cooperators	.288	.251	.539	.176	.026	-	-
Others	.361	.176	.479	.261	.062	-	-
Irrigated Wet Season	.251	.328	.625	.232	.270	.156	.156
Cooperators	.193	.345	.644	.578	.059	.145	.152
Others	.294	.316	.611	.039	.362	.165	.160
Irrigated Dry Season[b]	.239	.345	.655	.027	.043	.119	.119

[a] EXT1 = .629 = proportion of users who are cooperators.

[b] [illegible] proportion of non-users who are cooperators.

3.5 Planned use of new varieties in 1969

The computed equations which used NEW2 (one if the farmer states that he plans to use a new variety in 1969, zero otherwise) in lieu of NEW1(68) were of more uneven quality. Ranges of the parameter estimates are summarized in Table 3.14. A striking feature is that the computed constants are quite large, which, from the probability viewpoint, allows a relatively small potential contribution to the independent variables.

The rainfed farm regressions were again not significant by the F_1 - test. Standard errors were relatively large for almost all variables. The irrigated farm regressions were all significant at the 1% level.

In the latter equations, EXPERT again carried the highest significance, with t-ratios of 3 or greater. The coefficient sizes were however much smaller than those in the NEW1(68) functions. Coefficients of AIN were also small and had large standard errors. The hypothesis that farm size is irrelevant to planned use of new varieties in 1969 would easily be accepted. Only OWNER and EXT1 carried consistent coefficient signs across the three strata. Aside from EXPERT, the only other case of relatively high t-ratios was MQ4 in the irrigated dry season regressions.

Table 3.14

PARAMETER RANGES FROM ESTIMATED DIFFUSION FUNCTIONS, CENTRAL LUZON SUB-SAMPLE, DEPENDENT VARIABLE = NEW2

Independent Variable	Rainfed Lowland	Irrigated Wet Season	Irrigated Dry Season
10 EXPERT(68)	-.01,.02	.45,.49	.35,.40
22 AIN	-.03	.01,.02	.02,.04
12 OWNER	.04,.06	.04,.07	.06,.14
3 INTRST	-.15,-.13	-.01	.54,.59
36 MQ3	-.02	.09,.10	.06,.09
37 MQ4	.02	-.07	.28,.30
18 EXT1	.07	.05	.04,.11
30 PUMP	-	-.04	.08,.10
Constant	.36,.38	.46,.54	.28,.48
NEW2 Mean	.34	.63	.68
R^2	Nil	.05	.06,.08
F_1	.8,1.2	4.29,6.91	2.79;4.39
Sample Size	412	454	206

A second set of regressions was run for samples including only those farmers who did not use new varieties in 1968. The constant terms were reduced somewhat for these samples. Regressions were significant only at the 5% level. Performance of the individual variables was again not too consistent across the strata. EXPERT performed well as usual for the irrigated crops, but gave negative coefficients for the rainfed crop. The coefficients of AIN were positive with fair-sized t-ratios for the irrigated dry season crop, but the t-ratios were lower (sometimes less than one) for the irrigated wet season crop; the coefficients were negative for rainfed lowland farmers. OWNER consistently had a positive coefficient. Surprisingly, its significance as indicated by the t-ratios was greatest for the rainfed sample, less for the irrigated wet season crop and least for the irrigated dry season crop. Its absolute value ranged from .07 to .14.

INTRST was a fairly good variable for the irrigated wet season crop, but had very large errors for the rainfed crop and again turned positive for the irrigated dry season crop. MQ3 was usually positive but with large errors, and sometimes negative. MQ4 performed likewise except for the irrigated dry season. EXT1, which was again introduced in all strata since cooperators were pooled with non-cooperators, performed just as badly as MQ3.

3.6 Summary

The acceptance of new varieties was used as a dummy dependent variable in cross-sectional regressions, separately for three crop types. rainfed lowland farms, irrigated wet season farms and irrigated dry season farms. When acceptance in 1968 was considered, Chow tests indicated that the sample farmers under the first two crop types might be separated into two sub-strata, one for cooperators in areas under the government rice production program, and another for all other farmers; the tests indicated that the coefficient vectors from the two sub-strata would be significantly different. The government extension program did not have the same effect on acceptance functions when planned use of new varieties in 1969 was considered. In the latter cases extension was introduced as an independent variable instead.

All things considered, the results were clearer in the statistical sense for the 1968 functions than for the 1969 functions. We know of course that the planned use of new varieties was much greater in 1969 than in 1968. Of the 412 farmers in the rainfed lowland sample, 22 were new variety users in 1967, 41 in 1968, and 139 (planned) in 1969. Of the 454 irrigated wet season farmers, 50 were users in 1967, 115 in 1968, and 301 (planned) in 1969. For the 206 irrigated dry season farmers the cumulative numbers of users are 54, 97 and 141 respectively. It is plausible to find that as diffusion increases such variables as expertise, farm size, ownership etc. tend to lose their ability to distinguish between users and non-users of new varieties.

Many observers have wondered why the new varieties are accepted by so many rainfed farms, since they were originally bred specifically for irrigated conditions. This remains a puzzle since the rainfed lowland results were notably not significant for either 1968 or 1969 regressions.

Given the strata which were used, the most significant variable explaining adoption is farmer expertise, defined by EXPERT. It was originally tested as a substitute for years of formal schooling, defined by SCHOOL, and clearly came out superior. In the irrigated dry season regressions the estimated coefficient of EXPERT was as high as .9. This implies that knowledge of one additional recommended practice (out of 7) contributes .9/7 = 13% to the probability of adoption, if we interpret the regression equation as a probability function. The contribution of the other variables considered are small in comparison.

We have the following general conclusions with respect to the other variables:

1. It is not clear that larger farms are always cet. par. the earlier adoptors. Adoptors in the dry season in particular had slightly smaller farms than non-adoptors.

2. Ownership of the farm contributes moderately to adoption. Since this is negatively related to the farm's marketed surplus ratio, there may be a tendency for its contribution to be underestimated if the latter variable is not simultaneously considered.

3. The marketed surplus ratios did not always have positive coefficients, so it may not be said that non-commercialization is a serious impediment to diffusion. There is a little evidence that the market surplus ratio of operator and landlord combined is more relevant than that of the operator alone.

4. The interest rate coefficient was in most cases negative and of fair size. Its size was found directly related to the initial favorability to diffusion of the crop type and extension grouping.

5. Irrigation by pump rather than by gravity was a contributory factor among wet season farms.

6. Extension assistance was included as a variable rather than a stratifying factor for the dry season farms. Its contribution was approximately the same as that of ownership.

The 1968 regressions for irrigated farms were used to form discriminant functions, and these functions were then applied to the original samples. On the criterion of individual identification of users and non-users, the functions discriminated correctly roughly 60% of the time. It was argued that a more interesting criterion is accuracy in estimating the cumulative use ratios of the sample groups. Offsetting errors contributed to make accuracy under this criterion approximately 90%.

APPENDIX 1

The Rice and Corn Production Program

The Program is implemented by the Rice and Corn Production Coordinating Council (RCPCC), in which a large number of government agencies are represented. [1]The following agencies have major responsibilities:

1. Bureau of Plant Industry (research; procurement of breeder, foundation and registered seeds; seed certification; procurement and distribution of certified seeds; control of pests and diseases)

2. Commission on Agricultural Productivity (educational campaign on improved cultural practices and use of certified seeds)

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[1]The Council's title was very recently (1969) changed to National Food and Agriculture Council, as its interest has expanded to include fish, livestock, vegetables, etc. (The abbreviation RCPCC is still commonly used however). Its original legal basis was R.A. 2084 of June 15, 1958: An Act to Promote Rice and Corn Production. Active work began only in 1966. R.A. 2084 also authorized subsidized sales of fertilizer and seed, but this subsidy was (purposely) not implemented by the RCPCC administration. References for this section are Mina and Tiongson (1967), Arcega (1969), and the RCPCC Four-year Rice and Corn Self-sufficiency Program, updated July 1967.

3. Bureau of Soils (soil analysis and fertilizer recommendations)

4. Agricultural Credit Administration (procurement, warehousing and distribution of fertilizers; loans to cooperatives and farmers)

5. U.P. College of Agriculture (research; production of breeder seed)

Other member agencies are the Bureau of Public Works, Soils, Animal Industry, Lands, and Mines, the Department of General Services, the Agricultural Credit Administration, and the Rice and Corn Administration.

In July 1966, the International Rice Research Institute sold 50 tons of IR8 seed to the government at a price of ₱25 per cavan. Forty tons were channeled at cost to selected private multiplication farms and seed companies, and the rest to test plots of BPI and CAP. IR8 was approved in April 1967, after three seasons of testing. It was the first of the new high-yielding varieties introduced, and continues to be dominant among them. Other varieties early introduced were BPI-76-1 and C-18, the former from the Bureau of Plant Industry and the latter from the U.P. College of Agriculture; at present, the varieties IR5 and C4-63 are rapidly gaining favor.

BPI guarantees seed multipliers a premium for certificable seed of ₱2 above the market price for non-seed grain, minimum ₱12.50/cavan. The seed farms are not obliged to sell to BPI; indeed about half find other buyers more advantageous, and sell without benefit of BPI certification. (It is felt that farmers need to purchase new seed every 2-3 years to maintain genetical purity). Sales from BPI certified seed stocks are made preferentially to RCPCC program cooperators.

The program cooperators are those farmers who receive the most intensive assistance within the RCPCC in terms of Agricultural extension scheme. The Program considers the country as divided into three priority areas, ranked in order of past productivity. Thus all the important Central Luzon provinces are in Priority I. The more productive barrios in a province are chosen as program barrios; these receive more thorough extension assistance than the non-program barrios. Tehn certain farmers within the program barrios are selected as co-operators. Such farmers are not necessarily 'cooperative' in the ordinary sense. The term carries no necessary connotation of initial eargerness on the part of the farmers, although the innovative types doubtless do not find it difficult to become 'cooperators'.

Tables A.1 and A.2 contain RCPCC data on hectarage planted to all varieties and to new varieties respectively in the RCPCC priority areas. They indicate the relative importance of the six provinces chosen for the study. The corresponding cumulative diffusion ratios are in Table A.3. The cumulative dry season ratios at the country level are 9.4% (1967), 23.4% (1968) 51.3% (1969), and the wet season ratios also at the country level are 9.9% (1967), 17.4% (1968). The diffusion process is of course even more rapid for the progressive six provinces under study. As a general conclusion, it is clear that the farmers of this relatively poor country are in no sense laggards so far as the response to a major technological innovation is concerned.

Table A.1

Total Hectarage Planted in Priority Areas of the RCPCC Program

	1967 Dry	1967 Wet	1968 Dry	1968 Wet	1969 Dry[a]
Priority Area I	367,163	1,522,141	237,083	1,203,881	155,047
Total 6 provinces	93,229	713,320	59,075	608,708	40,260
Bulacan	15,771	99,127	5,853	83,339	10,257
Nueva Ecija	10,206	267,387	7,656	266,610	5,385
Pampanga	6,674	69,619	21,845	58,552	8,517
Pangasinan	23,783	188,955	7,870	152,029	7,654
Tarlac	19,362	56,489	5,652	29,880	3,218
Laguna	17,503	31,743	10,199	18,298	5,259
Priority Area II	181,593	589,451	233,636	562,768	66,717
Priority Area III	90,555	165,288	243,351	273,068	90,069
Total	639,311	2,276,880	704,070	2,039,717	311,823

[a]January-March 1969 only.

Table A.2

Hectarage Planted to New Varieties in Priority Areas of the RCPCC Program

	1967 Dry	1967 Wet	1968 Dry	1968 Wet	1969 Dry[a]
Priority Area I	46,798	174,217	81,801	204,693	92,648
Total 6 provinces	22,974	89,852	31,575	97,502	24,207
Bulacan	565	12,187	2,419	16,086	4,282
Nueva Ecija	3,071	16,869	5,337	10,482	2,352
Pampanga	1,175	10,069	6,811	16,058	6,534
Pangasinan	1,132	13,345	5,868	27,787	5,022
Tarlac	14,092	17,455	4,827	16,626	2,617
Laguna	2,939	19,927	6,313	10,513	3,400
Priority Area II	8,627	37,305	43,843	104,066	40,963
Priority Area III	4,407	14,113	39,015	47,420	26,630
Total	60,129	225,635	164,659	356,176	160,241

[a]January-March 1969 only.

Table A.3

Ratio of Hectarage Planted to New Varieties in Priority Areas of the RCPCC Program

	1967 Dry	1967 Wet	1968 Dry	1968 Wet	1969 Dry[a]
Priority Area I	.127	.114	.345	.170	.598
Total 6 provinces	.246	.126	.543	.160	.601
Bulacan	.036	.123	.413	.192	.417
Nueva Ecija	.301	.063	.697	.039	.436
Pampanga	.176	.145	.312	.274	.767
Pangasinan	.048	.071	.746	.182	.658
Tarlac	.728	.309	.854	.556	.813
Laguna	.168	.628	.619	.574	.646
Priority Area II	.048	.633	.188	.184	.613
Priority Area III	.052	.085	.160	.173	.295
Total	.094	.099	.234	.174	.513

[a]January-March 1969 only.

Table A.4

Rice Yields in Priority Areas of the RCPCC Program
in cavans per hectare

	All Varieties			
	1967 Wet	1968 Dry	1968 Wet	1969 Dry[a]
Priority Area I	43.72	49.09	46.84	42.54
Total 6 provinces	48.48	51.24	54.71	42.99
Bulacan	48.44	54.26	45.58	35.26
Nueva Ecija	45.27	61.41	56.08	n.a.
Pampanga	59.10	53.03	56.90	50.65
Pangasinan	45.47	44.30	47.92	38.62
Tarlac	53.67	60.67	74.88	60.40
Laguna	81.52	66.68	68.35	62.48
Priority Area II	40.33	38.81	38.94	57.41
Priority Area III	32.94	40.88	37.55	37.92
Total	42.25	43.63	42.42	43.00

[a]January-March 1969 only.

Table A.4 Contd.

Rice Yields in Priority Areas of the RCPCC Program
in cavans per hectare

	New Varieties			
	1967 Wet	1968 Dry	1968 Wet	1969 Dry[a]
Priority Area I	78.95	69.14	77.32	66.56
Total 6 provinces	86.87	76.41	78.12	62.23
Bulacan	73.71	95.05	62.78	65.98
Nueva Ecija	85.48	67.73	82.14	n.a.
Pampanga	88.82	67.89	79.78	75.14
Pangasinan	85.76	76.29	82.62	48.61
Tarlac	84.26	84.96	79.92	69.42
Laguna	101.81	72.55	75.49	65.29
Priority Area II	82.57	85.50	78.10	92.64
Priority Area III	63.70	62.91	66.90	61.75
Total	78.71	71.09	76.20	67.77

[a]January-March 1969 only.

Table A.4 Contd.

Rice Yields in Priority Areas of the RCPCC Program
in cavans per hectare

	New Varieties ÷ Old Varieties			
	1967 Wet	1968 Dry	1968 Wet	1969 Dry[a]
Priority Area I	2.01	1.61	2.03	1.77
Total 6 provinces	2.02	1.67	1.59	1.65
Bulacan	1.61	2.02	1.53	2.12
Nueva Ecija	2.01	1.37	1.52	n.a.
Pampanga	1.69	1.36	1.78	1.75
Pangasinan	2.16	1.81	2.48	1.33
Tarlac	2.11	1.70	1.36	1.45
Laguna	2.07	1.33	1.29	1.13
Priority Area II	2.27	2.46	2.65	1.76
Priority Area III	2.11	1.70	2.04	1.67
Total	2.07	1.85	2.20	1.76

[a]January-March 1969 only.

Appendix 2

The 1968 Crop and Livestock Survey/Rice and Corn Self-Sufficiency Program Evaluation Survey II[1]

This survey was a joint project of the Bureau of Agricultural Economics and the Rice and Corn Production Coordinating Council (RCPCC). Main emphasis is on palay and corn variables, especially hectarage and production, but data on livestock and other crops are also collected.

Each province, except for the minor outliers Batanes, Palawan and Sulu, is a distinct domain of study. The primary sampling unit is the survey barrio, consisting of all farm households (residences) within the limits of the revenue barrio (the political unit). Barrios within RCPCC first-priority provinces have two main strata,

(1) program barrios, and
(2) non-program barrios.

The sampling fraction is about 1/4 for program barrios and 1/14 for non-program barrios. Simple random sampling

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[1]"The 1968 Crop and Livestock Survey/Rice and Corn Self-sufficiency Program Evaluation Survey II: Operations Manual", Agricultural Estimates and Statistics Branch, Bureau of Agricultural Economics, D.A.N.R., R.P.

without replacement is employed. The Bureau of Agricultural Economics gave permission for a roughly 50% random subsample of the sampled barrios for the purpose of this study. The number of barrios contained in the original sample and those in the subsample used in this study are given in Table B1.

The secondary sampling unit is the farm household, distinguished by commonality of kitchen and residence. Farmer-residents in sample barrios are either (1) program cooperators, or (2) non-cooperators; samples are drawn from these two categories independently. Sampling is systematic with a random start, with a sampling fraction of about 1/15 in each category, provided (a) that at least two non-cooperators are sampled and (b) that all large farms (at least 100 ha.) are sampled.

A farm by definition consists of at least 1,000 sq. meters cultivated to agricultural products or at least 20 head of adult livestock or at least 100 units of adult poultry, entirely operated by one person. The crop year covered is July 1, 1967-June 30, 1968. The inventory date is January 1, 1968. The respondent preferred was the household head, and repeat visits were as much as possible arranged in order that he be interviewed.

Field operations took place during April-May 1968. Interviewers received ₱6/day (the legal minimum), after submitting accomplished survey forms of acceptable quality. Interviewers were to be, in order of preference, those with previous experience, graduates/students of agricultural colleges, graduates/students of other colleges, and finally high school graduates with "experience." Fluency in the language of the region was required. Interviewers were given two days' training, including a practice interview.

Operation Rice Bowl[2] is a project conceived by the military, sometime prior to July 1967, for the purpose of combating communism. (A request was made for financial support from SEATO. Apparently the project has not gotten off the ground.) Its aim is to complement the Central Luzon Development Program by concentrating on (1) extension work in Nueva Ecija (800 ha.) and Pampanga (1,000 ha.) with respect to rice, (2) construction of communal water works in rural areas, (3) road-building through "self-help", (4) land surveys, (5) provision of mobile health services, and (6) establishment of a technical training center.

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[2]R.P. Department of National Defense, Civic Action Coordinating Center, Operation Rice Bowl, mimeo, 28 pp., undated, but with reference to FY 1967/68 as in the future.

Table B1

<u>1968 RCPCC Evaluation Survey: Sizes of Population, Sample & Sub-sample</u>

	(Number of Barrios)		
	Population (* if estimate)	Sample	Sub-sample
Bulacan			
Program	88*	22	11
Non-program	322*	23	12
Land reform area	20	5	5
Nueva Ecija			
Program	152*	38	19
Non-program	364*	26	13
Land reform area	14	3	3
Pampanga			
Program	96*	24	12
Non-program	126*	9	5
Land reform area	249	29	15
Pangasinan			
Program	140*	35	18
Non-program	868*	62	32
Rice Bowl Project	27	6	3
Land reform area	12	2	2
Tarlac			
Program	120*	30	15
Non-program barrios	210	15	8
Land reform area	35	5	5
Laguna			
Program	92*	23	12
Non-program	462*	33	17
Operation Spread	12	2	2

Appendix 3

CLASSIFICATION OF PADDY RICE SOILS ACCORDING TO NATIVE FERTILITY AND EXPECTED RESPONSE TO FERTILIZER[1]

by

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CATEGORIES AND CRITERIA IN CLASSIFICATION OF THE SERIES

<u>Category 1</u>. Soils series with high native fertility that low or no response are obtained from fertilization of ordinary varieties. Improved varieties give economic response from recommended rates of nitrogen primarily.

<u>Category 2</u>. Soil series with medium native fertility that ordinary varieties are expected to give moderate response to recommended rates of nitrogen and additional phosphorous and/or potassium. Improved varieties can be expected to respond to higher rates of N and P and/or K.

<u>Category 3</u>. Soil series with low native fertility that ordinary varieties are expected to give moderately higher response to recommended rates of fertilizers, but improved varieties will require very much higher rates of N and P and/or K.

<u>Category 4</u>. Soil series which have high or medium fertility but other factors such as salt limits response to fertilizers.

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[1]Prepared at the request of Mr. Mahar Mangahas. The classification is based on the assumption that proper cultural methods such as muds, pests, and disease control are used and irrigation water is adequate.

Classification of Soil Series by Category

Category 1	Category 2	Category 3	Category 4
Bani	Arayat	Alaminos	Beach sand
Bantog	Bigaa	Angeles	Hydrosol
Calumpang	Buenavista	Annam	Pangasinan
Candaba	Carmona	Antipolo	
Marikina	Guadalupe	La Paz	
Paete (Bay)	Lipa (Macolod) and mountain soils)	Luisiana	
San Fernando	Luisita	Novaliches	
Umingan	Maligaya	Obando	
	Quingua	Prensa	
	San Fabian	Tarlac	
	San Miguel		
	Zaragosa		

CATEGORIES AND CRITERIA IN CLASSIFICATION OF SOIL TEXTURE

The classification of various soil series where a wide range of textural classes are present may be modified a certain degree according to the following:

Category 1. Where recommended rates can be applied all at planting particularly for short season varieties of 110-125 days.

Category 2. Where split application of N and/or K will produce the best results.

Category 3. Where applications of N and/or K has to be divided into more than two installments in order to obtain most efficient use of fertilizers.

Textual Classes Under Each Category

Category 1	Category 2	Category 3
clay	loam	sand
sandy clay	clay loam	fine sand
silty clay	silt loam	coarse sand
	silty clay loam	very fine sand
	sandy clay loam	loamy sand
	undifferentiated soils[2]	fine sandy loam
		hydrosol[2]

NOTE: In general soil series possess a limited range of textural classes and therefore the classification by soil series should be given more emphasis.

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[2] My classification - M.M.