Part II. FARMERS WHO RECEIVED NEITHER TG-HDP RICE VARIETIES NOR TG-HDP TRAINING ON RICE PRODUCTION

Section 1. CHARACTERISTICS OF THE SURVEYED POPULATION

Tables 1 thorough 5 are frequency representations describing the surveyed population in terms of geographic and ethnic composition. A total of 106 farmers who had received neither rice varieties nor rice production training were selected randomly. (A few farmers reported having received training on rice production; however, none of these individuals were on the list of trained farmers and none had received any rice seed from TG-HDP.) The sampled population was approximately evenly divided between the Wawi and Nam Lang project areas.

Table 1. DISTRIBUTION OF SURVEYED FARMERS BY PROJECT AREA

	Frequency	Percent
TAMBON WAWI	53	50.0
NAM LANG	53	50.0
TOTAL	106	100.0

Table 2. DISTRIBUTION OF SURVEYED FARMERS BY ETHNIC GROUP

	Frequency	Percent
LISU	20	18.9
LAHU	37	34.9
AKHA	21	19.8
KAREN	13	12.3
THAI YAI	13	12.3
OTHER	2	1.9
TOTAL	106	100.0

Table 3. DISTRIBUTION OF SURVEYED FARMERS BY VILLAGE

	Frequency	Percent
SAN CHAROEN KAO	4	3.8
SAN CHAROEN MAI	5	4.7
PHA DAENG MUSER	4	3.8
THUNG PRAO MUSER	2	1.9
THUNG PRAO KARIANG	3	2.8
PONG SALAM	4	3.8
HUEY KHRAI	6	5.7
HUEY NAM YEN	5	4.7
PHA DAENG LISU	7	6.6
DOI CHANG	2	1.9
HUEY PU	5	4.7
WAWI	6	5.7
WANNA LUANG	4	3.8
MAE MU	5	4.7
NONG TONG	3	2.8
LUK KHAOLAM	6	5.7
SOB PONG	3	2.8
JABO	3	2.8
NONG PHA CHAM	5	4.7
PANG KHAM NOI	5	4.7
MAI HUNG	4	3.8
MUANG PAM	5	4.7
THAM LOD	5	4.7
YAPANAE	5	4.7
TOTAL	106	100.0

Table 4. DISTRIBUTION OF SURVEYED FARMERS BY EDUCATION LEVEL

	Frequency	Percent
NONE	79	74.5
LESS THAN 4	11	10.4
4 YEARS	9	8.5
OVER 4 YEARS	6	5.7
	1	.9
TOTAL	106	100.0

Table 5. DISTRIBUTION OF SURVEYED FARMERS BY AGE

	Frequency	Percent
20 OR UNDER	13	12.3
21 TO 40	71	67.0
41 TO 60	19	17.9
OVER 60	2	1.9
NO ANSWER	1	.9
TOTAL	106	100.0

Although none of the persons surveyed had received rice production training (according to TG-HDP records) or improved variety seed, over two thirds were aware of TG-HDP rice production activities in their area. (Table 6) The primary source of information was project officials followed by other villagers. (Table 7) It is probable that many respondants heard of the project from more than one source, e.g., both neighbors and government officials.

Table 6. KNOWLEDGE OF TG-HDP ACTIVITIES

	Frequency	Percent
NO KNOWLEDGE	27	25.5
HAVE KNOWLEDGE	68	64.2
NO ANSWER	11	10.4
TOTAL	106	100.0

Table 7. SOURCE OF KNOWLEDGE OF TG-HDP ACTIVITIES

	Frequency	Percent
RECEIPT OF SEEDS/TRAINING	4	3.8
PROJECT OFFICIALS	28	26.4
OTHER VILLAGERS	21	19.8
NO ANSWER	53	50.0
TOTAL	106	100.0

Section 2. RICE YIELD DATA

The data shown in Table 8 below are all based on yields measured by the survey team. Yields per rai are extrapolated from survey measurements made on three plots per field, each plot 25 square meters in area. The totals may slightly exceed the actual amount of rice a farmer would obtain as the survey methods used as the survey methods precluded virtually all losses which normally occur during harvest and post-harvest transfer to the village.

To get a further indication of variability in yields, measurements of individual 25 square meter plots were extrapolated to yields per rai. The results are shown in Table

9. Variability can be seen here to be rather high, and relatively equally distributed across the yield range.

Table 8. MEASURED AVERAGE RICE YIELD PER RAI (BASED ON MEASUREMENTS OF THREE 25 SQUARE METER PLOTS PER FIELD)

	Frequency	Percent
50 TO 100 KG	1	1.0
101 TO 150 KG	16	16.5
151 TO 200 KG	13	13.4
OVER 200 KG	67	69.1
TOTAL	97	100.0

Table 9. MEASURED AVERAGE RICE YIELD PER RAI (EXTRAPOLATED FROM INDIVIDUAL 25 SQUARE METER PLOT MEASURES

	Frequency	Percent
50 TO 100 KG	14	4.8
101 TO 150 KG	41	14.1
151 TO 200 KG	49	16.8
201 TO 250 KG	51	17.5
251 TO 300 KG	31	10.7
301 TO 350 KG	39	13.4
351 TO 400 KG	30	10.3
OVER 400 KG	36	12.4
TOTAL	291	100.0

Mean yields are shown in Tables 10 - 11.1 broken down by ethnic group, project area and village. In each case there was a very significant statistical difference. The Akha had the highest yields, with Thai Yai and Other just ahead of the Lahu. The rather large standard deviations, with the exception of the Thai Yai, indicate a high variability of yields within each tribe.

Yields in the Wawi area were markedly higher than in the Nam Lang area. This fact should be given due weight when future rice production activities are planned.

In terms of inter-village comparison, the highest yields were in San Charoen Kao, with the lowest in Muang Pam and Pang Kham Noi. Again, standard deviations are rather high. (Note: no rice yield measurements were made in the major Thai Yai village, Mai Hung. The reason for this exception is that this village upholds the Thai Yai custom that no villager will thresh his rice - or allow his rice to be threshed - until all villagers' rice fields have been cut.)

Table 10. MEASURED RICE YIELD PER RAI BY ETHNIC GROUP

		Mean	Std Dev	Cases
For Entire Population		265.7755	119.0747	98
1	LISU	280.8500	86.3507	20
2	LAHU	227.2973	120.3248	37
3	AKHA	344.5238	142.4625	21
4	KAREN	253.1818	95.8194	11
5	THAI YAI	222.1250	29.9449	8
7	OTHER	222.0000	0.0	1

Chi-Square Significance .0089

Table 11. Crosstabulation: MEASURED RICE YIELD PER RAI BY PROJECT AREA

Count / Col Pct	TAMBON WAWI	NAM LANG	Row Total
50 TO 100 KG		1	1
		2.2	1.0
101 TO 150 KG	1	15	16
	2.0	32.6	16.5
151 TO 200 KG	4	9	13
	7.8	19.6	13.4
OVER 200 KG	46	21	67
	90.2	45.7	69.1
Column Total	51	46	97
	52.6	47.4	100.0

Chi-Square Significance .0000

Table 11.1 MEASURED RICE YIELD PER RAI BY VILLAGE

		Mean	Std Dev	Cases
For Entire Population		262.9780	119.2172	91
1	SAN CHAROEN KAO	355.2500	61.8459	4
2	SAN CHAROEN MAI	331.0000	38.0066	5
3	PHA DAENG MUSER	270.7500	94.1785	4
4	THUNG PRAO MUSER	271.0000	21.2132	2
5	THUNG PRAO KARIANG	317.3333	80.9032	3
6	PONG SALAM	252.0000	93.5414	4
7	HUEY KHRAI	369.3333	54.0247	6
8	HUEY NAM YEN	332.6667	42.8291	3
10	DOI CHANG	578.0000	410.1219	2
11	HUEY PU	384.8000	167.3147	5
13	WAWI	274.5000	67.2986	6
15	WANNA LUANG	171.5000	108.3959	4
16	MAE MU	214.8000	73.7170	5
17	NONG TONG	301.3333	49.3592	3
18	LUK KHAOLAM	181.5000	36.2533	6
19	SOB PONG	244.5000	28.9914	2
20	JABO	133.0000	53.8424	3
21	NONG PHA CHAM	208.6000	52.5623	5
22	PANG KHAM NOI	120.6000	15.4532	5
23	MAI HUNG	209.0000	34.0294	4
24	MUANG PAM	196.6000	91.2650	5
26	YAPANAE	244.6000	94.2274	5

Chi-Square Significance .0000

An attempt was made to determine the variety of rice planted by each farmer surveyed. Results of this attempt are shown in Table 12 below. As there were so many names for rice varieties used by the different tribes, and as translitteration is difficult at best, going from hilltribe language to Thai then to English, this list should not be considered definitive. It is suggested that a catalog of hilltribe rice varieties be compiled to include the names used by the different tribes for the same variety. This would allow more meaningful inter-variety analysis in the future.

Table 12. VARIETY OF RICE PLANTED (MANY ARE TRANSLITTERATIONS OF HILLTRIBE LANGUAGES)

	Frequency	Percent
NU KHAE	2	1.9
PA-BO	3	2.8
YA KO FO	4	3.8
YA FU FU	2	1.9
KLU	12	11.3
PA TE	11	10.4
JA AE	5	4.7
KHAO MAN	16	15.1
FUANG KHAM	6	5.7
KAO LUANG	5	4.7
MI KHAO KHAO	1	.9
HAO	2	1.9
RAI LUANG	1	.9
KHOM PO MO	3	2.8
BU YO	2	1.9
E NOI	2	1.9
MALET KHAO	2	1.9
JA NU E	2	1.9
KHAO BO	1	.9
KHAO SAN	6	5.7
RAI SAM	3	2.8
CHIANG DAO JAYAE	1	.9
JA BE	8	7.5
THO WA	3	2.8
LAO SU	1	.9
SA NI	2	1.9
TOTAL	106	100.0

To determine how long a rice field is used, farmers were questioned regarding how many years their field had been planted in succession regardless of crop. The results are shown in Table 13 below. It appears to be quite significant that nearly three quarters of the fields had been used for only one or two years. This indicates a very rapid field rotation given the shortage of arable land in the project areas.

Table 13. YEAR FIELD FIRST PLANTED (NUMBER OF YEARS FIELD PLANTED)

	Frequency	Percent
1986	48	45.3
1985	28	26.4
1984	10	9.4
1983	9	8.5
1981	2	1.9
1980	3	2.8
BEFORE 1980	6	5.7
TOTAL	106	100.0

One reason for this rapid rotation can be seen in Table 14: yields fall off significantly as the number of years a field is used increases. Equally significant is several other variables measured (including number of clumps of rice per square meter, age of farmer, number of times a field was weeded, slope of the field, education level of the farmer, variety of seed) had a statistically significant effect when crosstabulated with measured yields.

Table 14. Crosstabulation: NUMBER OF YEARS FIELD PLANTED BY MEASURED RICE YIELD PER RAI

- - - - Part 1 of 2

	Count / Col Pct	50 TO 100 KG	101 TO 150 KG	151 TO 200 KG	OVER 200 KG	Row Total
1986			9	6	32	47
			56.3	46.2	47.8	48.5
1985			4	4	17	25
			25.0	30.8	25.4	25.8
1984			1	2	7	10
			6.3	15.4	10.4	10.3
1983			1		7	8
			6.3		10.4	8.2
(Continued)	Column Total	1	16	13	67	97
		1.0	16.5	13.4	69.1	100.0

Table 14. (cont.) Crosstabulation: NUMBER OF YEARS FIELD PLANTED BY MEASURED RICE YIELD PER RAI

- - - - Part 2 of 2

	Count / Col Pct	50 TO 100 KG	101 TO 150 KG	151 TO 200 KG	OVER 200 KG	Row Total
1980					3	3
					4.5	3.1
BEFORE 1980		1	1	1	1	4
		100.0	6.3	7.7	1.5	4.1
	Column Total	1	16	13	67	97
		1.0	16.5	13.4	69.1	100.0

Chi-Square Significance .0173

Although not statistically significant in terms of predicting yields, the following tables (Table 15 - 21) provide a description of past cropping systems of surveyed hilltribe farmers.

Table 15. FIRST CROP 1985

	Frequency	Percent
RICE	52	49.1
SOYBEANS	1	.9
NO CROP PLANTED	53	50.0
TOTAL	106	100.0

Table 16. SECOND CROP 1985

	Frequency	Percent
RICE	6	5.7
CORN	5	4.7
SOYBEANS	3	2.8
KIDNEY BEANS	3	2.8
MUNGBEANS	1	.9
NO CROP PLANTED	88	83.0
TOTAL	106	100.0

Table 17. FIRST CROP 1984

	Frequency	Percent
RICE	29	27.4
CORN	1	.9
MUNGBEANS	1	.9
NO CROP PLANTED	75	70.8
TOTAL	106	100.0

Table 18. SECOND CROP 1984

	Frequency	Percent
CORN	2	1.9
SOYBEANS	1	.9
MUNGBEANS	6	5.7
NO CROP PLANTED	97	91.5
TOTAL	106	100.0

Table 19. FIRST CROP 1983

	Frequency	Percent
RICE	23	21.7
CORN	1	.9
KIDNEY BEANS	1	.9
NO CROP PLANTED	81	76.4
TOTAL	106	100.0

Table 20. SECOND CROP 1983

	Frequency	Percent
RICE	5	4.7
CORN	2	1.9
KIDNEY BEANS	3	2.8
NO CROP PLANTED	96	90.6
TOTAL	106	100.0

Table 21. CROPPING SYSTEM IN 1985

	Frequency	Percent
RICE ONLY	34	32.1
RICE + CORN	5	4.7
RICE + BEANS	7	6.6
NEW FIELD IN 1986	60	56.6
TOTAL	106	100.0

Table 22 shows the average slope of the measured plots. Slopes were evaluated by eye rather than with inclinemeters. To help achieve standardization, training of surveyors included practice on evaluating the degree of slopes. All surveyors estimated the slope of practice fields, then arrived at a concensus of how the slope of that practice field should be rated.

Table 22. AVERAGE SLOPE OF INDIVIDUALLY MEASURED 25 SQUARE METER PLOTS

	Frequency	Percent
FLAT	38	13.0
SLIGHT SLOPE	67	22.9
MODERATE SLOPE	54	18.4
STEEP SLOPE	99	33.8
VERY STEEP SLOPE	28	9.6
NOT MEASURED	7	2.4
TOTAL	293	100.0

As with slopes, weed densities were measured visually by the surveying team. (Table 23) Also as with slopes, training included estimating weed densities in practice fields to help achieve standardization.

Table 23. DENSITY OF WEEDS

	Frequency	Percent
NONE	50	17.1
LITTLE	175	59.7
MODERATE	62	21.2
HIGH	6	2.0
TOTAL	293	100.0

Density of weeds at the time of harvest was found to be statistically correlated to yields per rai as shown in Table 24 below. These results can only be taken as preliminary. The interactions between weeds and crops is highly complex and a subject worthy of study in its own right. For example, key questions for research would include at what periods is weed/crop competiton greatest and when does additional weeding cease to be cost-effective in terms of labor inputs. A detailed analysis of yields versus times of weeding using actual weeding dates, not

the approximate dates farmers are able to recall months after weeding has been done would be needed for such an effort as well as more detailed information on labor inputs. Such a study would be highly beneficial as weeding is highly labor intensive, so hilltribe farmers need to get the most benefit in terms of yield for each man-day spent weeding.

Table 24. Crosstabulation: DENSITY OF WEEDS BY MEASURED RICE YIELD PER RAI

- - - - Part 1 of 2

	Count / Col Pct	50 TO 100 KG	101 TO 150 KG	151 TO 200 KG	201 TO 250 KG	251 TO 300 KG	Row Total
NONE		1 7.1	2 4.9	3 6.1	7 13.7	8 25.8	50 17.2
LITTLE		9 64.3	31 75.6	27 55.1	31 60.8	21 67.7	174 59.8
MODERATE		4 28.6	7 17.1	16 32.7	13 25.5	2 6.5	61 21.0
HIGH			1 2.4	3 6.1			6 2.1
(Continued)	Column Total	14 4.8	41 14.1	49 16.8	51 17.5	31 10.7	291 100.0

Table 24. (cont.) Crosstabulation: DENSITY OF WEEDS BY MEASURED RICE YIELD PER RAI

	Count / Col Pct	301 TO 350 KG	351 TO 400 KG	OVER 400 KG	Row Total
NONE		8	7	14	50
		20.5	23.3	38.9	17.2
LITTLE		24	17	14	174
		61.5	56.7	38.9	59.8
MODERATE		7	4	8	61
		17.9	13.3	22.2	21.0
HIGH			2		6
			6.7		2.1
	Column Total	39	30	36	291
		13.4	10.3	12.4	100.0

Chi-Square Significance .0020

Another measure made during the survey was the number of clumps of rice (groups of rice plants growing from the same planting hole) per square meter. (Table 25) It was hypothesized that this could have an effect on yield: too dense (too many clumps) or too sparse planting would reduce yields. In fact, although there was some variation in the number of clumps, the number apparently did not affect yields per rai over the range in clump numbers observed. This would indicate that farmers, even without training on rice production by TG-HDP or government officials generally know what planting density is best for their fields.

Table 25. NUMBER OF CLUMPS PER SQUARE METER

	Frequency	Percent
1 TO 5	1	.3
6 TO 10	125	42.7
11 TO 15	158	53.9
16 TO 20	7	2.4
NOT MEASURED	2	.7
TOTAL	293	100.0

The average height of rice stalks was measured as well to determine the effect on yields. (Table 26) The average height of rice stalks was found to be statistically related to the average yields per rai. (Table 27)

Table 26. AVERAGE HEIGHT OF RICE STALKS

	Frequency	Percent
51 TO 75 CM	9	3.1
76 TO 100 CM	102	34.8
101 TO 125 CM	140	47.8
126 TO 150 CM	27	9.2
OVER 150 CM	6	2.0
NOT MEASURED	9	3.1
TOTAL	293	100.0

Table 27. Crosstabulation: AVERAGE HEIGHT OF RICE STALKS BY MEASURED RICE YIELD PER RAI

- - - - Part 1 of 2

Count / Col Pct	50 TO 100 KG	101 TO 150 KG	151 TO 200 KG	201 TO 250 KG	251 TO 300KG	Row Total
51 TO 75 CM	1 7.1	3 7.5			1 3.2	8 2.8
76 TO 100 CM	9 64.3	15 37.5	17 37.8	23 45.1	11 35.5	101 35.8
101 TO 125 CM	4 28.6	17 42.5	27 60.0	23 45.1	14 45.2	140 49.6
126 TO 150 CM		4 10.0	1 2.2	4 7.8	5 16.1	27 9.6
OVER 150 CM		1 2.5		1 2.0		6 2.1
Column Total	14 5.0	40 14.2	45 16.0	51 18.1	31 11.0	282 100.0

(Continued)

Table 27 (cont.) Crosstabulation: AVERAGE HEIGHT OF RICE STALKS BY MEASURED RICE YIELD PER RAI

- - - - Part 2 of 2

Count / Col Pct	301 TO 350 KG	351 TO 400 KG	OVER 400 KG	Row Total
51 TO 75 CM	1 2.6	1 3.6	1 2.9	8 2.8
76 TO 100 CM	15 39.5	6 21.4	5 14.3	101 35.8
101 TO 125 CM	16 42.1	19 67.9	20 57.1	140 49.6
126 TO 150 CM	3 7.9	2 7.1	8 22.9	27 9.6
OVER 150 CM	3 7.9		1 2.9	6 2.1
Column Total	38 13.5	28 9.9	35 12.4	282 100.0

Chi-Square Significance .0280

To test for lodging of very high stalks, a multiple regression equation was evaluated which included both average height of the stalks and average height squared. Although the signs of the coefficients on the variables were as theory would predict (plus on the height alone, minus on the height squared) the overall R squared was under 0.1 and the Beta value on the height square term was extremely small. Thus lodging of tall rice plants appears not to be a significant problem. (Table 28)

Table 28. Multiple Regression Equation - MEASURED RICE YIELD PER RAI BY AVERAGE HEIGHT OF RICE STALKS AND AVERAGE HEIGHT OF RICE STALKS SQUARED

R Square .07547

Significance of F = .0000

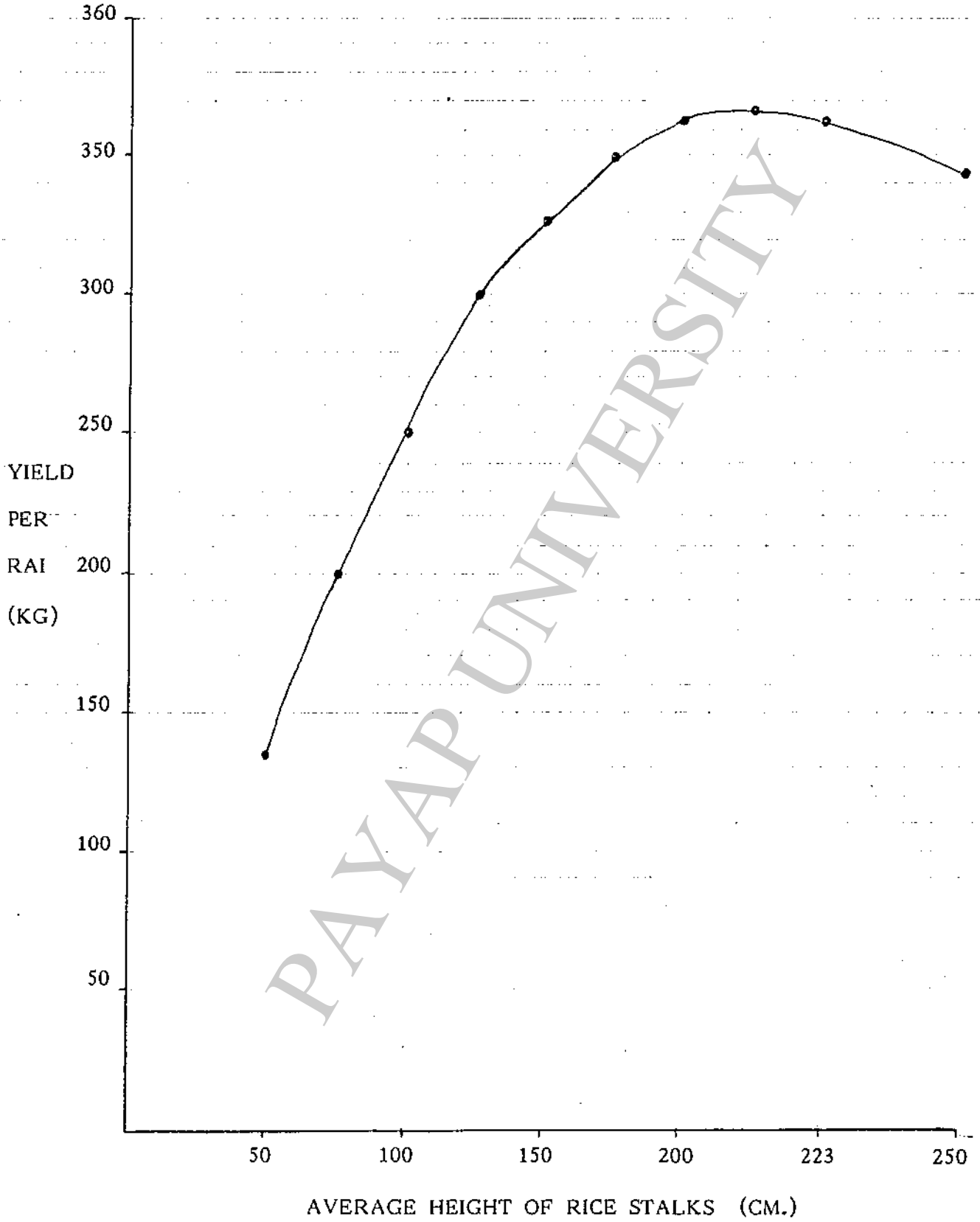
---------- Variables in the Equation ----------

Variable	B	Signifcance of T
HEIGHT2	-8.79848E-03	.3991
HEIGHT	3.67868	.1159
(Constant)	-27.09406	.8343

To provide a visual picture of the relationship between rice stalk heights and yield, a graph of the regression formula has been prepared. (Figure 1) From the graph it can be seen that the optimal height of rice stalks (measured as they are held straight, not bent over as they normally are in the fields) is approximately 2 meters.

A second multiple regression was attempted including density of weeds as well as average height of rice stalks. The results, shown in Table 29 below, still reflect a rather low R squared, while the overall significance of the equation is very high.

Figure 1. AVERAGE HEIGHT OF RICE STALKS VS. YIELD PER RAI



This means that the two factors investigated, height and weed density, have a definite effect on yields but that the effect is rather limited: there must be other, as yet unidentified, factors which determine rice yields. Possible candidates for the missing factors include rainfall and soil quality. Measurement of both of these factors could be accomplished, although only soil quality would lend itself to TG-HDP intervention.

Table 29. Multiple Regression - AVERAGE YIELD PER RAI BY AVERAGE HEIGHT OF RICE STALKS, AVERAGE HEIGHT OF RICE STALKS SQUARED AND DENSITY OF WEEDS

R Square .10107

Significance of F = .0000

---------- Variables in the Equation ----------

Variable	B	Sigificance of T
HEIGHT	3.65406	.1139
WEED	-16.49126	.0044
HEIGHT2	-8.45410E-03	.4121
(Constant)	7.58487	.9529

Planting methods was also hypothesized as a potential factor affecting yields. In fact, it proved to have virtually no predictive value in terms of yields. The majority of farmers surveyed said they used traditional planting methods. (Table 30) It must be emphasized, however, that it was virtually impossible in practice to distinguish between traditional and TG-HDP recommended planting methods. Farmers traditionally planted rice in rows aready, and usually did so more or less on the contour. The suggestion this finding prompts is that a close look at the syllabus of rice production training programs be accomplished to see if the production methods being promoted are indeed new to

the farmers. If not, other avenues of increasing rice production should be sought.

Table 30. PLANTING METHOD

	Frequency	Percent
TG-HDP METHOD	4	3.8
TRADITIONAL METHOD	102	96.2
TOTAL	106	100.0

The number of times each field was weeded is shown in Table 31. As with TG-HDP promoted varieties, Akha and Karen weeded significantly more frequently than other tribes. (Table 32) It is important to note that, in spite of these differences, the number of times a field was weeded was not statistically significant in terms of predicting yields in spite of the fact that yields of Akha and Karen were higher than those of other tribes.

Table 31. NUMBER OF TIMES FIELD WEEDED

Times Weeded	Frequency	Percent
1	9	8.5
2	53	50.0
3	41	38.7
4	2	1.9
NO ANSWER/DID NOT WEED	1	.9
TOTAL	106	100.0

Table 32. Crosstabulation: NUMBER OF TIMES FIELD WEEDED BY ETHNIC GROUP

Count / Col Pct	LISU	LAHU	AKHA	KAREN	THAI YAI	Row Total
1	3	4	1	1		9
	15.0	11.1	4.8	7.7		8.6
2	8	22	7	4	12	53
	40.0	61.1	33.3	30.8	92.3	50.5
3	8	9	13	8	1	41
	40.0	25.0	61.9	61.5	7.7	39.0
4	1	1				2
	5.0	2.8				1.9
Column Total	20	36	21	13	13	105
	19.0	34.3	20.0	12.4	12.4	100.0

(Continued)

Table 32. (cont.) Crosstabulation: NUMBER OF TIMES FIELD WEEDED BY ETHNIC GROUP

Count / Col Pct	OTHER	Row Total
1		9
		8.6
2		53
		50.5
3	2	41
	100.0	39.0
4		2
		1.9
Column Total	2	105
	1.9	100.0

Chi-Square Significance .0443

It was found that the Tambon Wawi area farmers did significantly more weeding than those in Nam Lang. (Table 33)

The cause of this disparity in weed problems is perhaps due to higher population densities in the former area and thus lower land availability for agricultural production.

Table 33. Crosstabulation: NUMBER OF TIMES FIELD WEEDED BY PROJECT AREA

Count / Col Pct	TAMBON WAWI	NAM LANG	Row Total
1	2	7	9
	3.8	13.2	8.6
2	21	32	53
	40.4	60.4	50.5
3	29	12	41
	55.8	22.6	39.0
4		2	2
		3.8	1.9
Column Total	52	53	105
	49.5	50.5	100.0

Chi-Square Significance .0028

Tables 34 through 42 below show the weeding patterns of the project area farmers. There were no inter-tribal or inter-area differences in terms of number of days between planting and each weeding nor in terms of tools used for each weeding.

In addition, there were statistically significant differences in tools used depending on whether it was the first, second or third weeding on how many years the field had been used. (Table 43 - 48) The practical implications, if any, of this difference in tool use for TG-HDP development activities is not immediately clear.

Table 34. FIRST WEEDING: DAYS AFTER PLANTING (GROUPED)

	Frequency	Percent
1 TO 10 DAYS	7	6.6
11 TO 20 DAYS	32	30.2
21 TO 30 DAYS	53	50.0
31 DAYS OR MORE	9	8.5
NO ANSWER/DID NOT WEED	5	4.7
TOTAL	106	100.0

Table 35. FIRST WEEDING: DAYS AFTER PLANTING (UNGROUPED)

Days	Frequency	Percent
10	7	6.6
15	21	19.8
20	11	10.4
24	1	.9
25	2	1.9
26	1	.9
28	2	1.9
30	47	44.3
35	2	1.9
40	1	.9
43	1	.9
45	5	4.7
NO ANSWER/DID NOT WEED	5	4.7
TOTAL	106	100.0

Table 36. TOOLS USED FOR FIRST WEEDING

	Frequency	Percent
HOOKED KNIFE	68	64.2
SMALL HOE	33	31.1
CURVED KNIFE	1	.9
HAND	2	1.9
NO ANSWER/DID NOT WEED	2	1.9
TOTAL	106	100.0

Table 37. SECOND WEEDING: DAYS AFTER FIRST WEEDING (GROUPED)

	Frequency	Percent
1 TO 10 DAYS	3	2.8
11 TO 20 DAYS	20	18.9
21 TO 30 DAYS	38	35.8
31 DAYS OR MORE	34	32.1
NO ANSWER/DID NOT WEED	11	10.4
TOTAL	106	100.0

Table 38. SECOND WEEDING: DAYS AFTER FIRST WEEDING (UNGROUPED)

Days	Frequency	Percent
10	3	2.8
11	1	.9
15	8	7.5
17	1	.9
20	10	9.4
24	1	.9
25	6	5.7
28	1	.9
30	30	28.3
35	5	4.7
38	1	.9
40	9	8.5
45	10	9.4
60	7	6.6
75	1	.9
90	1	.9
NO ANSWER/DID NOT WEED	11	10.4
TOTAL	106	100.0

Table 39. TOOLS USED FOR SECOND WEEDING

	Frequency	Percent
HOOKED KNIFE	59	55.7
SMALL HOE	26	24.5
CURVED KNIFE	6	5.7
HAND	3	2.8
NO ANSWER/DID NOT WEED	12	11.3
TOTAL	106	100.0

Table 40. THIRD WEEDING: DAYS AFTER SECOND WEEDING (GROUPED)

	Frequency	Percent
1 TO 10 DAYS	7	6.6
11 TO 20 DAYS	7	6.6
21 TO 30 DAYS	21	19.8
31 DAYS OR MORE	10	9.4
NO ANSWER/DID NOT WEED	61	57.5
TOTAL	106	100.0

Table 41. THIRD WEEDING: DAYS AFTER SECOND WEEDING (UNGROUPED)

Days	Frequency	Percent
4	1	.9
8	1	.9
10	5	4.7
14	1	.9
15	1	.9
20	5	4.7
25	5	4.7
30	16	15.1
35	2	1.9
40	3	2.8
43	1	.9
45	3	2.8
50	1	.9
NO ANSWER/DID NOT WEED	61	57.5
TOTAL	106	100.0

Table 42. TOOLS USED FOR THIRD WEEDING

	Frequency	Percent
HOOKED KNIFE	19	17.9
SMALL HOE	10	9.4
CURVED KNIFE	13	12.3
HAND	2	1.9
NO ANSWER/DID NOT WEED	62	58.5
TOTAL	106	100.0

Table 43. Crosstabulation: TOOL USED FOR FIRST WEEDING BY NUMBER OF YEARS FIELD PLANTED

	Count / Col Pct	1986	1985	1984	1983	1981	Row Total
HOOKED KNIFE		36	16	4	7	1	68
		76.6	57.1	44.4	77.8	50.0	65.4
SMALL HOE		11	11		2	1	33
		23.4	39.3	33.3	22.2	50.0	31.7
CURVED KNIFE			1				1
			3.6				1.0
HAND				2			2
				22.2			1.9
(Continued)	Column Total	47	28	9	9	2	104
		45.2	26.9	8.7	8.7	1.9	100.0

Table 43. (cont.) Crosstabulation: TOOL USED FOR FIRST WEEDING BY NUMBER OF YEARS FIELD PLANTED

	Count / Col Pct	1980	BEFORE 1980	Row Total
HOOKED KNIFE		2	2	68
		66.7	33.3	65.4
SMALL HOE		1	4	33
		33.3	66.7	31.7
CURVED KNIFE				1
				1.0
HAND				2
				1.9
	Column Total	2.9	5.8	104 100.0

Chi-Square Significance .0275

Table 44. Crosstabulation: TOOL USED FOR SECOND WEEDING BY NUMBER OF YEARS FIELD PLANTED

	Count / Col Pct	1986	1985	1984	1983	1981	Row Total
HOOKED KNIFE		30	15	4	7	1	59
		75.0	57.7	44.4	77.8	50.0	62.8
SMALL HOE		8	8	3	2	1	26
		20.0	30.8	33.3	22.2	50.0	27.7
CURVED KNIFE		1	2	2			6
		2.5	7.7	22.2			6.4
HAND		1	1				3
		2.5	3.8				3.2
(Continued)	Column Total	40 42.6	26 27.7	9 9.6	9 9.6	2 2.1	94 100.0

Table 44 (cont.) Crosstabulation: TOOL USED FOR SECOND WEEDING BY NUMBER OF YEARS FIELD PLANTED

	Count / Col Pct	1980	BEFORE 1980	Row Total
HOOKED KNIFE		1	1	59
		33.3	20.0	62.8
SMALL HOE			4	26
			80.0	27.7
CURVED KNIFE		1		6
		33.3		6.4
HAND		1		3
		33.3		3.2
	Column Total	3.2	5 5.3	94 100.0

Chi-Square Significance .0427

Table 45. Crosstabulation: TOOL USED FOR THIRD WEEDING BY NUMBER OF YEARS FIELD PLANTED

	Count / Col Pct	1986	1985	1984	1983	1980	Row Total
HOOKED KNIFE		8	5	2	4		19
		53.3	35.7	40.0	50.0		43.2
SMALL HOE		2	2	3	2		10
		13.3	14.3	60.0	25.0		22.7
CURVED KNIFE		5	6		2		13
		33.3	42.9		25.0		29.5
HAND			1			1	2
			7.1			100.0	4.5
(Continued)	Column Total	15 34.1	14 31.8	5 11.4	8 18.2	1 2.3	44 100.0

Table 45. (cont.) TOOL USED FOR THIRD WEEDING BY NUMBER OF YEARS FIELD PLANTED

	Count / Col Pct	BEFORE 1980	Row Total
HOOKED KNIFE			19
			43.2
SMALL HOE		1	10
		100.0	22.7
CURVED KNIFE			13
			29.5
HAND			2
			4.5
	Column Total	1	44
		2.3	100.0

Chi-Square Significance .0046

Table 46. Crosstabulation: TOOL USED FOR FIRST WEEDING BY TOOL USED FOR SECOND WEEDING

	Count / Col Pct	HOOKED KNIFE	SMALL HOE	CURVED KNIFE	HAND	Row Total
HOOKED KNIFE		59		2	2	63
		100.0		33.3	66.7	67.0
SMALL HOE			25	2	1	28
			96.2	33.3	33.3	29.8
CURVED KNIFE			1			1
			3.8			1.1
HAND				2		2
				33.3		2.1
	Column Total	59	26	6		94
		62.8	27.7	6.4	3.2	100.0

Chi-Square Significance .0000

Table 47. Crosstabulation: TOOL USED FOR SECOND WEEDING BY TOOL USED FOR THIRD WEEDING

Count / Col Pct	HOOKED KNIFE	SMALL HOE	CURVED KNIFE	HAND	Row Total
HOOKED KNIFE	18 94.7		12 92.3		30 68.2
SMALL HOE	1 5.3	10 100.0			11 25.0
CURVED KNIFE			1 7.7		1 2.3
HAND				2 100.0	2 4.5
Column Total	19 43.2	10 22.7	13 29.5	2 4.5	44 100.0

Chi-Square Significance .0000

Table 48. Crosstabulation: TOOL USED FOR FIRST WEEDING BY TOOL USED FOR THIRD WEEDING

Count / Col Pct	HOOKED KNIFE	SMALL HOE	CURVED KNIFE	HAND	Row Total
HOOKED KNIFE	18 94.7		13 100.0	1 50.0	32 72.7
SMALL HOE	1 5.3	9 90.0		1 50.0	11 25.0
CURVED KNIFE		1 10.0			1 2.3
Column Total	19 43.2	10 22.7	13 29.5	2 4.5	44 100.0

Chi-Square Significance .0000

Only four farmers indicated they had used fertilizer on their rice, a very small number. (Table 49) In addition, over 80% said they would be either unable or unwilling to purchase fertilizer if they received seed input from TG-HDP. (Table 50)

Thus, it is recommended that, at least for the present, the project should emphasize rice varieties which provide satisfactory yields without fertilizer inputs.

Table 49. USE OF FERTILIZER

	Frequency	Percent
NOT USED	102	96.2
USED	4	3.8
TOTAL	106	100.0

Table 50. ABILITY/WILLINGNESS TO PURCHASE FERTILIZER IF RECEIVE TG-HDP SEED

	Frequency	Percent
NOT PURCHASE	66	62.3
PURCHASE	12	11.3
NO ANSWER/DO NOT KNOW	28	26.4
TOTAL	106	100.0

As with farmers receiving TG-HDP inputs/training, the majority of farmers here indicated they had rice pest problems. (Table 51) Animals and above-ground insects were the problem vectors most frequently cited. (Table 52)

Comments made in Part I of this report hold for these farmers as well: they were largely unaware or unconcerned with crop diseases. This is an area that bears looking into further.

Also paralleling Part I, few farmers used pesticides. (Table 53) Please note comments made in Part I regarding pesticide safety.

Table 51. PROBLEMS WITH CROP PESTS

	Frequency	Percent
NO PROBLEMS	30	28.3
HAVE PROBLEMS	75	70.8
NO ANSWER	1	.9
TOTAL	106	100.0

Table 52. NATURE OF CROP PESTS

	Frequency	Percent
DIED, CAUSE UNKNOWN	3	2.8
WHITE/YELLOW LEAVES, DIED	5	4.7
ANIMALS/ABOVE GROUND INSECTS	53	50.0
UNDERGROUND INSECTS	12	11.3
ROTTING	2	1.9
NO ANSWER/NO PESTS	31	29.2
TOTAL	106	100.0

Table 53. USE OF PESTICIDES

	Frequency	Percent
NOT USED	95	89.6
USED	6	5.7
	5	4.7
TOTAL	106	100.0

Section 3. FARMERS' ATTITUDES

Although they did not plant TG-HDP promoted rice themselves, farmers in this portion of the survey were asked to compare project and non-project rice yields based on their own observations. The results are shown in Table 33: the majority (almost 60%) felt local varieties gave higher yields versus. Of

farmers who actually planted TG-HDP rice, only 27% rated local varieties as higher yielding. Due to the very small number of plots of TG-HDP promoted rice which were actually measured, empirical measurement of which group is correct will have to await a future survey.

It is noteworthy that significantly more farmers who had received no inputs from TG-HDP in the Nam Lang area rated TG-HDP promoted variety yields higher. Whether this is actually the case or whether some social factors have colored farmers' perceptions cannot be determined with the available data. (Tables 54 - 55)

Table 54. FARMERS' ASSESSMENT OF TG-HDP VS. LOCAL VARIETY RICE YIELDS

	Frequency	Percent
LOCAL VARIETY HIGHER	38	35.8
EQUAL	14	13.2
TG-HDP HIGHER	13	12.3
NO ANSWER/NO KNOWLEDGE	41	38.7
TOTAL	106	100.0

Table 55. Crosstabulation FARMERS' ASSESSMENT OF TG-HDP VS. LOCAL VARIETY RICE YIELDS BY PROJECT AREA

Count / Col Pct	TAMBON WAWI	NAM LANG	Row Total
LOCAL VARIETY HIGHER	26 / 76.5	12 / 38.7	38 / 58.5
EQUAL	4 / 11.8	10 / 32.3	14 / 21.5
TG-HDP HIGHER	4 / 11.8	9 / 29.0	13 / 20.0
Column Total	34 / 52.3	31 / 47.7	65 / 100.0

Chi-Square Significance .0085

Table 56 below shows farmers' stated desires regarding exchanging local variety seed for equal quantities of TG-HDP promoted rice. As expected, there is a significant difference between areas, with fewer farmers in Tambon Wawi desiring to exchange. (Table 57)

Table 56. FARMERS' DESIRE TO EXCHANGE FOR TG-HDP RICE SEED

	Frequency	Percent
DO NOT DESIRE	46	43.4
DESIRE TO EXCHANGE	34	32.1
NO ANSWER/DO NOT KNOW	26	24.5
TOTAL	106	100.0

Table 57. Crosstabulation: FARMERS' DESIRE TO EXCHANGE FOR TG-HDP RICE SEED BY PROJECT AREA

Count / Col Pct	TAMBON WAWI	NAM LANG	Row Total
DO NOT DESIRE	30	16	46
	73.2	41.0	57.5
DESIRE TO EXCHANGE	11	23	34
	26.8	59.0	42.5
Column Total	41	39	80
	51.3	48.8	100.0

Chi-Square Significance .0036

Surprisingly few respondants were able to articulate a reason for desiring to exchange. (Table 58) An equally limited number stated a reason for not wanting to exchange. (Table 59) With so few farmers responding, it is difficult to evaluate the results meaningfully.

Table 58. REASON DESIRE TO EXCHANGE FOR TG-HDP RICE VARIETY

	Frequency	Percent
TRY NEW VARIETY	16	15.1
USE DIFFERENT VARIETY	1	.9
EARLY YIELDS	8	7.5
FOLLOW NEIGHBORS EXAMPLE	1	.9
BETTER YIELDS	4	3.8
NO ANSWER	76	71.7
TOTAL	106	100.0

Table 59. REASON DO NOT DESIRE TO EXCHANGE FOR TG-HDP RICE VARIETY

	Frequency	Percent
BETTER TASTE	1	.9
YIELDS SAME	1	.9
HAVE TG-HDP VARIETY	1	.9
UNSURE OF QUALITY	4	3.8
NO ANSWER	99	93.4
TOTAL	106	100.0

To further refine the nature of farmers' attitudes, crosstabulations were made between desire to exchange for TG-HDP promoted rice and desire/ability to purchase fertilizer if seed is received. Most of those who desired to exchange could/would purchase fertilizer. (Table 60) However, even though the statistics are technically significant, the number willing/able to purchase is still very low. Any rice production project which necessitates the use of either fertilizer or pesticides should be carefully scrutinized for feasibility.

Table 60. Crosstabulation: DESIRE TO EXCHANGE FOR TG-HDP RICE BY DESIRE/ABILITY TO PURCHASE FERTILIZER IF RECEIVE TG-HDP RICE SEED

Count / Col Pct	NOT PURCHASE	PURCHASE	Row Total
DO NOT DESIRE TO EXCHANGE	42 63.6	4 33.3	46 59.0
DESIRE TO EXCHANGE	24 36.4	8 66.7	32 41.0
Column Total	66 84.6	12 15.4	78 100.0

Chi-Square Significance .0496