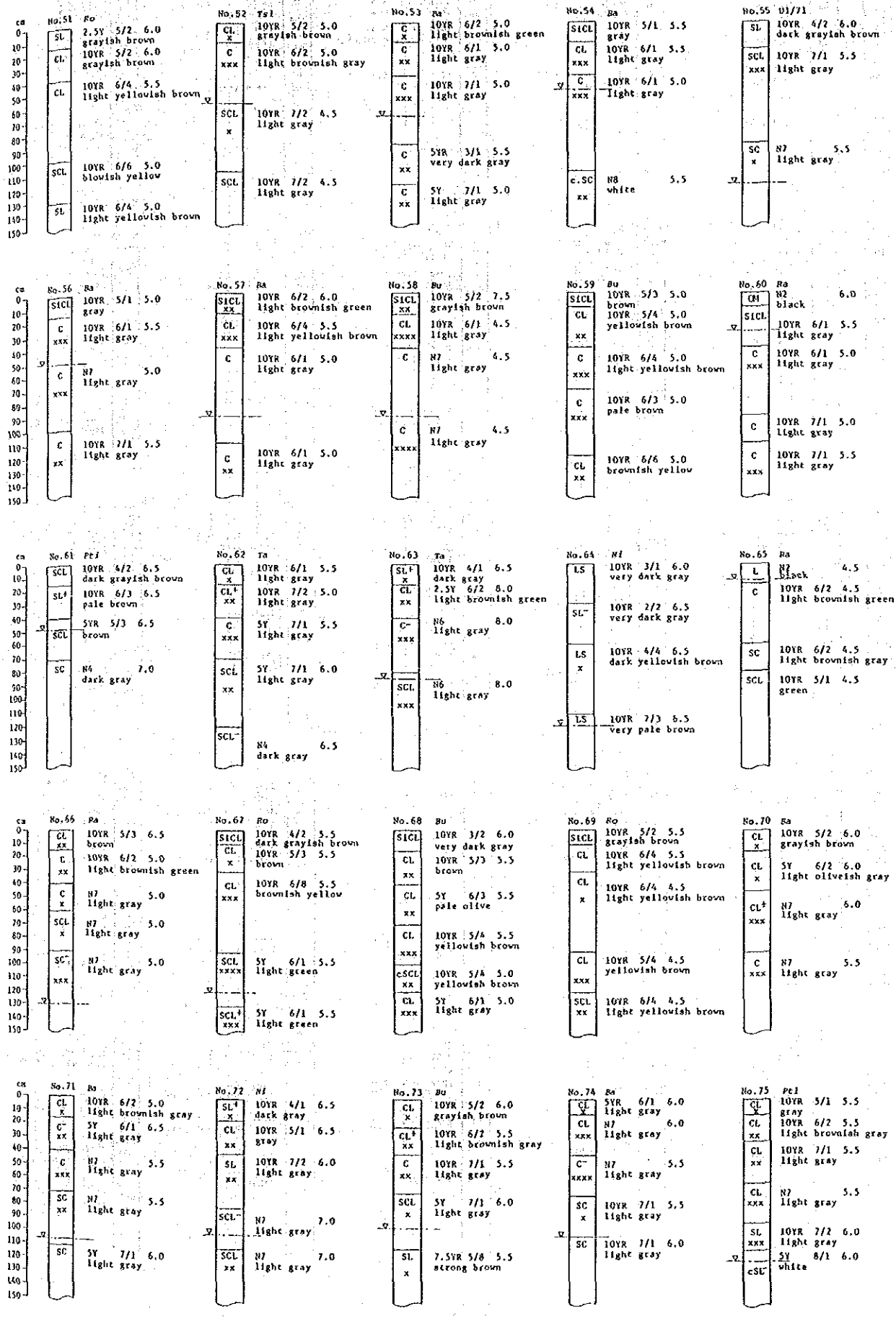
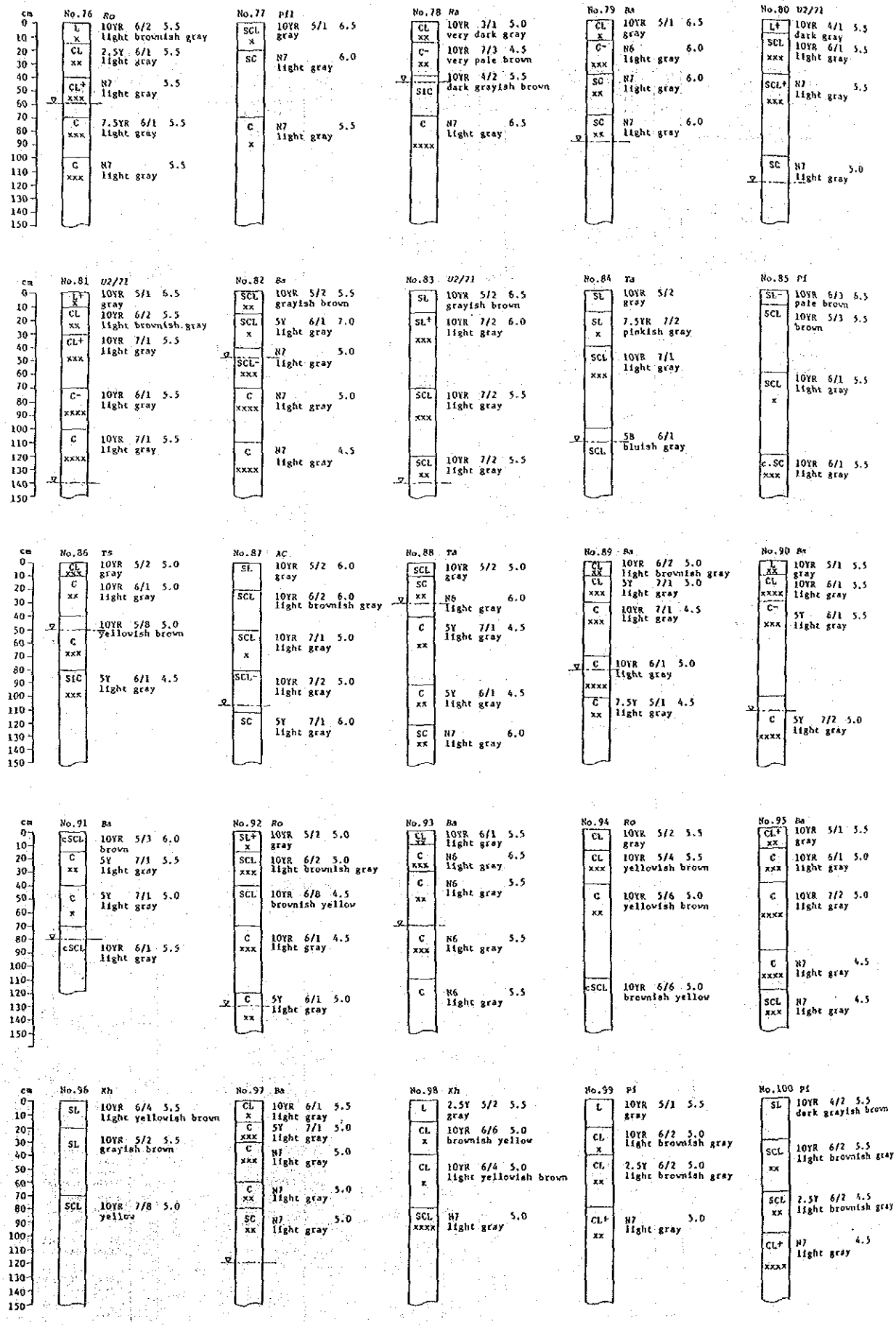
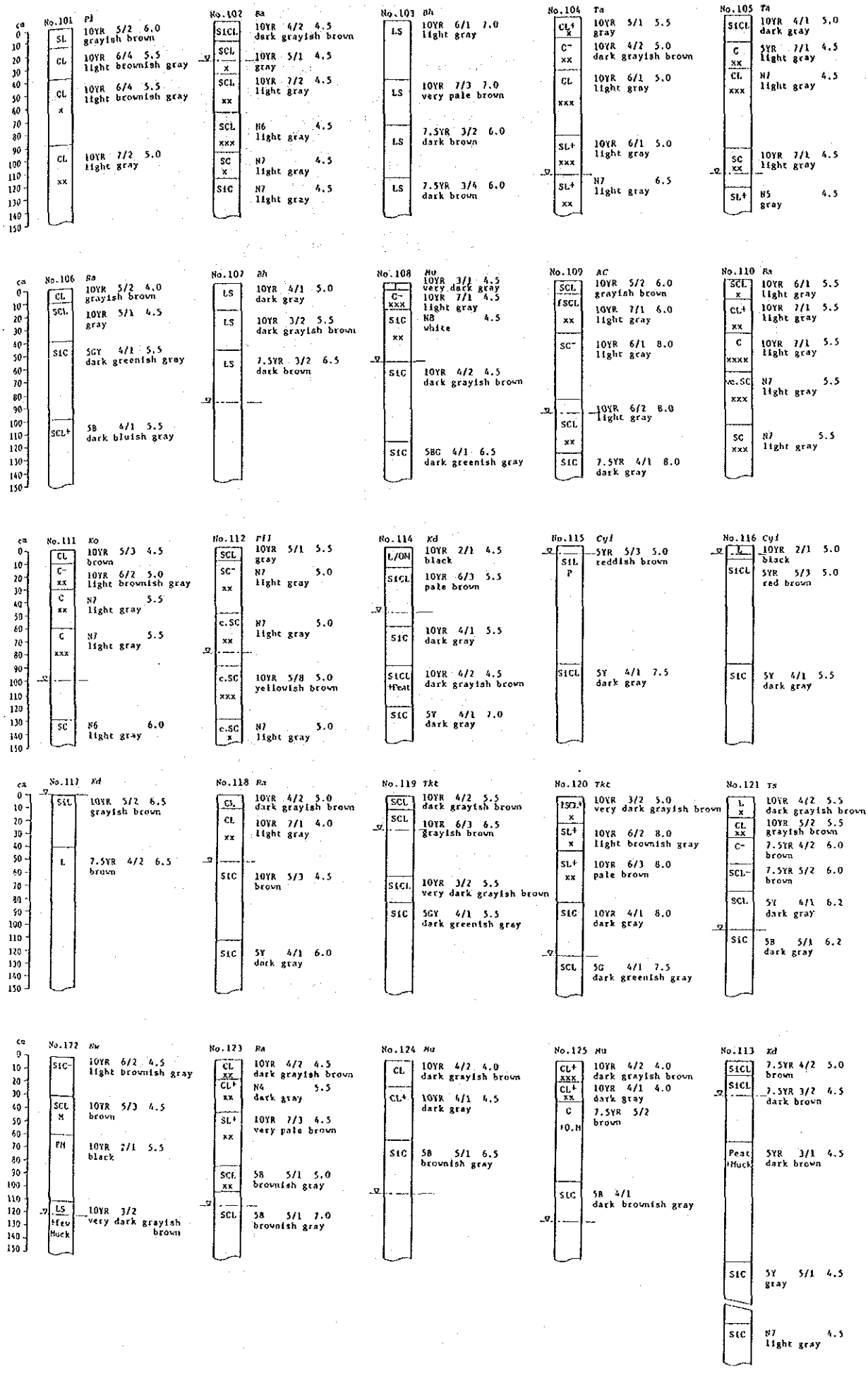
4-5-3. General Information of Auger Boring Sites

No.	Village	District	Land Use	Soil Series	Slope(%)	Remarks
51	Ban Khok Ko	Muang	Coconuts	Ro	2	
52	Ban Khae Na	"	Rubber	Tsl	2	
53	"	"	Rice	Ba	<1	
54	Ban Ya Ro	"	Rice	Ba	<1	
55	Ban Bang Po	"	Rubber	U1/71	2	
56	Ban Khok Ti Te	"	Rice	Ba	1	
57	Ban Pha Ca	"	Rice	Ba	1	
58	Ban Thai	Rangae	Rice	Bu	1	
59	Ban Ba Nae Ta	"	Rubber	Bu	2	
60	Ban Khao Kumpom	Muang	Grasses	Ra	<2	
61	Ban Khok Ma Fuang	Tak Bai	Rice	Pti	0-1	Potential
62	Ban Sala Mai/Jar Rou	"	Rice	Ta	0-2	Potential
63	Ban Khok Ngu	"	Rice	Ta	0-1	
64	Ban Prub Chang	"	Coconuts	Ni	2-4	
65	Ban Khok Chumbok	"	Grass/Forest	Ra	1-2	Potential
66	Ban Lam Phu	Muang	Rice	Ra	1-2	
67	Ban Bang Pho	"	Rubber	Ro	2-4	
68	Ban Khu Be	"	Rubber	Bu	2-4	
69	Ban Phu Ta	Yi-ngo	Rubber	Ro	>3	
70	Ban Do Nong	"	Grasses	Ba	2	
71	Ban Thong Ka	"	Rice	Ba	<2	
72	Ban Ka Sue	Muang	Coconuts	Ni	<1	
73	Ban Lam Phu	"	Rubber	Bu	2	
74	Ban Ba Lo	"	Rice	Ba	1-2	
75	Ban Suttai Bala	"	Pasture	Ptl	1	
76	Ban Manungka Yi	"	Rubber	Ro	1	
77	Ban Bar Ngoa	Rangae	Rice	Pil	1-2	
78	Ban Pileng	"	Rubber/Grass	Ra	3	
79	Ban Maroubo	"	Rice	Ba	1-2	
80	Ban Ba Ngo Du Dung	"	Rubber	U2/71	2	
81	Ban Ra Yo Bra Do	"	Rubber	U2/71	2	
82	Ban To Lang	"	Rice	Ba	1-2	
83	Ban Khok Saya	Muang	Cashew	U2/71	2-4	
84	Ban Charoasato	"	Rice	Ta	2	
85	Ban Ku Bae Pu Yu	"	Rubber	Pi	4-6	
86	Ban Yabi	"	Rice	Ts	2-3	
87	Ban Tung Kha	"	Rubber	AC	1	
88	Ban Khok Ko	"	Rice	Ta	1	
89	Ban Tham Neap	"	Rice	Ba	1	
90	Ban Kae Mae	Rangae	Rice	Ba	1-2	
91	Ban Kao Kong	Muang	Rice	Ba	1-2	
92	Ban Tung Kanun	"	Rubber	Ro	1-2	
93	"	"	Rice	Ba	<1	
94	Ban Hu Ru Par Rae	Rangae	Grass/Rice	Ro	1	
95	Ban Ba Ngo Ba Ngae	"	Rice	Ba	1	
96	Ban Ba Ngo	"	Coconut/Fruit	Kh	2	
97	Ban Khok Naeng	"	Rice	Ba	1-2	
98	Ban Ba Ngo De Yae	"	Rubber	Kh	2-4	
99	Ban Ba Lo De Yae	"	Rubber	Pi	2-4	
100	Ban Pha Pai	"	Rubber/Fruit	Pi	2-4	
101	Ban Ba Ngo Du Dung	"	Coconuts	Pi	2-4	
102	Ban Tung Kraeng	"	Rice	Ba	1-2	
103	Ban Ku Bu	Tak Bai	Coconuts	Bh	4	
104	Ban Ta Phang	"	Coconut/Rubber	Ta	2-3	
105	Ban Cha Ro	"	Rice	Ta	1-2	
106	Ban Ba Do Mati	"	Rice	Ra	1-2	Potential
107	Ban Klong Lai	"	Forest(Samet)	Bh	2	
108	Ban Khok Sila	Muang	Forest/Grass	Mu	1-2	Actual
109	Ban Tung Ngai	"	Rice	AC	1-2	
110	Ban Pa Kha	Rangae	Rice	Ba	1-2	
111	Ban Chuap	"	Rice	Ko	1-2	
112	Ban Ku Bae Pu Yu	"	Rice	Pil	1-2	
113	Ban Pileng	"	Swamp Forest	Kd	1-2	Potential
114	Ban Khu Chum	Muang	Grass/Samet	Kd	1-2	Potential
115	Ban Khok Si Dae	Rangae	Forest(Samet)	Cyi	1-2	Potential
116	Ban Char Ro Pu Yu	Muang	Forest/Grass	Cyi	1-2	Potential
117	Ban Bang Po	Rangae	"	Kd	2	Potential
118	Ban Ka Nae	Muang	"	Ra	2	Potential
119	Ban Tung Bua	"	"	Tkt	2	Potential
120	Ban Pley	"	Coconut/Forest	Tkt	2	Potential
121	Ban Ka Lo Wo	"	Swamp (Grass)	Ts	1-2	Potential
122	Ban Phu Khap Dang	"	Grass	Nw	<1	
123	Ban Sa-Mong	Tak Bai	Rice	Rs	1	Potential
124	Ban Khong Lai	"	Grass/Samet	Mu	1	Actual
125	Ban Chum Bok	"	"	Mu	1	Actual

4-5-4. COLUMNAR SECTIONS OF SOIL PROFILE BY AUGER BORING (NO.51 - NO.125)




No.76 Ro
10YR 6/2 5.5 light brownish gray
2.5Y 6/1 5.5 light gray
N7 5.5 light gray
7.5YR 6/1 5.5 light gray
N7 5.5 light gray
No.77 Pfl
10YR 5/1 6.5 gray
N7 6.0 light gray
N7 5.5 light gray
No.78 Ra
10YR 3/1 5.0 very dark gray
10YR 7/3 4.5 very pale brown
10YR 4/2 5.5 dark grayish brown
N7 6.5 light gray
No.79 Ra
10YR 5/1 6.5 gray
N6 6.0 light gray
N7 6.0 light gray
N7 6.0 light gray
No.80 U2/Z1
10YR 4/1 5.5 dark gray
10YR 6/1 5.5 light gray
N7 5.5 light gray
N7 5.0 light gray
No.81 U2/Z1
10YR 5/1 6.5 gray
10YR 6/2 5.5 light brownish gray
10YR 7/1 5.5 light gray
10YR 6/1 5.5 light gray
10YR 7/1 5.5 light gray
No.82 Ba
10YR 5/2 5.5 grayish brown
5Y 6/1 7.0 light gray
N7 5.0 light gray
N7 5.0 light gray
N7 4.5 light gray
No.83 U2/Z1
10YR 5/2 6.5 grayish brown
10YR 7/2 6.0 light gray
10YR 7/2 5.5 light gray
10YR 7/2 5.5 light gray
No.84 Ya
10YR 5/2 gray
7.5YR 7/2 pinkish gray
10YR 7/1 light gray
5B 6/1 bluish gray
No.85 Pf
10YR 6/3 6.5 pale brown
10YR 5/3 5.5 brown
10YR 6/1 5.5 light gray
10YR 6/1 5.5 light gray
No.86 Ts
10YR 5/2 5.0 gray
10YR 6/1 5.0 light gray
10YR 5/8 5.0 yellowish brown
5Y 6/1 4.5 light gray
No.87 Ac
10YR 5/2 6.0 gray
10YR 6/2 6.0 light brownish gray
10YR 7/1 5.0 light gray
10YR 7/2 5.0 light gray
5Y 7/1 6.0 light gray
No.88 Ya
10YR 5/2 5.0 gray
N6 6.0 light gray
5Y 7/1 4.5 light gray
5Y 6/1 4.5 light gray
N7 6.0 light gray
No.89 Ba
10YR 6/2 5.0 light brownish gray
5Y 7/1 5.0 light gray
10YR 7/1 4.5 light gray
10YR 6/1 5.0 light gray
7.5Y 5/1 4.5 light gray
No.90 Ra
10YR 5/1 5.5 gray
10YR 6/1 5.5 light gray
5Y 6/1 5.5 light gray
5Y 7/2 5.0 light gray
No.91 Ba
10YR 5/3 6.0 brown
5Y 7/1 5.5 light gray
5Y 7/1 5.0 light gray
10YR 6/1 5.5 light gray
No.92 Ro
10YR 5/2 5.0 gray
10YR 6/2 5.0 light brownish gray
10YR 6/8 4.5 brownish yellow
10YR 6/1 4.5 light gray
5Y 6/1 5.0 light gray
No.93 Ba
10YR 6/1 5.5 light gray
N6 6.5 light gray
N6 5.5 light gray
N6 5.5 light gray
N6 5.5 light gray
No.94 Ro
10YR 5/2 5.5 gray
10YR 5/4 5.5 yellowish brown
10YR 5/6 5.0 yellowish brown
10YR 6/6 5.0 brownish yellow
No.95 Ba
10YR 5/1 5.5 gray
10YR 6/1 5.0 light gray
10YR 7/2 5.0 light gray
N7 4.5 light gray
N7 4.5 light gray
No.96 Xh
10YR 6/4 5.5 light yellowish brown
10YR 5/2 5.5 grayish brown
10YR 7/8 5.0 yellow
No.97 Ba
10YR 6/1 5.5 light gray
5Y 7/1 5.0 light gray
N7 5.0 light gray
N7 5.0 light gray
N7 5.0 light gray
No.98 Xh
2.5Y 5/2 5.5 gray
10YR 6/6 5.0 brownish yellow
10YR 6/4 5.0 light yellowish brown
N7 5.0 light gray
No.99 Pf
10YR 5/1 5.5 gray
10YR 6/2 5.0 light brownish gray
2.5Y 6/2 5.0 light brownish gray
N7 5.0 light gray
No.100 Pf
10YR 4/2 5.5 dark grayish brown
10YR 6/2 5.5 light brownish gray
2.5Y 6/2 4.5 light brownish gray
N7 4.5 light gray


No.101 Pl
10YR 5/2 6.0 grayish brown
10YR 6/4 5.5 light brownish gray
10YR 6/4 5.5 light brownish gray
10YR 7/2 5.0 light gray
No.102 Ba
10YR 4/2 4.5 dark grayish brown
10YR 5/1 4.5 gray
10YR 7/2 4.5 light gray
N6 4.5 light gray
N7 4.5 light gray
N7 4.5 light gray
No.103 Bh
10YR 6/1 7.0 light gray
10YR 7/3 7.0 very pale brown
7.5YR 3/2 6.0 dark brown
7.5YR 3/4 6.0 dark brown
No.104 Ta
10YR 5/1 5.5 gray
10YR 4/2 5.0 dark grayish brown
10YR 6/1 5.0 light gray
10YR 6/1 5.0 light gray
N7 6.5 light gray
No.105 Ta
10YR 4/1 5.0 dark gray
5YR 7/1 4.5 light gray
N7 4.5 light gray
10YR 7/1 4.5 light gray
N5 4.5 gray
No.106 Ba
10YR 5/2 4.0 grayish brown
10YR 5/1 4.5 gray
5GY 4/1 5.5 dark greenish gray
5B 4/1 5.5 dark bluish gray
No.107 Bh
10YR 4/1 5.0 dark gray
10YR 3/2 5.5 dark grayish brown
7.5YR 3/2 6.5 dark brown
No.108 Hu
10YR 3/1 4.5 very dark gray
10YR 7/1 4.5 light gray
N8 4.5 white
10YR 4/2 4.5 dark grayish brown
5BG 4/1 6.5 dark greenish gray
No.109 Ac
10YR 5/2 6.0 grayish brown
10YR 7/1 6.0 light gray
10YR 6/1 8.0 light gray
10YR 6/2 8.0 light gray
7.5YR 4/1 8.0 dark gray
No.110 Ba
10YR 6/1 5.5 light gray
10YR 7/1 5.5 light gray
10YR 7/1 5.5 light gray
N7 5.5 light gray
N7 5.5 light gray
No.111 Ko
10YR 5/3 4.5 brown
10YR 6/2 5.0 light brownish gray
N7 5.5 light gray
N7 5.5 light gray
N6 6.0 light gray
No.112 Fl
10YR 5/1 5.5 gray
N7 5.0 light gray
N7 5.0 light gray
10YR 5/8 5.0 yellowish brown
N7 5.0 light gray
No.114 Kd
10YR 2/1 4.5 black
10YR 6/3 5.5 pale brown
10YR 4/1 5.5 dark gray
10YR 4/2 4.5 dark grayish brown
5Y 4/1 7.0 dark gray
No.115 Cyl
5YR 5/3 5.0 reddish brown
5Y 4/1 7.5 dark gray
No.116 Cyl
10YR 2/1 5.0 black
5YR 5/3 5.0 red brown
5Y 4/1 5.5 dark gray
No.117 Kd
10YR 5/2 6.5 grayish brown
7.5YR 4/2 6.5 brown
No.118 Ra
10YR 4/2 5.0 dark grayish brown
10YR 7/1 4.0 light gray
10YR 5/3 4.5 brown
5Y 4/1 6.0 dark gray
No.119 Tkc
10YR 4/2 5.5 dark grayish brown
10YR 6/3 6.5 grayish brown
10YR 3/2 5.5 very dark grayish brown
5GY 4/1 5.5 dark greenish gray
No.120 Tkc
10YR 3/2 5.0 very dark grayish brown
10YR 6/2 8.0 light brownish gray
10YR 6/3 8.0 pale brown
10YR 4/1 8.0 dark gray
5G 4/1 7.5 dark greenish gray
No.121 Ts
10YR 4/2 5.5 dark grayish brown
10YR 5/2 5.5 grayish brown
7.5YR 4/2 6.0 brown
7.5YR 5/2 6.0 brown
5Y 4/1 6.2 dark gray
5B 5/1 6.2 dark gray
No.122 Hw
10YR 6/2 4.5 light brownish gray
10YR 5/3 4.5 brown
10YR 2/1 5.5 black
10YR 3/2 very dark grayish brown
No.123 Ra
10YR 4/2 4.5 dark grayish brown
N4 5.5 dark gray
10YR 7/3 4.5 very pale brown
5B 5/1 5.0 brownish gray
5B 5/1 7.0 brownish gray
No.124 Hu
10YR 4/2 4.0 dark grayish brown
10YR 4/1 4.5 dark gray
5B 5/1 6.5 brownish gray
No.125 Hu
10YR 4/2 4.0 dark grayish brown
10YR 4/1 4.0 dark gray
7.5YR 5/2 brown
5B 4/1 dark brownish gray
No.113 Kd
7.5YR 4/2 5.0 brown
7.5YR 3/2 4.5 dark brown
5YR 3/1 4.5 dark brown
5Y 5/1 4.5 gray
N7 4.5 light gray

APPENDIX 4-6. Results of Soil Analyses

4-6-1. Chemical Analysis

Pit No.	Laboratory No.	Horizon	Depth (cm)	USDA Grading Sand <2.0	Silt <0.05	Clay <0.002mm.	Texture	pH 1:1Water	pH 1:1KCl	Moisture Air to oven dry	Organic Matter %	Total N %	EC×10³ 1:5 mS/cm	Exchange Capacity and Cations (me/100g) Ca	Mg	K	Na	Extr. Acidity	C.E.C	Base Saturat. %	Extract. Al me/100g	Soluble SO_4 me/100g	Avail. P ppm
1	8 - 1198	A	0-13	89.9	7.0	3.1	S	4.45	4.3	0.258	0.29	<0.02	0.010	0.62	0.15	0.05	0.21	1.32	0.57	43.8	0.98	0.05	1.56
Bh	1199	E	13-26	88.8	6.0	5.2	S	4.55	4.55	0.289	-	-	0.009	0.16	0.04	0.04	0.17	0.77	0.46	34.7	0.66	0.05	-
	1200	Bs1	26-51	83.4	11.7	4.9	LS	4.7	4.6	0.735	-	-	0.009	0.20	0.04	0.05	0.20	5.74	2.40	7.9	0.66	0.02	-
	1201	Bs2	51-72	88.1	3.1	8.8	LS	4.7	4.8	0.337	-	-	0.007	0.09	0.02	0.04	0.19	2.09	0.46	14.0	0.33	0.02	-
	1202	Bs3	72-120	88.1	3.1	8.8	LS	4.75	5.1	0.227	-	-	0.007	0.15	0.03	0.04	0.20	0.78	0.11	35.0	0.33	0.08	-
2	8 - 1203	A	0-27	75.9	10.3	13.8	SL	4.4	4.3	2.308	1.45	<0.02	0.012	0.14	0.06	0.08	0.23	5.81	3.03	8.1	1.34	0.05	5.29
Bc	1204	AC	27-39	71.9	9.3	18.8	SL	4.5	4.4	2.053	-	-	0.008	0.10	0.04	0.05	0.22	3.35	1.62	10.9	1.33	0.03	-
	1205	C1	39-70	69.4	9.3	21.3	SCL	4.45	4.1	2.419	-	-	0.007	0.22	0.05	0.05	0.21	1.34	3.73	28.3	1.14	0.03	-
	1206	C2	70-120	69.4	9.3	21.3	SCL	4.45	4.0	2.317	-	-	0.007	0.22	0.05	0.05	0.20	2.24	4.19	18.8	1.34	0.02	-
3	8 - 1207	Oi	0-30	59.8	12.6	27.6	OM	4.7	3.95	2.600	15.93	0.84	0.100	4.40	1.27	0.34	0.96	27.26	24.89	20.4	1.01	0.40	7.57
Nw	1208	Oe	30-150	50.4	24.4	25.2	OM	4.95	4.4	57.831	-	-	0.094	22.02	6.70	0.52	2.13	64.77	36.67	32.6	0.78	1.10	-
4	8 - 1209	A1	0-10	33.1	41.8	25.1	Sil	3.75	3.8	8.602	5.12	<0.02	0.299	1.22	0.22	0.34	0.44	31.79	15.30	6.5	10.38	1.00	54.68
Mu	1210	A2	10-40	3.1	26.8	70.1	C	3.55	3.45	4.571	-	-	0.256	1.26	0.35	0.17	0.20	21.41	16.32	8.5	10.28	1.06	-
	1211	AC	40-67	13.5	36.4	50.1	C	3.3	3.2	3.043	-	-	0.320	1.45	0.30	0.11	0.23	16.76	9.38	12.4	7.42	1.43	-
	1212	Cg	67-120	23.5	36.8	39.7	CL	2.35	2.3	6.829	-	-	4.037	1.05	1.55	0.07	0.29	39.28	10.37	8.5	31.94	62.05	-
5	8 - 1213	Ap	0-10	13.5	26.8	59.7	C	3.6	3.35	3.955	3.74	<0.02	0.340	2.24	1.11	0.34	0.31	17.06	13.49	19.0	3.74	1.82	15.31
Ta	1214	Bg1	10-64	1.3	31.5	67.2	C	4.0	3.4	3.500	-	-	0.068	1.60	1.05	0.12	0.28	9.39	8.13	14.5	3.73	0.04	-
	1215	Bg2	64-120	1.7	36.1	62.2	C	2.6	2.4	4.959	-	-	2.590	1.68	2.26	0.11	0.27	30.46	13.28	12.3	18.92	37.81	-
6	8 - 1216	Ap	0-14	29.4	40.4	30.2	CL	3.95	3.55	4.348	3.58	0.23	0.116	0.98	0.09	0.21	0.38	17.25	10.10	8.8	3.76	0.15	35.55
Ta	1217	Bg1	14-45	56.9	24.3	18.8	SL	4.3	3.7	1.449	-	-	0.043	1.81	0.14	0.08	0.24	7.20	5.42	24.0	3.32	0.03	-
	1218	Bg2	45-120	64.4	11.8	23.8	SCL	4.4	3.8	0.997	-	-	0.049	0.54	1.29	0.05	0.10	5.41	3.79	26.8	2.31	0.09	-
7	8 - 1219	A	0-13	85.9	7.8	6.3	LS	4.45	3.9	0.327	0.65	0.03	0.017	0.87	0.05	0.05	0.08	3.73	5.13	22.0	0.66	0.02	5.48
Bh	1220	E	13-43/60	83.4	7.8	8.8	LS	4.7	4.2	0.599	-	-	0.009	0.14	0.04	0.05	0.19	5.38	2.80	7.2	1.31	0.05	-
	1221	Bs1	43/60-82/95	85.9	7.8	6.3	LS	4.85	4.3	4.270	-	-	0.008	0.24	0.05	0.05	0.22	24.99	9.32	2.2	2.05	0.02	-
	1222	Bs2	82/85-120	89.4	4.3	6.3	S	4.95	4.55	0.297	-	-	0.008	0.12	0.03	0.05	0.12	3.18	0.97	9.1	0.98	0.04	-
8	8 - 1223	Ap	0-10	23.4	42.8	33.8	CL	4.5	3.7	3.139	1.33	<0.02	0.033	0.52	0.15	0.19	0.15	9.02	6.34	10.1	2.70	0.07	6.56
Ba	1224	AB	10-25	11.7	35.7	52.6	C	4.3	3.5	3.704	-	-	0.040	0.29	0.12	0.09	0.25	12.48	9.33	5.7	3.74	0.04	-
	1225	Btg1	25-53	13.8	33.6	52.6	C	4.3	3.6	2.927	-	-	0.039	1.62	0.28	0.10	0.28	11.48	12.41	16.6	3.71	0.01	-
	1226	Btg2	53-120	33.8	29.0	37.2	CL	4.3	3.6	2.985	-	-	0.036	0.92	0.12	0.10	0.31	8.78	5.86	14.2	3.37	0.03	-
9	8 - 1227	Ap	0-11	9.5	35.8	54.7	C	4.05	3.7	11.538	10.05	0.51	0.644	12.04	8.08	0.26	0.88	32.17	26.22	39.2	4.44	1.84	25.03
Ta	1228	AB	11-42	4.5	25.8	69.7	C	3.95	3.4	6.283	-	-	0.323	9.30	5.68	0.14	0.47	17.57	14.92	47.0	4.19	1.07	-
	1229	Bg1	42-94	3.1	44.3	52.6	SiC	3.8	3.3	2.609	-	-	0.336	7.31	6.56	0.19	0.46	10.19	9.69	58.8	3.69	1.12	-
	1230	Bg2	94-120	3.8	41.1	55.1	SiC	3.1	2.85	8.081	-	-	1.178	11.02	7.26	0.36	0.89	22.42	15.34	46.6	10.32	4.68	-
10	8 - 1231	A	0-13	84.4	4.3	11.3	LS	3.85	3.15	0.593	1.04	0.04	0.037	0.96	0.03	0.05	0.17	4.94	2.74	19.7	1.31	0.07	1.94
Bh	1232	E	13-42	84.4	4.3	11.3	LS	4.55	4.25	0.283	-	-	0.014	0.74	0.08	0.04	0.16	0.76	0.40	57.3	0.66	0.05	-
	1233	Bs1	43-49	71.9	9.3	18.8	SL	4.4	4.0	13.131	-	-	0.029	2.61	0.22	0.08	0.23	40.62	32.07	7.2	4.26	0.04	-
	1234	Bs2	49-78	76.9	10.4	12.7	SL	4.8	4.4	4.290	-	-	0.012	2.17	0.11	0.04	0.20	19.81	5.88	11.3	1.94	0.02	-
	1235	Bs3	78-120	74.4	7.8	17.7	SL	4.8	4.45	0.813	-	-	0.008	1.72	0.22	0.04	0.16	4.42	1.78	32.6	1.12	0.04	-
11	8 - 1236	A	0-12	40.4	29.7	29.9	CL	3.95	3.7	2.809	3.71	0.18	0.173	1.44	0.88	0.08	0.22	17.82	9.48	12.8	3.82	0.65	12.37
Ra	1237	AC	12-35	62.9	22.2	14.9	SL	4.1	3.7	0.738	-	-	0.109	1.66	0.98	0.06	0.21	4.19	6.76	41.0	2.62	0.40	-
	1238	C1	35-73	67.6	15.0	17.4	SL	3.7	3.35	2.247	-	-	0.186	1.19	1.06	0.08	0.22	7.96	5.35	24.3	3.41	0.49	-
	1239	C2	73-110	65.1	16.4	18.5	SL	3.7	3.35	2.265	-	-	0.197	1.27	0.95	0.10	0.23	8.18	4.54	23.8	3.79	0.70	-
	1240	Cg	110-120	61.7	16.1	22.2	SCL	3.3	3.15	1.767	-	-	0.886	6.62	4.97	0.09	0.32	11.04	5.32	52.1	3.40	3.62	-
12	8 - 1241	Ap	0-20	17.0	37.9	45.1	C	4.05	3.8	5.051	5.62	0.40	1.434	14.36	8.14	0.49	3.24	19.97	17.84	56.8	2.41	3.74	13.71
Ra	1242	ACg	20-50	7.0	40.4	52.6	SiC	4.95	4.45	2.186	-	-	0.528	7.11	4.31	0.26	0.98	4.26	7.90	74.8	0.67	1.95	-
	1243	Cg1	50-80	2.0	37.9	60.1	C	5.7	5.5	6.257	-	-	0.504	8.79	5.69	0.31	1.08	4.47	12.56	78.0	0.70	1.39	-
	1244	Cg2	80-120	2.0	32.9	65.1	C	5.8	5.15	11.558	-	-	0.547	18.48	11.63	0.41	1.42	5.95	16.84	84.3	0.74	2.01	-
13	8 - 1245	Ap	0-16	80.1	5.4	14.5	SL	5.1	4.15	0.332	0.75	0.05	0.019	0.96	0.08	0.05	0.10	2.19	1.31	35.2	0.98	0.09	2.67
Bc	1246	AC	16-70	80.1	5.4	14.5	SL	4.1	4.2	0.548	-	-	0.009	2.97	0.22	0.04	0.08	0.81	0.91	80.3	0.56 1/	0.08	-
	1247	C1	70-115	82.6	5.4	12.0	LS	5.3	4.45	0.312	-	-	0.008	0.84	0.14	0.05	0.07	1.44	0.40	43.3	0.66 1/	0.04	-
	1248	C2	115-120	85.1	7.9	7.0	LS	5.3	4.6	0.277	-	-	0.013	0.61	0.14	0.07	0.09	1.11	0.51	45.0	0.66 1/	0.04	-
14	8 - 1249	A	0-8	77.0	8.6	14.4	SL	4.7	4.15	0.585	1.07	0.02	0.021	1.13	0.12	0.08	0.09	4.41	2.97	24.4	0.98	0.15	4.62
Pk	1250	AC	8-21	72.0	8.6	19.4	SL	4.95	4.2	0.639	-	-	0.014	0.92	0.15	0.04	0.08	4.08	2.29	22.6	0.99	0.08	-
	1251	Bt1	21-84	69.5	6.1	14.4	SCL	4.9	4.1	0.955	-	-	0.010	1.54	0.03	0.04	0.09	3.54	4.59	32.4	1.32	0.05	-
	1252	Bt2	84-120	67.0	6.1	26.9	SCL	4.8	4.1	1.042	-	-	0.011	1.69	0.27	0.04	0.08	3.32	4.48	38.5	2.97	0.08	-
15	8 - 1253	Ap	0-25	34.5	23.3	42.2	C	4.7	3.8	2.747	1.22	0.10	0.057	4.59	1.67	0.13	0.27	5.63	7.95	54.2	1.01	0.15	3.87
Cb	1254	Bg1	25-68	69.9	13.2	16.9	SL	5.0	4.35	0.920	-	-	0.028	3.14	1.14	0.16	0.13	1.66	3.21	73.4	0.99	0.05	-
	1255	Bg2	68-100	62.4	11.1	26.5	SCL	4.95	4.0	1.282	-	-	0.019	2.29	1.58	0.24	0.15	4.11	4.49	50.9	0.99	0.09	-
	1256	Cg	100-150	66.1	12.4	21.5	SCL	3.6	3.4	0.725	-	-	0.559	2.13	2.57	0.05	0.12	8.94	3.66	35.3	0.99	1.57	-
16	8 - 1257	A	0-15	75.2	10.8	14.0	SL	4.6	4.05	2.000	4.16	0.15	0.023	4.20	0.62	0.05	0.10	12.86	6.50	27.9	2.64	0.07	6.49
Ni	1258	AB	15-40	70.2	10.4	19.4	SL	4.95	4.35	1.020	-	-	0.010	1.56	0.30	0.03	0.10	4.32	2.87	31.5	2.24	0.03	-
	1259	Bt	40-77	65.6	7.9	26.5	SCL	4.9	4.2	1.205	-	-	0.008	0.84	0.24	0.04	0.10	4.10	3.45	22.9	1.50	0.03	-
	1260	Btg	77-120	63.1	12.9	24.0	SCL	4.85	4.0	1.538	-	-	0.008	1.14	0.16	0.04	0.10	2.30	4.62	38.5	1.51	0.03	-

1/ Analyzed at the Pikulthong Center, DLD.

2/ pH measurement of freeze dried samples did not show a significant result.

Pit No.	Laboratory No.	Horizon	Depth (cm)	USDA Grading Sand <2.0	Silt <0.05	Clay <0.002mm.	Texture	pH 1:1Water	pH 1:1KCl	Moisture Air to oven dry	Organic Matter %	Total N %	EC×10³ 1:5 mS/cm	Exchange Capacity and Cations (me/100g) Ca	Mg	K	Na	Extr. Acidity	C.E.C	Base Saturat. %	Extract. Al me/100g	Soluble SO_4 me/100g	Avail. P ppm
17	8 - 1261	Ap	0-20	18.1	47.9	34.0	SICL	4.15	4.0	8.696	7.90	0.35	0.171	1.80	0.24	0.21	0.28	28.21	19.80	8.2	4.06	0.52	22.00
Mu	1262	AB	20-34	10.6	49.7	39.7	SICL	3.7	3.5	1.449	-	-	0.147	4.75	0.88	0.05	0.12	8.12	4.96	41.7	3.38	0.38	-
	1263	Bt	34-50	8.5	44.3	47.2	SiC	3.8	3.45	1.130	-	-	0.113	1.52	0.03	0.04	0.08	6.54	4.60	20.3	3.31	0.25	-
	1264	BC	50-80	4.5	45.8	49.7	SiC	3.6	3.2	2.674	-	-	0.193	1.66	0.41	0.08	0.11	11.48	8.53	16.4	5.33	0.61	-
	1265	Cg	80-150	12.0	35.8	52.2	C	3.45	3.0	2.885	-	-	0.855	18.53	5.79	0.16	0.32	11.39	10.77	68.5	3.82	8.93	-
18	8 - 1266	A	0-42	9.9	38.2	51.9	C	4.6	3.85	3.349	2.67	0.02	0.048	3.52	1.08	0.13	0.27	13.83	11.03	26.6	3.45	0.26	12.04
Pil	1267	SB	42-70	5.9	50.3	43.8	SiC	4.6	3.7	2.083	-	-	0.021	2.48	0.55	0.08	0.12	10.97	8.94	22.7	3.79	0.09	-
	1268	Bt	70-85	5.6	37.9	56.5	C	4.05	3.4	2.451	-	-	0.191	1.65	0.46	0.13	0.21	9.66	8.04	20.2	4.18	0.43	-
	1269	Btg	85-150	3.4	27.8	68.8	C	4.4	3.55	3.141	-	-	0.032	0.97	0.80	0.10	0.15	11.77	13.15	14.6	8.04	0.15	-
19	8 - 1270	Ap	0-10	25.6	37.9	36.5	CL	3.4	3.4	3.704	4.18	0.02	0.734	1.53	1.16	0.21	0.77	20.03	10.15	15.5	6.16	0.29	14.60
Mu	1271	AB	10-22	25.6	35.4	39.0	CL	3.9	3.7	1.899	-	-	0.171	1.62	0.08	0.07	0.16	9.83	7.53	16.4	3.78	0.53	-
	1272	Btg1	22-87	25.6	35.4	39.0	CL	3.8	3.65	1.364	-	-	0.150	1.22	0.05	0.08	0.15	7.00	4.73	17.6	3.76	0.35	-
	1273	Btg2	87-120	25.6	33.2	41.2	C	3.7	3.8	1.914	-	-	0.178	1.81	0.17	0.12	0.20	10.28	5.91	18.3	3.78	0.38	-
20	8 - 1274	A	0-12	20.6	37.9	41.5	C	4.6	3.75	1.923	1.32	<0.02	0.023	1.37	0.03	0.14	0.17	8.60	5.80	16.6	3.40	0.05	6.02
Bu	1275	BA	12-32	8.1	35.7	56.2	C	5.0	3.75	2.162	-	-	0.010	1.83	1.09	0.08	0.14	7.89	6.27	28.5	3.79	0.04	-
	1276	Bt	32-100	4.4	45.9	49.7	SiC	5.0	3.8	1.863	-	-	0.011	0.31	0.94	0.16	0.15	6.03	5.58	20.6	2.65	0.10	-
21	8 - 1277	A	0-11	7.2	40.6	52.2	SiC	4.75	3.9	3.501	3.24	0.22	0.026	0.45	0.23	0.25	0.15	13.51	9.54	7.4	3.46	0.10	8.22
Ro	1278	Bt1	11-65	3.4	30.3	66.3	C	5.05	3.85	1.485	-	-	0.009	0.26	0.01	0.18	0.12	9.46	7.69	5.7	3.63	0.05	-
	1279	Bt2	65-120	2.2	20.6	77.2	C	4.95	3.8	4.233	-	-	0.012	0.25	0.66	0.26	0.13	8.69	8.64	13.0	4.14	0.04	-
22	8 - 1280	AP	0-12	14.7	38.1	47.2	C	4.7	3.8	2.222	1.28	0.02	0.020	0.38	0.07	0.13	0.13	8.41	5.60	7.8	3.25	0.09	4.70
Ba	1281	Btg1	12-55	7.2	28.1	64.7	C	4.8	3.75	3.636	-	-	0.011	0.30	0.13	0.14	0.12	8.53	6.90	7.5	3.71	0.07	-
	1282	Btg2	55-80	32.2	20.6	47.2	C	5.1	3.9	1.905	-	-	0.013	0.32	0.19	0.14	0.12	6.14	4.87	11.1	2.83	0.04	-
	1283	Btg3	80-130	2.2	10.6	87.2	C	4.8	3.8	3.390	-	-	0.014	0.34	0.36	0.24	0.16	9.42	8.21	10.5	4.12	0.07	-
	1284		130-150	15.9	17.8	66.3	C	4.85	3.8	3.509	-	-	0.012	0.30	0.27	0.18	0.13	8.63	6.40	9.3	3.70	0.02	-
	-		>150	-	-	-	-	-	-	-	-												
23	8 - 1285	Ap	0-15	4.7	20.6	74.7	C	4.35	3.4	4.785	3.12	0.02	0.040	0.82	1.11	0.17	0.29	12.89	11.63	15.6	3.75	0.03	6.43
Ts1	1286	Btg1	15-40	2.2	10.6	87.2	C	4.5	3.5	5.455	-	-	0.026	0.57	0.92	0.12	0.32	9.97	10.85	16.2	3.78	0.006	-
	1287	Btg2	40-90	2.2	22.9	74.9	C	4.7	3.55	5.727	-	-	0.021	0.44	0.73	0.18	0.23	9.76	10.63	13.9	4.21	0.02	-
24	8 - 1288	Ap	0-15	49.7	28.1	22.2	L	4.8	4.2	1.015	0.68	0.02	0.030	0.48	0.11	0.27	0.11	2.77	2.47	25.9	2.00	0.02	8.51
Ko	1289	Btg1	15-40	17.2	30.6	52.2	C	4.95	3.9	3.067	-	-	0.022	0.98	0.76	0.34	0.15	4.75	6.37	31.9	2.46	0.08	-
	1290	Btg2	40-90	4.4	28.4	68.2	C	4.9	3.85	4.301	-	-	0.022	1.26	1.05	0.42	0.19	4.81	6.09	37.8	2.49	0.01	-
	1291	C	90-120	36.9	13.4	49.7	C	5.0	4.05	2.020	-	-	0.023	0.99	0.81	0.33	0.16	3.81	5.83	37.5	2.03	0.04	-
25	8 - 1292	Ap	0-13	44.4	30.9	24.7	L	4.7	3.95	0.966	1.11	0.02	0.022	0.40	0.02	0.08	0.11	4.98	2.59	10.9	2.42	0.02	5.66
Ba	1293	Bt1	13-27	36.9	30.9	32.2	CL	4.85	3.9	1.370	-	-	0.013	0.32	0.01	0.08	0.15	4.00	2.48	12.3	3.42	0.02	-
	1294	Bt2	27-44	26.9	30.9	42.2	C	4.9	3.8	1.794	-	-	0.010	0.23	0.02	0.09	0.09	5.13	3.80	7.7	3.43	0.02	-
	1295	Bt3	44-80	24.4	30.9	44.7	C	4.9	3.8	1.835	-	-	0.010	0.31	0.80	0.12	0.09	5.58	7.24	19.1	3.43	0.02	-
	1296	Bt4	80-110	14.4	28.4	57.2	C	4.95	3.75	2.604	-	-	0.011	0.44	0.55	0.21	0.11	7.43	23.58	15.0	3.89	0.02	-
	1297	Btg	110-150	4.4	25.9	69.7	C	4.9	3.7	3.012	-	-	0.011	0.46	0.72	0.25	0.12	7.91	31.26	16.4	3.91	0.02	-
26	8 - 1298	Oi	0-30	8.8	45.4	45.8	OM	3.9	3.55	8.054	19.85	0.02	0.643	3.88	1.59	0.21	0.42	32.89	34.87	15.6	10.53	3.57	11.84
Kd	1299	Oe	30-90	3.5	40.3	56.2	OM	4.45	3.9	6.623	-	-	0.293	5.68	3.08	0.27	0.45	25.94	28.97	26.8	4.60	1.54	-
27	9 - 701	Ap	0-18	25.7	44.4	29.9	CL	4.5	3.9	1.0	3.62	0.13	0.180	2.64	1.49	0.10	0.34	8.30	7.46	35.5	0.23	0.47	7.22
Ta	702	AB	18-30	36.5	36.8	26.7	L	4.4	3.7	2.0	-	-	0.260	2.84	1.29	0.08	0.45	5.64	6.17	45.2	0.54	0.92	-
	703	Bg1	30-45	33.6	39.0	27.4	CL	4.65	3.95	1.0	-	-	0.380	3.04	1.41	0.07	0.54	3.87	4.97	56.7	0.06	1.84	-
	704	Bg2	45-70	36.1	36.5	27.4	CL	5.2	4.3	2.0	-	-	0.310	2.83	1.44	0.07	0.55	2.99	5.02	62.1	<0.01	1.22	-
	705	Bg3	70-120	36.1	32.9	31.0	CL	5.65	4.7	1.0	-	-	0.340	3.29	1.50	0.08	0.65	2.99	5.88	62.9	<0.01	1.26	-
28	9 - 706	A	0-27	79.7	6.2	14.1	SL	4.3	3.95	1.0	2.67	0.09	0.020	2.04	0.21	0.05	0.06	7.08	3.16	25.0	0.90	0.05	1.87
02/71	707	AB	27-47	81.5	7.9	10.6	LS	4.4	4.35	0.5	-	-	0.009	0.86	0.001	0.03	0.06	6.75	2.14	12.3	0.38	0.01	-
	708	B1	47-72	79.0	10.4	10.6	SL	4.2	4.15	1.0	-	-	0.011	1.21	0.02	0.03	0.08	4.76	1.69	22.0	0.67	0.01	-
	709	B2	72-100	79.0	7.9	13.1	SL	4.1	4.0	2.0	-	-	0.011	1.16	0.02	0.02	0.06	3.87	1.71	24.6	0.38	0.01	-
29	9 - 710	Ap	0-20	5.2	52.2	42.6	SIC	4.3	3.6	7.0	2.12	0.13	0.017	2.18	0.70	0.20	0.11	6.97	5.65	31.4	0.62	0.05	4.54
Cb	711	Btg1	20-80	1.8	40.1	58.1	C	4.5	3.65	3.0	-	-	0.020	1.83	1.66	0.30	0.14	5.98	6.11	37.4	0.60	0.06	-
	712	Btg2	80-110	14.0	42.9	43.1	SIC	4.5	3.65	1.0	-	-	0.021	2.05	1.52	0.22	0.16	4.54	4.52	46.5	0.62	0.04	-
	713	Bg	110-150	16.5	60.4	23.1	SiL	4.4	3.7	2.0	-	-	0.016	1.77	0.38	0.11	0.10	4.09	3.20	36.6	0.81	0.02	-
30	9 - 714	A	0-20	16.8	47.1	36.1	SICL	3.2	3.15	9.0	8.57	0.19	0.427	5.30	0.79	0.07	0.24	26.45	12.54	19.5	4.06	1.17	9.52
Mu	715	AC	20-70	14.0	40.4	45.6	SiC	3.0	2.85	5.0	-	-	0.862	4.55	3.18	0.07	0.59	23.24	12.25	26.5	5.49	4.14	-
	716	Cg	70-150	11.5	31.8	56.7	C	4.2	3.6	11.0	-	-	1.296	5.20	1.79	0.16	1.46	14.61	16.47	37.1	1.32	3.28	-
31	9 - 717	Oe	0-12	34.0	24.3	41.7	OM	4.7	3.85	18.0	45.93	0.96	0.057	9.29	2.25	0.18	0.34	41.49	43.86	22.5	0.76	0.33	12.79
Kd	718	E	12-20	49.0	16.8	34.2	SCL	4.6	3.7	1.0	-	-	0.045	3.62	1.26	0.07	0.16	12.06	9.72	29.8	0.85	0.15	-
	719	Bh	20-32	84.0	6.8	9.2	LS	5.0	4.25	2.0	-	-	0.019	1.72	0.06	0.03	0.08	8.53	3.77	18.2	0.21	0.05	-
	720	B	32-60	79.0	11.8	9.2	SL	4.85	4.2	1.0	-	-	0.018	1.15	0.37	0.03	0.08	3.32	2.15	32.9	0.94	0.05	-
	721	Cg	60-120	76.5	11.8	11.7	SL	3.3	3.0	1.0	-	-	0.724	1.39	0.64	0.04	0.06	7.63	2.71	21.8	1.35	2.68	-
32	9 - 722	Oi	0-20	41.3	13.9	44.8	C	3.9	3.55	1.0	2.93	0.12	0.149	1.70	0.83	0.04	0.10	12.61	6.56	17.5	1.75	0.38	4.80
Ra	723	B1	20-60	74.4	16.4	9.2	SL	3.55	3.3	1.0	-	-	0.107	1.65	0.15	0.03	0.06	5.98	3.16	24.0	1.27	0.29	-
	724	B2	60-90	59.0	26.8	14.2	SL	3.3	2.9	2.0	-	-	0.158	1.77	0.26	0.05	0.08	7.41	3.88	22.6	1.24	0.29	-
	725	Cg	90-110	35.1	25.7	39.2	CL	2.4	2.2	4.0	-	-	2.480	1.91	0.65	0.03	0.10	25.12	7.23	9.4	4.16	13.41	-

Pit No.	Laboratory No.	Horizon	Depth (cm)	USDA Grading Sand <2.0	Silt <0.05	Clay <0.002mm.	Texture	pH 1:1Water	pH 1:1KCl	Moisture Air to oven dry	Organic Matter %	Total N %	EC×10³ 1:5 mS/cm	Exchange Capacity and Cations (me/100g) Ca	Mg	K	Na	Extr. Acidity	C.E.C	Base Saturat. %	Extract. Al me/100g	Soluble SO_4 me/100g	Avail. P ppm
33	9 - 726	Ap	0-15	80.1	8.2	11.7	SL	4.4	3.75	1.0	1.24	0.06	0.044	1.05	0.22	0.04	0.06	3.21	1.58	29.9	0.06	0.14	13.28
Pt1	727	B1	15-50	81.2	9.6	9.2	LS	4.8	3.8	0.5	-	-	0.019	0.99	0.16	0.03	0.10	2.10	1.80	37.9	0.25	0.03	-
	728	B2	50-100	88.7	2.1	9.2	LS	4.9	3.85	0.5	-	-	0.013	0.42	0.27	0.03	0.08	1.44	1.24	35.7	0.21	0.04	-
	729	Cg	100-150	88.7	2.1	9.2	LS	4.1	3.7	0.5	-	-	0.095	0.32	0.70	0.04	0.08	2.54	1.46	31.0	0.17	0.29	-
34	9 - 730	A	0-30	88.7	4.3	7.0	LS	4.5	3.65	0.5	1.03	0.05	0.011	1.00	0.03	0.03	0.06	3.76	1.35	23.0	0.12	0.03	2.12
Bc	731	AC	30-45	84.9	4.7	10.4	LS	4.7	4.15	0.5	-	-	0.008	0.50	<0.001	0.03	0.06	1.77	0.90	25.0	0.09	0.03	-
	732	C	45-100	84.9	4.7	10.4	LS	4.8	4.35	1.0	-	-	0.006	1.60	0.09	0.02	0.04	6.86	2.26	20.3	0.27	0.02	-
35	9 - 733	Ap	0-10	38.9	29.2	31.9	CL	4.9	4.2	1.0	3.46	0.16	0.040	2.80	0.86	0.09	0.12	5.75	4.97	40.2	0.06	0.07	2.69
Ta	734	AB	10-30	50.3	21.8	27.9	SCL	6.4	5.65	0.5	-	-	0.033	2.35	0.90	0.07	0.16	1.44	4.16	70.1	0.01	0.06	-
	735	B	30-45	50.3	19.3	30.4	SCL	6.7	5.75	0.5	-	-	0.035	3.36	1.24	0.07	0.16	1.66	4.61	74.4	0.01	0.08	-
	736	Bg	45-80	47.8	16.8	35.4	SC	6.75	5.8	1.0	-	-	0.024	4.32	1.40	0.07	0.10	2.43	5.76	70.8	0.02	0.03	-
36	9 - 737	A	0-28	72.0	6.2	21.8	SCL	5.5	4.75	2.0	4.17	0.12	0.026	3.49	1.25	0.06	0.06	8.08	5.59	37.6	0.10	0.04	23.64
Bc	738	AC	28-46	82.8	4.6	12.6	SL	5.0	4.35	3.0	-	-	0.012	1.87	0.44	0.04	0.06	19.47	7.04	11.0	0.69	0.03	-
	739	C1	46-65	82.8	7.1	10.1	LS	4.8	4.4	1.0	-	-	0.007	2.63	0.15	0.03	0.04	10.40	3.05	21.5	0.58	0.02	-
	740	C2	65-100	82.8	2.1	15.1	SL	4.7	4.35	1.0	-	-	0.008	1.79	0.12	0.03	0.06	7.52	2.03	21.0	0.48	0.02	-
37	9 - 741	A	0-30	77.3	6.2	16.5	SL	4.7	4.1	1.0	2.45	0.10	0.018	1.03	0.04	0.06	0.06	7.63	2.94	13.5	0.58	0.03	6.27
N1	742	B	30-65	77.8	2.1	20.1	SCL	4.35	3.9	0.5	-	-	0.009	1.16	0.02	0.04	0.10	2.77	1.57	32.3	0.71	0.04	-
	743	B	65-100	77.8	2.1	20.1	SCL	4.35	3.85	1.0	-	-	0.009	0.65	0.02	0.04	0.10	3.65	2.49	18.2	0.63	0.02	-
38	9 - 744	A	0-10	12.2	24.1	63.7	C	4.1	3.5	1.0	4.12	0.21	0.029	0.70	0.39	0.14	0.08	17.04	9.95	7.1	2.15	0.03	8.01
Ts1	745	B1	10-32	10.3	30.1	59.7	C	4.1	3.6	2.0	-	-	0.022	2.98	1.21	0.08	0.10	14.61	7.19	23.0	1.62	0.01	-
	746	B2	32-42	55.3	12.5	32.2	SCL	4.45	3.9	1.0	-	-	0.013	1.20	0.09	0.07	0.06	4.87	3.05	22.6	0.63	0.03	-
39	9 - 747	Ap	0-8	22.6	16.3	16.1	C	4.3	3.6	3.0	6.91	0.28	0.059	0.73	0.49	0.33	0.10	16.71	10.73	9.0	1.54	0.12	10.11
Ra	748	AB	8-25	30.3	14.6	55.1	C	3.95	3.5	2.0	-	-	0.043	2.15	0.10	0.08	0.06	9.96	6.39	19.4	1.69	0.08	-
	749	Bg	25-50	55.3	9.6	35.1	SC	3.9	3.6	1.0	-	-	0.047	1.22	0.17	0.05	0.06	7.19	4.41	17.3	1.39	0.10	-
	750	Bg	50-110	75.3	9.6	15.1	SL	4.1	3.8	1.0	-	-	0.043	0.81	0.06	0.04	0.06	3.43	1.58	22.0	0.50	0.08	-
	751	Bg	110-130	10.3	27.1	62.6	C	3.8	3.5	3.0	-	-	0.073	1.72	1.83	0.07	0.12	12.84	7.84	22.6	1.90	0.16	-
	752	2C	130-150	25.3	64.6	10.1	SIL	3.05	3.05	6.0	-	-	0.852	3.06	0.90	0.10	0.13	48.02	35.24	8.0	6.54	2.62	-
40	9 - 753	A	0-12	16.3	16.5	67.2	C	4.1	3.4	3.0	6.76	0.29	0.034	2.92	0.26	0.13	0.14	21.80	14.30	13.7	2.49	0.06	6.56
Ts	754	AC	12-30	20.3	65.3	14.4	SIL	4.05	3.3	1.0	-	-	0.034	5.19	0.54	0.08	0.12	11.84	8.02	33.4	2.36	0.02	-
	755	C1	30-45	52.8	14.6	32.6	SCL	4.15	3.5	1.0	-	-	0.024	0.46	0.03	0.05	0.06	5.98	5.65	9.1	1.34	0.03	-
	756	C2	45-70	52.8	14.6	32.6	SCL	4.1	3.5	1.0	-	-	0.025	1.81	0.03	0.05	0.08	7.08	4.29	17.2	1.25	0.02	-
	757	C2	70-120	50.3	12.1	37.6	SC	4.1	3.5	2.0	-	-	0.023	<0.002	0.05	0.06	0.08	7.08	6.85	2.6	1.82	0.01	-
	758	C3	120-150	42.8	9.6	47.6	C	4.1	3.5	1.0	-	-	0.026	<0.002	0.05	0.08	0.08	9.07	6.33	2.3	2.29	0.01	-
41	9 - 759	Ap	0-10	49.1	23.9	27.0	SCL	4.75	4.0	1.0	3.12	0.16	0.012	4.28	1.01	0.13	0.14	9.29	5.65	37.4	1.18	0.02	14.44
Ba	760	AB	10-25	47.8	24.6	27.6	SCL	4.5	3.9	1.0	-	-	0.014	2.30	1.36	0.10	0.08	7.41	3.84	34.1	0.89	0.04	-
	761	Bt1	25-40	42.8	22.1	35.1	CL	4.5	3.8	1.0	-	-	0.015	0.70	0.22	0.12	0.22	6.53	3.84	16.2	1.59	0.02	-
	762	Bt2	40-90	17.8	29.6	52.6	C	4.4	3.7	3.0	-	-	0.016	1.46	0.33	0.22	0.10	8.96	6.34	19.1	2.71	0.01	-
	763	Bt3	90-130	17.8	32.1	50.1	C	4.4	3.6	2.0	-	-	0.018	1.62	0.80	0.24	0.14	8.96	7.76	23.8	2.40	0.01	-
	764	Bt4	130-150	12.8	29.6	57.6	C	4.5	3.7	1.0	-	-	0.016	0.90	0.74	0.23	0.10	8.96	6.33	18.0	1.83	0.01	-
42	9 - 765	A	0-25	48.4	27.3	24.3	SCL	4.6	3.9	2.0	2.59	0.13	0.021	2.83	0.50	0.14	0.08	9.29	4.91	27.6	0.80	0.05	3.62
Ko	766	AB	25-44	50.3	16.1	33.6	SCL	4.35	3.9	1.0	-	-	0.013	1.12	0.34	0.05	0.04	7.19	3.84	17.7	1.17	0.01	-
	767	B1	44-72	70.3	12.1	17.6	SL	4.55	4.15	0.5	-	-	0.010	0.97	0.04	0.05	0.04	2.99	2.02	26.9	0.36	0.01	-
	768	B2	72-100	87.8	2.5	9.7	LS	5.1	4.75	1.0	-	-	0.011	0.08	0.03	0.08	0.06	1.22	0.90	17.0	0.09	0.01	-
44	9 - 769	Ap	0-15	11.8	35.3	52.3	C	4.35	3.75	1.0	4.09	0.20	0.028	1.07	3.01	0.13	0.14	12.95	7.35	25.1	1.48	0.02	3.42
Ba	770	AB	15-28	10.3	37.1	52.6	C	4.45	3.8	2.0	-	-	0.009	1.87	0.88	0.07	0.08	11.40	6.39	17.4	2.05	0.02	-
	771	Bt	28-80	5.3	38.2	56.5	C	4.7	3.75	2.0	-	-	0.006	3.51	0.91	0.08	0.10	8.96	6.51	33.9	1.69	0.01	-
45	9 - 772	Oe	0-20	15.2	36.1	48.7	OM	4.0	3.45	3.0	6.60	0.21	0.043	1.81	0.18	0.14	0.06	19.47	10.50	10.1	3.40	0.06	4.08
Kd	773	E	20-45	6.4	44.6	49.0	SIC	3.8	3.5	2.0	-	-	0.050	1.01	0.04	0.06	0.06	11.51	6.51	9.2	3.35	0.08	-
	774	Bt1	45-70	8.9	37.1	54.0	C	3.95	3.5	2.0	-	-	0.052	0.42	0.10	0.09	0.16	25.78	13.82	2.9	4.62	0.06	-
	775	Bt2	70-110	10.3	49.3	40.4	SIC	4.05	3.55	3.0	-	-	0.046	3.68	2.23	0.07	0.21	21.91	11.65	22.0	3.63	0.07	-
	776	Cg	110-150	3.9	58.2	37.9	SICL	3.0	2.9	2.0	-	-	1.359	1.00	2.06	0.04	1.80	32.31	10.96	13.2	8.48	8.76	-
46	9 - 777	Ap	0-20	74.1	9.4	16.5	SL	5.1	4.05	1.0	2.17	0.07	0.022	1.80	0.26	0.09	0.08	3.98	2.26	35.9	0.21	0.04	5.95
P11	778	AB	20-32	86.4	1.0	12.6	LS	4.8	4.1	0.5	-	-	0.010	0.91	0.05	0.04	0.12	1.66	1.12	40.3	0.26	0.02	-
	779	Bt1	32-50	70.3	8.2	21.5	SCL	4.5	3.7	1.0	-	-	0.012	0.02	0.10	0.05	0.10	5.42	3.05	4.7	1.02	0.01	-
	780	Bt2	50-90	5.3	11.8	82.9	C	4.3	3.4	2.0	-	-	0.015	0.08	0.53	0.11	0.08	13.72	9.93	5.5	2.58	0.01	-
47	9 - 781	Oa	0-10	1.5	21.0	77.5	C/OM	4.5	3.65	9.0	9.60	0.39	0.035	3.25	1.09	0.16	0.15	22.46	15.00	17.2	2.11	0.05	22.24
Cy1	782	A	10-30	0.3	35.7	64.0	C	4.4	3.5	4.0	-	-	0.017	1.42	0.87	0.15	0.10	15.27	11.66	35.9	2.43	0.01	-
	783	AB	30-70	2.8	33.2	64.0	C	4.35	3.4	3.0	-	-	0.016	1.22	0.74	0.12	0.08	18.26	12.23	10.6	3.38	0.02	-
	784	Bt1	70-120	0.3	27.1	72.6	C	4.05	3.3	2.0	-	-	0.033	4.29	1.06	0.08	0.08	11.95	8.68	31.6	3.07	0.03	-
	785	Bt2	120-150	5.3	27.1	67.6	C	4.1	3.3	3.0	-	-	0.025	1.61	1.66	0.10	0.12	10.18	7.38	25.5	1.52	0.01	-
48	9 - 786	O1	0-50	12.9	28.0	59.1	OM	4.05	3.4	3.0	45.62	1.25	0.131	5.52	1.77	0.32	0.23	53.78	41.99	12.7	1.74	0.36	31.95
Kd	787	Oe	50-110	2.8	35.7	61.5	C	4.5	3.6	5.0	-	-	0.035	2.43	1.95	0.07	0.23	19.03	11.31	19.7	1.79	0.07	-
	788	Cg	110-150	6.4	52.1	41.5	SIC	3.1	2.85	3.0	-	-	1.016	2.89	3.99	0.06	0.31	23.68	11.77	24.9	2.29	4.01	-
49	9 - 789	A	0-15	56.4	22.1	21.5	SCL	4.9	4.0	1.0	1.91	0.10	0.024	<0.002	0.04	0.09	0.06	7.19	3.16	2.6	0.55	0.04	3.74
P1	790	AB	15-35	50.3	19.0	30.7	SCL	4.6	3.9	1.0	-	-	0.014	0.55	0.11	0.07	0.06	5.64	3.16	12.3	0.58	0.02	-
	791	Bt1	35-50	50.3	19.0	30.7	SCL	4.55	4.0	0.5	-	-	0.011	1.18	0.16	0.07	0.04	3.21	2.02	31.1	0.41	0.01	-
	792	Bt2	50-100	41.7	20.7	37.6	CL	4.45	3.8	1.0	-	-	0.013	1.02	0.16	0.09	0.06	4.20	2.94	24.1	0.51	0.01	-
	793	Btg	100-150	52.8	11.5	35.7	SC	4.4	3.6	1.0	-	-	0.013	1.43	0.08	0.07	0.06	4.98	3.05	24.8	0.75	0.01	-
50	9 - 794	Oe	0-30	14.4	18.4	67.2	OM	4.2	3.7	16.0	25.79	1.11	0.077	3.28	0.76	0.13	0.29	51.78	33.44	7.9	3.57	0.15	17.76
Mu	795	C1	30-70	1.7	13.7	84.6	C	3.8	3.3	4.0	-	-	0.135	2.90	1.79	0.10	0.17	17.04	11.89	22.5	2.65	0.26	-
	796	C2	70-110	2.8	42.6	54.6	SIC	3.35	3.0	4.0	-	-	0.324	0.88	0.38	0.13	0.25	23.68	13.29	6.5	2.78	1.07	-
	797	Cg	110-150	0.3	46.2	53.5	SIC	3.0	2.6	3.0	-	-	3.075	3.52	9.98	0.06	0.12	28.33	14.42	32.6	2.71	10.14	-

4-6-2. Physical Analysis of Topsoils

Pit No.	Core No.	% Water Retention 1/3 atm.	% Water Retention 15 atm.	Available Water %	Bulk Density gm/cc
2	1	15.02	11.84	3.18	1.26
Bc	2	14.12	13.07	1.05	1.23
	3	14.45	11.31	3.14	1.05
	average	14.53	12.07	2.46	1.18
4	4*	82.55	81.42	1.13	0.62
Mu	5	74.37	49.75	24.62	0.59
	6	74.39	38.25	36.14	0.62
	average	74.38	44.00	30.38	0.61
6	7	33.01	26.79	6.22	0.92
Ta	8	32.67	29.85	2.82	1.10
	9	34.54	30.22	4.32	0.99
	average	33.41	28.95	4.45	1.00
8	10	28.69	22.89	5.80	1.13
Ba	11	29.03	23.05	5.18	1.18
	12	28.54	26.15	2.39	1.08
	average	28.75	24.30	4.46	1.13
9	13	58.29	55.94	2.35	0.72
Ta	14	50.91	54.23	3.68	0.81
	15	56.63	3.16	3.47	0.81
	average	55.28	37.78	3.17	0.78
11	16	29.88	26.27	3.61	1.02
Ra	17	25.48	22.73	2.75	1.31
	18	22.84	21.77	1.07	1.40
	average	26.07	23.59	2.48	1.24
12	19	30.22	29.52	0.70	1.28
Ra	20	31.21	30.35	0.86	1.27
	21*	31.68	29.04	2.64	1.85
	average	31.04	29.64	1.40	1.27
14	22	35.10	32.69	2.41	1.20
Pk	23	37.91	36.06	1.85	1.19
	24	34.21	32.32	1.89	1.21
	average	35.74	33.69	2.05	1.20
17	25	88.56	69.28	19.28	0.47
Mu	26	85.58	66.03	19.55	0.56
	27	80.43	67.38	13.05	0.59
	average	84.86	67.56	17.29	0.54
19	28	36.39	35.06	1.33	1.15
Mu	29	35.72	34.50	1.22	1.36
	30	35.97	34.07	1.90	1.36
	average	36.03	34.54	1.48	1.29
28	1	14.86	10.31	4.55	1.36
U2/71	2	13.92	10.22	3.70	1.34
	3	19.34	13.65	5.69	1.30
	average	16.04	11.39	4.65	1.33
29	4	24.76	20.03	4.73	1.46
Cb	5	26.14	19.97	6.17	1.27
	6	23.10	15.07	8.03	1.45
	average	24.67	18.36	6.31	1.39
31	7	131.74	106.96	24.78	0.47
Kd	8	133.04	107.93	25.11	0.46
	9	145.02	128.61	16.41	0.41
	average	136.60	114.50	22.10	0.45
32	10	35.48	29.52	5.96	1.27
Ra	11	33.59	29.91	3.68	1.33
	12	40.91	28.56	12.35	1.19
	average	36.66	29.33	7.33	1.26
33	13	20.22	11.97	8.25	1.31
Pti	14	21.41	16.62	4.79	1.32
	15	18.17	12.22	5.95	1.28
	average	19.93	13.60	6.33	1.30
35	16	33.52	30.99	2.53	1.29
Ta	17	35.87	26.21	9.66	1.24
	18	33.57	31.46	2.11	1.30
	average	34.32	29.55	4.77	1.28
38	19	34.79	32.29	2.50	1.31
Tsl	20	34.30	29.60	4.70	1.30
	21	34.47	26.09	8.38	1.31
	average	34.52	29.33	5.19	1.31
39	22	48.92	36.81	12.11	1.08
Ra	23	46.92	39.67	7.25	1.11
	24	49.86	44.60	5.26	1.08
	average	48.57	40.36	8.21	1.09
41	25	33.09	30.67	2.42	1.35
Ba	26	28.01	23.37	4.64	1.53
	27	26.47	22.61	3.86	1.34
	average	29.19	25.55	3.64	1.41
45	28	45.54	40.68	4.86	0.91
Kd	29	43.91	36.87	7.04	1.09
	30	45.44	39.12	6.32	1.07
	average	44.96	38.89	6.07	1.02

Note: * excluded

APPENDIX 4-7. Estimation of Natural Fertility of Study Area Soils

4-7-1. Estimation of Natural Fertility of Topsoils

Pit No.	Soil Series	CEC me/100g	Base Saturation %	Organic Matter %	Available-P ppm	Natural Fertility For Rice	Natural Fertility For Upland Crops
1	Bh	0.52 (L)	39.3 (M)	0.29 (L)	1.56 (L)	L	L
2	Bc	2.33 (L)	9.5 (L)	1.45 (ML)	5.29 (L)	L	L
3	Nw	24.89 (H)	20.4 (L)	15.93 (H)	7.57 (ML)	ML	ML
4	Mu	15.81 (M)	7.5 (L)	5.12 (H)	54.68 (H)	ML	ML
5	Ta	13.49 (M)	19.0 (L)	3.74 (H)	15.31 (M)	ML	ML
6	Ta	10.10 (ML)	8.8 (L)	3.58 (H)	35.55 (H)	ML	MH
7	Bh	3.97 (L)	14.6 (L)	0.65 (L)	5.48 (L)	L	L
8	Ba	7.84 (ML)	7.9 (L)	1.33 (ML)	6.56 (ML)	L	L
9	Ta	20.57 (MH)	43.1 (M)	10.05 (H)	25.03 (H)	ML	MH
10	Bh	1.57 (L)	38.5 (M)	1.04 (L)	1.94 (L)	L	L
11	Ra	9.48 (ML)	12.8 (L)	3.71 (H)	12.37 (M)	L	L
12	Ra	17.84 (MH)	56.8 (M)	5.62 (H)	13.71 (M)	M	M
13	Bc	1.31 (L)	35.2 (M)	0.75 (L)	2.67 (L)	L	L
14	Pk	2.64 (L)	23.5 (L)	1.07 (L)	4.62 (L)	L	L
15	Cb	7.95 (ML)	54.2 (M)	1.22 (ML)	3.87 (L)	MH	ML
16	Ni	4.69 (L)	29.7 (L)	4.16 (H)	6.49 (ML)	L	L
17	Mu	12.38 (M)	25.0 (L)	7.90 (H)	22.00 (MH)	M	ML
18	Pil	11.03 (M)	26.6 (L)	2.67 (MH)	12.04 (M)	ML	ML
19	Mu	8.84 (ML)	16.0 (L)	4.18 (H)	14.60 (M)	ML	ML
20	Bu	5.80 (ML)	16.6 (L)	1.32 (ML)	6.02 (ML)	L	ML
21	Ro	9.54 (ML)	7.4 (L)	3.24 (MH)	8.22 (ML)	L	ML
22	Ba	5.66 (ML)	7.8 (L)	1.28 (ML)	4.70 (L)	L	L
23	Tsl	11.63 (M)	15.6 (L)	3.12 (MH)	6.43 (ML)	ML	ML
24	Ko	2.47 (L)	25.9 (L)	0.68 (L)	8.51 (ML)	L	L
25	Ba	2.57 (L)	10.9 (L)	1.11 (ML)	5.66 (L)	L	L
26	Kd	34.87 (H)	15.6 (L)	19.85 (H)	11.84 (M)	ML	ML
27	Ta	6.82 (ML)	40.4 (M)	3.62 (H)	7.22 (ML)	M	ML
28	U2/71	3.16 (L)	25.0 (L)	2.67 (MH)	1.87 (L)	L	L
29	Cb	5.65 (ML)	31.4 (L)	2.12 (M)	4.54 (L)	L	L
30	Mu	12.54 (M)	19.5 (L)	8.57 (H)	9.52 (ML)	ML	ML
31	Kd	26.79 (H)	26.2 (L)	45.93 (H)	12.79 (M)	ML	ML
32	Ra	6.56 (ML)	56.8 (M)	2.93 (MH)	4.80 (L)	M	ML
33	Pti	1.58 (L)	29.9 (L)	1.24 (ML)	13.28 (M)	L	L
34	Bc	1.35 (L)	23.0 (L)	1.03 (L)	2.12 (L)	L	L
35	Ta	4.57 (L)	55.5 (M)	3.46 (MH)	2.69 (L)	ML	L
36	Bc	5.59 (ML)	37.6 (M)	4.17 (H)	23.64 (MH)	M	M
37	Ni	2.94 (L)	13.5 (L)	2.45 (M)	6.27 (ML)	L	L
38	Tsl	9.95 (ML)	7.1 (L)	4.12 (H)	8.01 (ML)	L	L
39	Ra	8.56 (ML)	14.2 (L)	6.91 (H)	10.11 (ML)	L	L
40	Ts	11.16 (M)	23.6 (L)	6.76 (H)	6.56 (ML)	ML	ML
41	Ba	4.75 (L)	35.8 (M)	3.12 (MH)	14.44 (M)	L	L
42	Ko	4.38 (L)	22.7 (L)	2.59 (M)	3.62 (L)	L	L
44	Ba	6.87 (ML)	21.3 (L)	4.09 (H)	3.42 (L)	L	L
45	Kd	10.50 (ML)	10.1 (L)	6.60 (H)	4.08 (L)	L	L
46	Pil	1.69 (L)	38.1 (M)	2.17 (M)	5.95 (L)	L	L
47	Cyi	13.33 (M)	26.6 (L)	9.60 (H)	22.24 (MH)	ML	ML
48	Kd	41.99 (H)	12.7 (L)	45.62 (H)	31.95 (H)	ML	ML
49	Pi	3.16 (L)	7.5 (L)	1.91 (M)	3.74 (L)	L	L
50	Mu	33.44 (H)	7.9 (L)	25.79 (H)	17.76 (MH)	ML	ML

1/ Topsoil : 0-30cm

4-7-2. Key for Estimating Natural Fertility

(a) Rating of the selected soil test values [1/]

CEC	me/100g soil
High	> 20
Moderately high	16 - 20
Medium	11 - 15
Moderately low	5 - 10
Low	< 5
Base Saturation	**%**
High	> 75
Medium	35 - 75
Low	< 35
Organic Matter	**weight %**
High	> 3.5
Moderately high	2.5 - 3.5
Medium	1.6 - 2.5
Moderately low	1.1 - 1.5
Low	< 1.0
Available Phosphorus [2/]	**P-ppm**
High	> 25
Moderately high	16 - 25
Medium	11 - 15
Moderately low	6 - 10
Low	< 6
Soil Reaction [3/]	**pH (1:1 H_2O)**
Moderately low	4.2 - 4.5
Moderately low - Low	4.0 - 4.2
Low	< 4.2

1/ From weighed average over 0 - 30 cm layer.

2/ Very Low and Very High may be used if significant for values below 3 and above 45.

3/ For soils with jarosite layuer within 1m, the soil reaction at 30cm may limit the natural fertility.

Source: Soil Interpretation Handbook for Thailand, Dept. of Land Development/FAO (1973)

(b) Key for estimating the natural fertility of soils mainly suited for paddy rice

C.E.C.	Base Sat.	Org. Matter	Av. Phosphate	Natural Fertility
H-MH	H	H-M	H-M	high
"	H	M-ML	M-ML	moderately high
"	M	M	H-M	moderately high
"	H	ML	M-L	moderate
"	M	M-ML	M-L	moderate
"	L	M	M	moderately low
"	L	ML	M-L	low
M	H	H-M	H	high
"	H	M	M	moderately high
"	H	ML	M-L	moderate
"	M	M	M-L	moderate
"	M	ML	H-M	moderate
"	M	ML	M-L	moderately low
"	L	M	H-M	moderately low
"	L	ML	M-L	low
ML	H	M	H-M	moderately high
"	H	ML	M-L	moderate
"	M	M	H-M	moderate
"	M	ML	M-L	moderately low
"	H	L	M-L	moderately low
"	M	L	M-L	low
"	L	ML	M-L	low
L	H	ML	M	moderately low
"	M-L	L	L	low

Source: Soil Interpretation Handbook for Thailand, Dept. of Land Development/FAO (1973).

(c) Key for estimating the natural fertility of soils mainly suited for upland crops

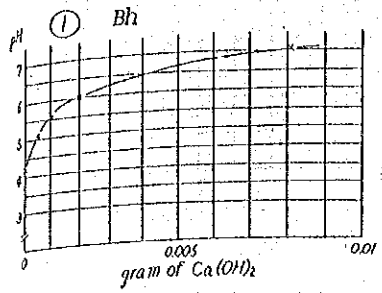
CEC	Base Sat.	Av. Phosphate	Natural Fertility
H-MH	H	H	high
"	M	H	moderately high
"	L	M	moderately low
"	H	MH-M	moderately high
"	H	L	moderate
"	M	M-L	moderate
M	H	H	high
"	M	H	moderately high
"	L	H	moderately low
"	H	M	moderately high
"	H	L	moderate
"	M	M-ML	moderate
"	M	L	moderately low
"	L	M-L	moderately low
ML	H	H	moderately high
"	M	H	moderate
"	L	H-M	moderately low
"	H	M	moderate
"	M	M-L	moderately low
"	L	L	low
L	H	M	moderately low
"	M-L	M-L	low

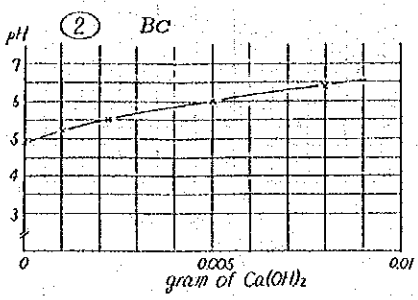
APPENDIX 4-8. Determination of Lime Requirement of Soils

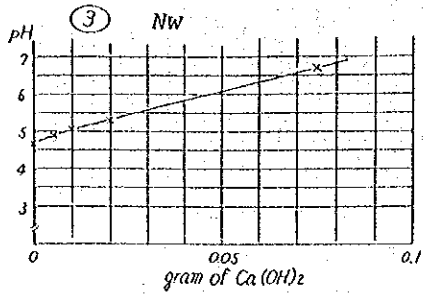
4-8-1. Result of Lime Requirement Determination

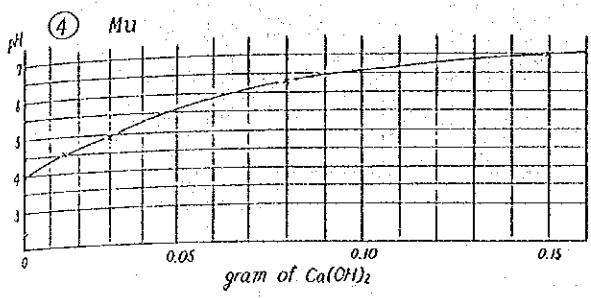
No.	Symbol	Lime Requirement ($CaCO_3$ ton/ha)					Remarks
		pH 7.0	pH 6.5	pH 6.0	pH 5.5	pH 5.0	
1	Bh	2.27	1.30	0.65	0.29	0.13	
2	Bc	4.52	1.83	1.22	0.54	0.09	
3	Nw	3.58	2.87	2.00	1.12	0.37	
4	Mu	20.27	12.83	8.79	6.49	4.19	Acid Sulfate Soils
5	Ta	22.26	16.87	13.15	9.78	6.07	
6	Ta	12.27	9.10	6.57	4.23	2.12	
7	Bh	4.71	3.25	2.28	1.30	0.49	
8	Ba	6.99	5.12	3.50	2.09	0.70	
9	Ta	27.30	21.42	13.39	8.03	4.46	
10	Bh	8.15	6.20	4.89	3.26	1.96	
11	Ra	18.34	12.91	9.04	5.94	3.62	Potential
12	Ra	20.00	15.36	9.72	6.40	3.84	Potential
13	Bc	1.89	1.14	0.65	0.23	0	
14	Pk	2.77	1.96	1.21	0.65	0	
15	Cb	4.55	3.25	2.25	1.50	0.75	
16	Ni	13.89	8.92	4.96	2.31	0.66	
17	Mu	14.25	10.18	6.94	4.43	2.39	Acid Sulfate Soils
18	Pil	15.58	10.72	6.70	4.02	1.01	
19	Mu	21.70	20.33	15.73	12.47	9.49	Acid Sulfate Soils
20	Bu	8.01	6.60	4.62	2.98	0.99	
21	Ro	12.08	8.06	6.04	3.69	1.68	
22	Ba	9.27	7.29	5.30	3.64	1.99	
23	Tsl	16.16	12.25	8.84	5.78	3.40	
24	Ko	4.91	3.27	1.80	0.49	0	
25	Ba	4.61	3.27	1.54	0.65	0	
26	Kd	28.53	21.80	16.78	13.21	10.17	Potential
27	Ta	5.07	3.15	1.80	0.90	0.45	
28	U2/71	4.64	2.73	1.91	1.09	0.55	
29	Cb	8.71	6.97	4.88	3.13	1.74	
30	Mu	33.10	27.77	22.07	16.73	12.10	Acid Sulfate Soils
31	Kd	14.67	12.35	8.38	5.18	1.99	Potential
32	Ra	9.82	7.75	5.43	3.88	2.33	Potential
33	Pti	2.00	1.33	0.91	0.45	0	Potential
34	Bc	3.26	2.77	2.15	1.50	0.75	
35	Ta	4.05	2.61	1.83	0.78	0	
36	Bc	5.12	2.64	0.66	0	0	
37	Ni	4.42	2.62	1.64	0.65	0	
38	Tsl	12.96	10.15	7.75	5.34	3.20	
39	Ra	13.65	10.92	8.64	6.60	4.09	Potential
40	Ts	31.05	24.38	18.70	13.70	9.02	
41	Ba	7.41	5.75	4.03	2.59	1.15	
42	Ko	9.42	5.95	4.30	2.64	0.98	
43	Pi	-	-	-	-	-	
44	Ba	13.09	9.82	7.85	5.56	3.27	
45	Kd	15.59	12.39	9.61	7.47	5.34	Potential
46	Pil	3.27	2.29	1.64	0.65	0.33	
47	Cyi	32.03	22.42	15.30	10.68	6.41	
48	Kd	35.06	26.30	17.53	12.52	8.77	Potential
49	Pi	5.07	3.60	2.30	0.98	0.33	
50	Mu	34.70	24.59	16.05	11.57	7.23	Acid Sulfate Soils

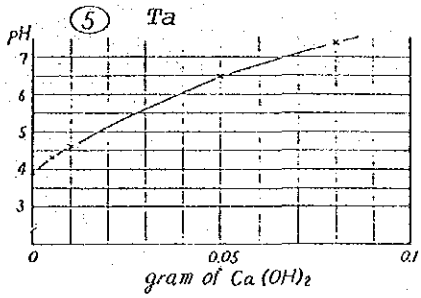
4-8-2. Buffer Curves for Determining Lime Requirement of Soils

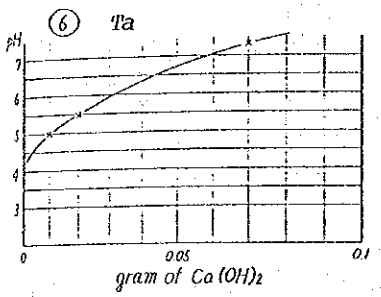


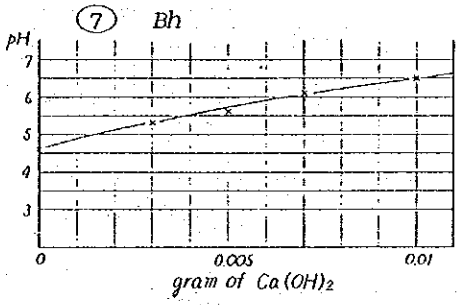


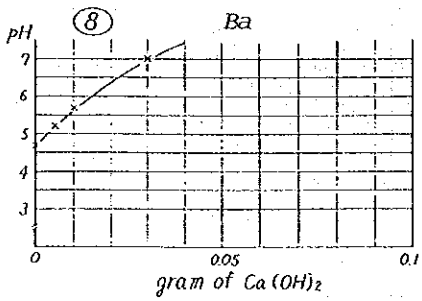


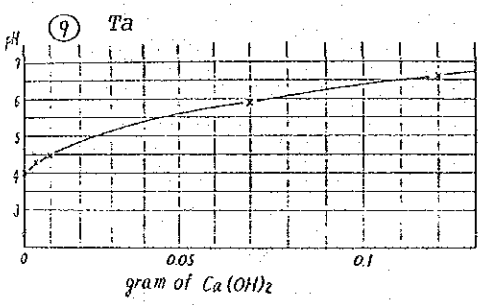


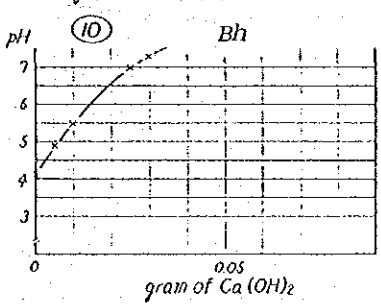


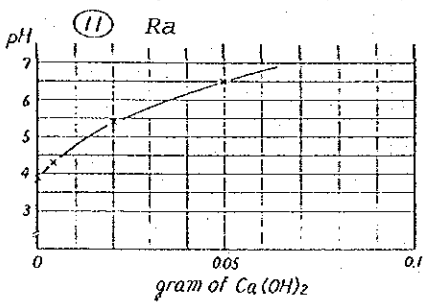


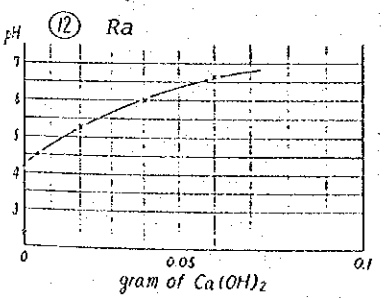


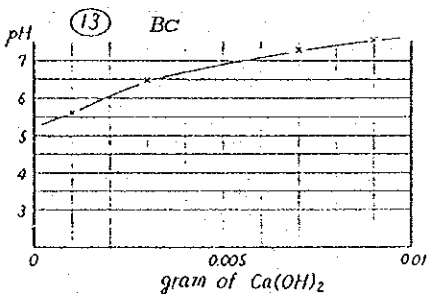


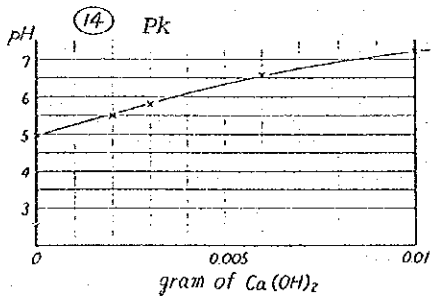


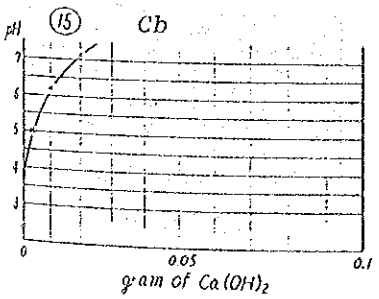


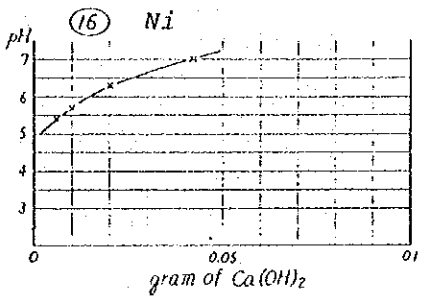


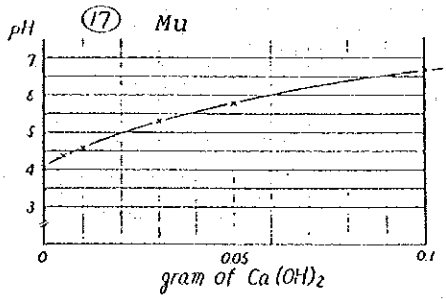


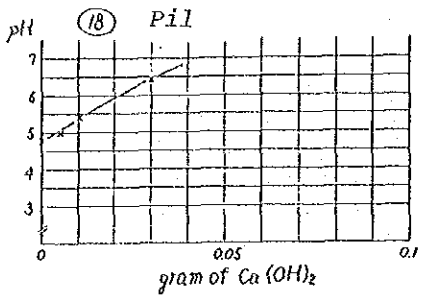


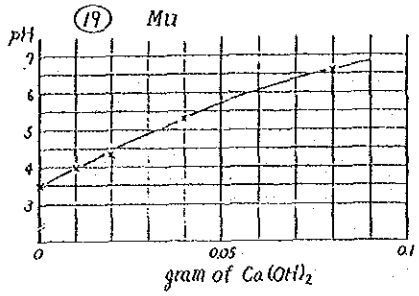









18 Pil
pH
gram of Ca(OH)2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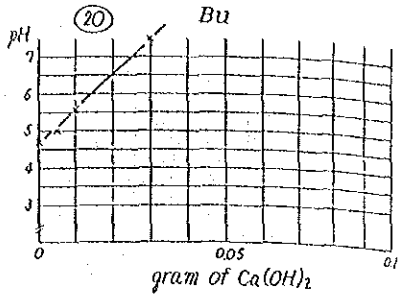
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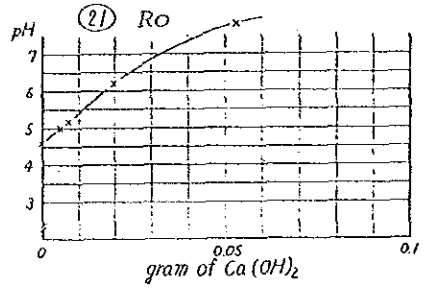
21 Ro
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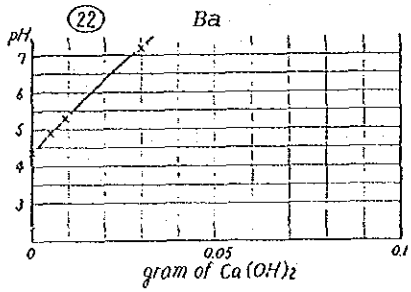
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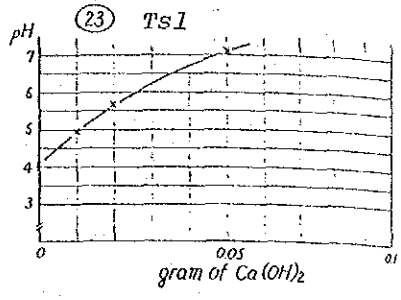
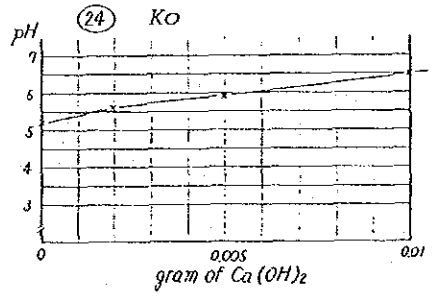
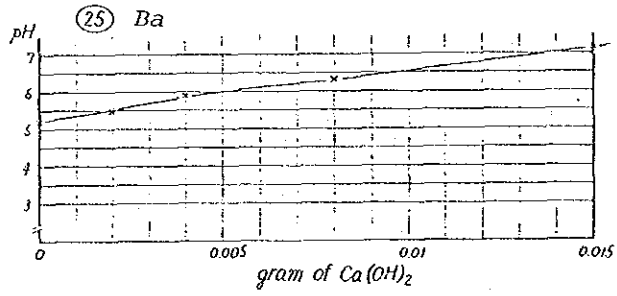
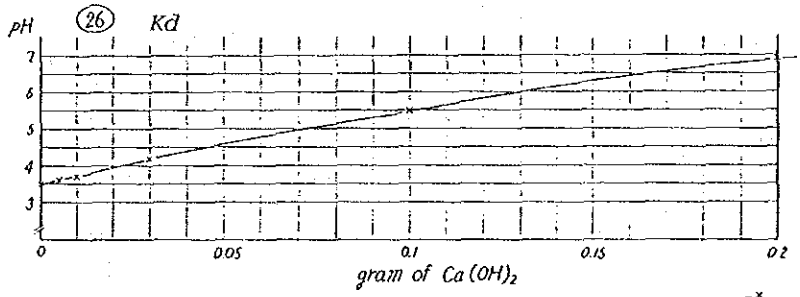
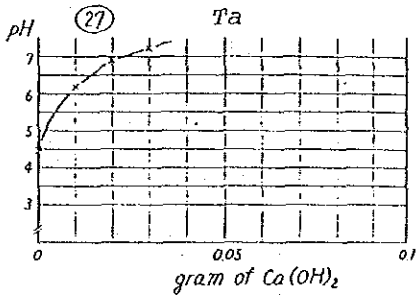
gram of Ca(OH)2

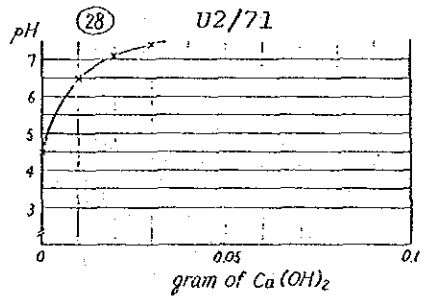

23 Tsl
pH
gram of Ca(OH)2

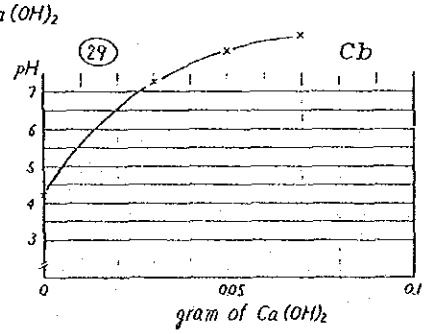

24 Ko
pH
gram of Ca(OH)2

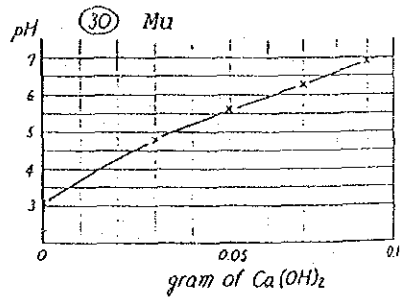

25 Ba
pH
gram of Ca(OH)2

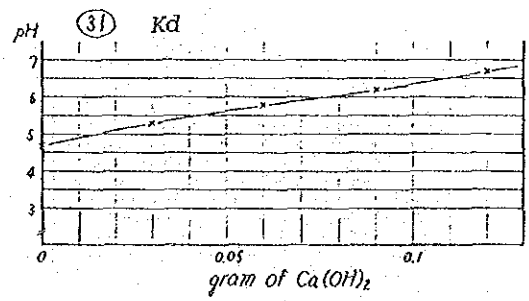

26 Kd
pH
gram of Ca(OH)2

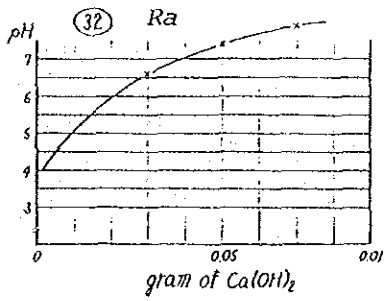

27 Ta
pH
gram of Ca(OH)2

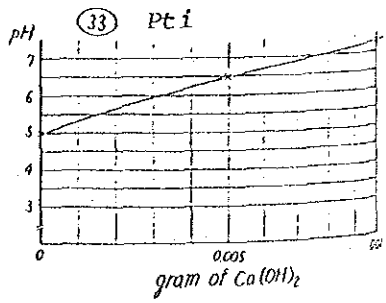

28 U2/71
pH
gram of Ca(OH)2

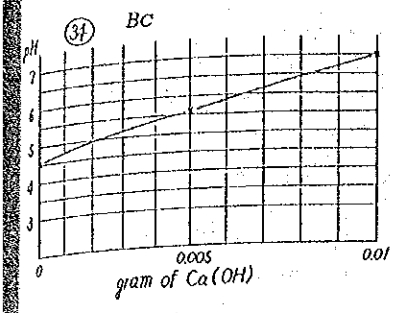

29 Cb
pH
gram of Ca(OH)2

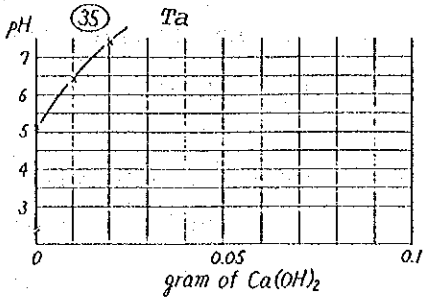

30 Mu
pH
gram of Ca(OH)2

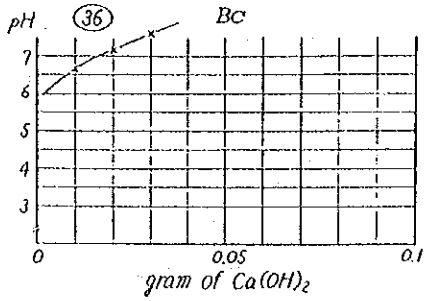

31 Kd
pH
gram of Ca(OH)2

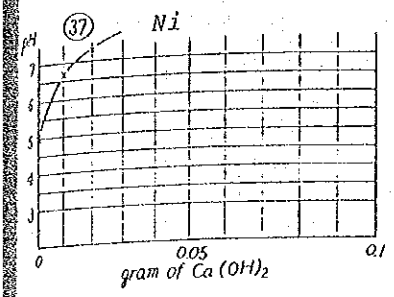

32 Ra
pH
gram of Ca(OH)2

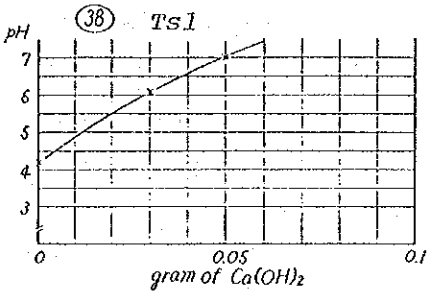

33 Pti
pH
gram of Ca(OH)2

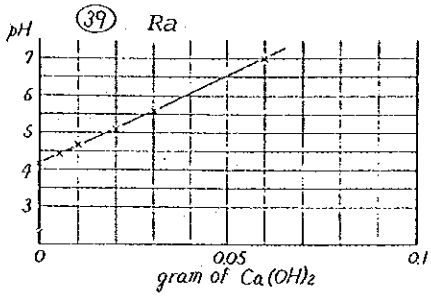

31 Bc
pH
7
6
5
4
3
0
0.005
0.01
gram of Ca(OH)

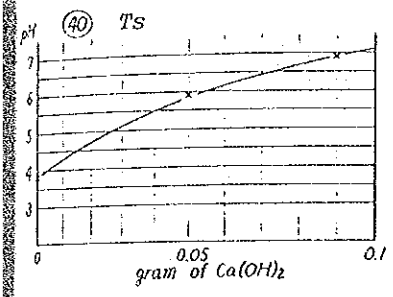

35 Ta
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

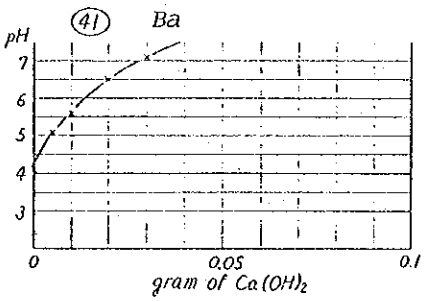

36 Bc
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

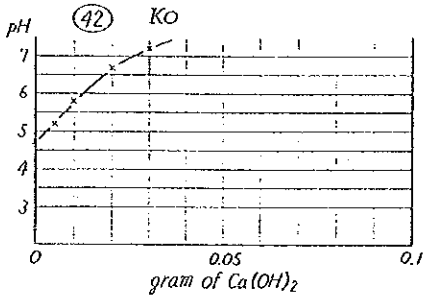

37 Ni
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

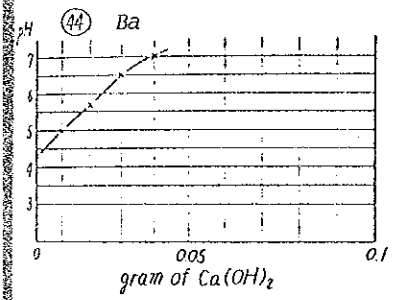

38 Tsl
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

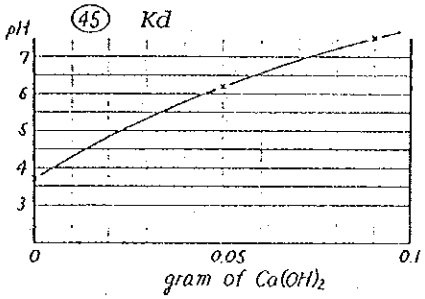

39 Ra
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

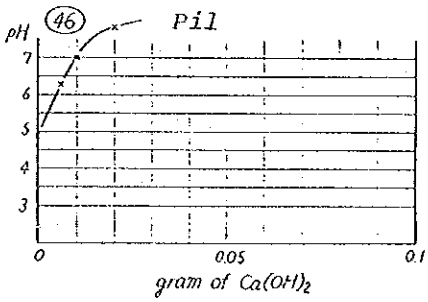

40 Ts
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

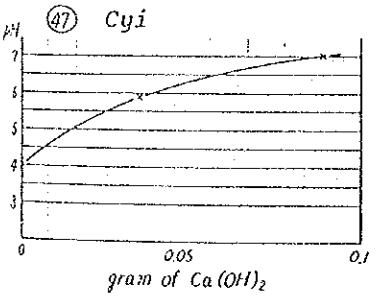

41 Ba
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

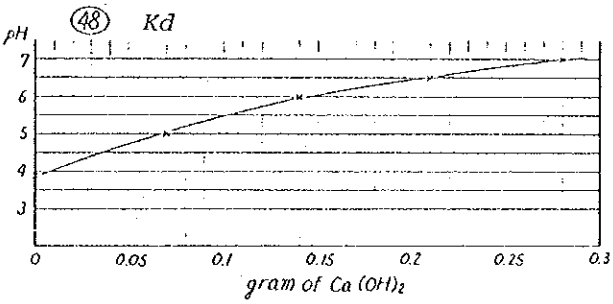

42 Ko
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

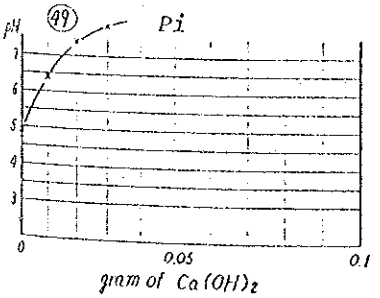

44 Ba
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2

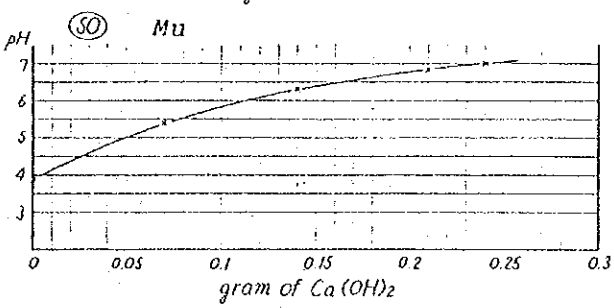

45 Kd
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2


46 Pil
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2


47 Cyi
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2


48 Kd
pH
7
6
5
4
3
0
0.05
0.1
0.15
0.2
0.25
0.3
gram of Ca(OH)2


49 Pi
pH
7
6
5
4
3
0
0.05
0.1
gram of Ca(OH)2


50 Mu
pH
7
6
5
4
3
0
0.05
0.1
0.15
0.2
0.25
0.3
gram of Ca(OH)2

4-8-3. Note: Level of Lime Dust Requirement for the Paddy Field With Different pH Values

There is no direct correlation between lime requirement and soil pH values because of the buffer capacity of soils. Therefore, the lime requirement is generally determined by the buffer curve method as conducted in the Study. As the result of determination, the lime requirement of each soil series has been grouped into four categories as shown in para. ii) Lime Requirement of Acid Soils", (3) "Problem Soils and Their Improvement", 3.3.3. "Soils", Chapter 3 in the Main Report.

o Requirement of $CaCO_3$

L0: less than 1.0 ton/ha

L1: 1.0 - 5.0 ton/ha

L2: 6.0 - 10.0 ton/ha

L3: more than 10.0 ton/ha

o Relation of Soil Series With Lo to 3

Soil Series	Map Symbol	
Beach Ridges & Sand Bars or Dunes		
Hua Hin	Hh	L0
Bacho	Bc	L0
Ban Thon	Bh	L1
Depression between Beach Ridges		
Pattani	Pti-ly	L0
Takua Thung	Tkt-ly	L1
Foremer Tidal Flat		
Tak Bai	Ta-ly	L2
	Ta-fc	L2
	Ta-fc-na	L0
	Ta-ly-na	L0
Rangae	Ra-ly-a_2	L2
	La-ly-a_3	L2
	Ra-m-sub	L2
	Rs-o	L2
	Ro-o/Ra-dm,sub	L2
	Ra/Kd-o	L2
Muno	Mu-ly	L3
Chian Yai	Cyi-ly	L2
	Cyi-o	L2
	Cyi-r,sub	L3
	Cyi/Mu-ly	L3
Thon Sai	Ts-ly	L2
	Ts-col	L1
	Ts-o	L2
Flood Plain, Leveers & Breach Deposits		
Chon buri	Cb-ly	L0
	Cb-fc	L1
Alluvial Complex	Ac	L1
Sai Buri	Bu	L1
Ruso	Ro	L1

Low Terrace		
Pileng	Pil-ly	L1
Khok Kian	Ko-ly	L0
Tha Sala	Tsl-ly	L1
Pattalung	Ptl-ly	L1
	Ptl/Ba-m.sub	
Bangnara	Ba-ly	L1
	Ba/Ptl-ly	L1
	Ba/Tsl-ly	L1
	U1/71	L0
Sungai Padi	Pi	L1
Sungai Kolok	Gk	L1
Nam Krachai	Ni	L1
Middle Terrace		
Kohong	Kh	L1
	U2/71	L1
Lamphu La	L1	L1
Hills & Foothill Slopes		
Nuai Pong	Hp	L1
Phuket	Pk	L0
Yi-ngo	Yg	L0
Slope Complex	SC	L0
Domed Bogs		
Narathiwat	$Nw\text{-}d_1$	L1
	$Nw\text{-}d_{1+2}$	L2
	$Nw\text{-}d_2$	L1
	$Nw\text{-}d_3, a_{1+2}$	L1
	$Nw\text{-}d_3, a_2$	L1
Kap Dang	$Kd\text{-}a_2$	L2
	$Kd\text{-}a_3$	L2
	$Kd\text{-}a_4$	L3

o Study Area by L0 to 3

L0	6,870ha	14.7%
L1	25,600ha	54.8%
L2	8,990ha	19.3%
L3	4,400ha	9.4%
W	840ha	1.8%
Total	46,700ha	100.0%

o Lime Dust Requirement by L0 to 3

(ton/ha)

	$CaCO_3$	Lime Dust */
L0	< 1.0	< 1.2
L1	1.0 - 5.0	1.2 - 6
L2	6.0 - 10.0	6 - 12
L3	>10.0	>12

*/ ..... CCE: 78-92%, 85% average

APPENDIX 4-9. Lime Application Experiments in Pikulthong Center

4-9-1. List of Experiments Conducted in Pikulthong Center

1) DLD

The following studies on rate of soil amendments (lime dust, rock phosphate, chemical fertilizers) on various kinds of crops or varieties on different soil conditions,

Crop, Variety	Amendment	Soil
Rice:		
RD23	lime dust	Muno
"	lime dust, rock phosphate	Rangae
RD21	lime dust	Muno
"	lime dust, rock phosphate	Muno
"	lime dust	Rangae
RD7	lime dust, N-P-K	Muno
"	lime dust	Rangae
"	lime dust, rock phosphate	Muno
Upland Crops:		
Sweet corn	lime dust	Thon Sai
Soybean	"	"
Peanut	"	"
Mung bean	"	"
Upland rice	"	"
Sweet corn	"	Rangae
Soybean	"	"
Peanut	"	"
Mung bean	"	"
Upland rice (Koo Muang Luong)	"	"
" (RD11)	"	"
Peanut	lime dust, rock phosphate	"
Mung bean	lime dust, N-P-K	"
"	lime dust, rock phosphate	"
Sugar cane	lime dust	"
Young corn	lime dust, compost	"
Long bean	" "	"

Corp, Varity	Amendment	Soil
Chinese cabbage	lime dust, compost	Rangae
Mustand green	" "	"
Morning glory	" "	"
Kanale	" "	"
Tree Crops:		
Coconut	soil amelioration	Rangae
Tangerin	"	"
Pamelo	"	"
Forage Crops:		
Forage Crop	lime dust, rock phosphate	Rangae
"	" "	Muno
"	" "	Thon Sai

And the following studies were programmed;

- Study on chemical and physical changes before and after burning the organic soils in Narathiwat Province.
- Study on toxicity of iron and aluminium to rice grown on Narathiwat (Muno and Rangae series)
- Study on available phosphorus and potassium which related to the growth of rice, corn and mung bean grown in Narathiwat province.
- Study on acidification of acid sulfate soil

2) DOA

- Rate and source of chemical fertilizer for pineapple on Rangae series.
- Study on the factors involved in Rangae series improvement on growth and yield of string bean.
- Farmer trial cum demonstration of crops adaptability on Rangae series.
- Study on the tolerant crops in treated TongSai series on cropping systems.
- Breeding for tolerance to acid soil in rice for southern region.

3) Livestock Dept.

- The effects of different lime and fertilizer rates Brachiaria mutica in swamp area.

4-9-2. Rice Yield in Satellite Villages

Location	1984		1985		Remarks
	Kg/rai	ton/ha	Kg/rai	ton/ha	
Ban Ya Bi	660	4.1	700	4.4	No liming
Ban Khiri	480	3.0	470	2.9	No liming
Ban Koksya	330	2.1	280	1.8	Liming
Ban Pikulthong	430	2.7	-	-	Liming
Ban Kao Tanyong	1,030	6.4	1,030	6.4	Liming Rotation with mung bean
Ban Mai Sepom	310	1.9	-	-	Liming
Ban Bang Mamao	700	4.4	640	4.0	Liming
Ban Ple	600	3.8	670	4.2	Liming

1/ Local varieties

Fertilization: { 15-15-15 25 kg/rai
urea 8 kg/rai (top dressing)

Liming : Slaked lime 1.7 ton/rai

Managed by the farmer

APPENDIX 4-10. Result of Pyrite Oxidation Test

No.	Sample No.	Depth(cm)		pH	Color		Mottling		Remarks
27 Ta ① Jan 21 ③ May 13	27-2	18-30	①	6.0	10YR5/2	Grayish brown	7.5YR7/8	Reddish yellow, common	
			③	4.1	10YR7/2	Light gray	10YR6/8	Brownish yellow, few	
	27-3	30-45	①	6.5	N7	Light gray	10YR6/6	Brownish yellow, few	
			③	4.4	10YR8/1	White	10YR7/8	Yellow, few	
	27-4	45-70	①	7.5	5Y7/1	Light gray	10YR6/6	Brownish yellow, common	
			③	5.2	10YR8/1	White	10YR5/8	Yellowish brown, common	
	27-5	70-120	①	7.5	N7	Light gray	10YR6/6	Brownish yellow, few	
			③	5.8	N8	White	7.5YR7/8	Reddish yellow, few	
29 Cb ① Jan 21 ③ May 13	29-2	20-80	①	6.0	10YR7/1	Light gray	10YR5/6	Strong brown, many	
			③	4.7	10YR8/1	White	10YR7/8	Yellow, many	
	29-3	80-110	①	5.5	N7	Light gray	7.5YR5/8	Strong brown, common	
			③	4.7	N8	White	10YR7/8	Yellow, common	
	29-4	110-150	①	5.0	10YR7/1	Light gray	7.5YR5/8	Strong brown, common	
			③	4.5	10YR8/1	White	10YR6/8	Brownish yellow, common	
30 Nu Actual ① Jan 22 ③ May 13	30-2	20-70	①	4.2	10YR5/2	Grayish brown	10YR6/8	Brownish yellow, common	
			③	2.5 **	7.5YR6/2	Pinkish gray	7.5YR6/8	Brownish yellow, common	Jarosite mottles, few
	30-3	70-150	①	6.5	5G5/1	Greenish gray	none		
			③	4.9	5GY6/1	Gray	none		
31 Kd Potential ① Jan 22 ③ May 13	31-2	12-20	①	5.0	10YR6/2	Light brownish gray	10YR5/8	Yellowish brown, common	
			③	4.5	10YR5/3	Brown	10YR7/8	Yellow, few	
	31-3	20-32	①	5.5	10YR3/2	Very dark grayish brown	10YR4/6	Dark yellowish brown, few	
			③	5.1	7.5YR5/2	Brown	none		
	31-4	32-60	①	6.0	10YR5/2	Grayish brown	7.5YR5/8	Strong brown, common	
			③	4.9	7.5YR5/4	Brown	7.5YR5/6	Strong brown, few	
	31-5	60-120	①	6.0	10YR5/1	Gray	none		Pyrite-enriched horizon
			③	2.4 **	10YR5/2	Grayish brown	none		
32 Ra Potential ① Jan 22 ③ May 13	32-2	20-60	①	5.0	10YR6/3	Pale brown	7.5YR5/6	Strong brown, common	Pyrite-enriched horizon
			③	3.3 *	10YR8/2	White	7.5YR6/8	Reddish yellow, few	
	32-3	60-90	①	4.0	10YR7/2	Light gray	10YR6/8	Brownish yellow, many	Pyrite-enriched horizon
			③	2.8 *	10YR8/2	White	10YR7/8	Yellow, common	
	32-4	90-110	①	4.0	N7	Light gray	10YR5/8	Yellowish brown, many	Pyrite-enriched horizon
			③	1.7 **	10YR7/1	Light gray	10YR7/8	Yellow, many	Jarosite mottles, few
33 Prl Potential ① Jan 23 ③ May 13	33-2	15-50	①	5.0	5Y6/3	Pale olive	10YR5/8	Yellowish brown, common	
			③	4.7	2.5Y7/2	Pale yellow	10YR6/8	Brownish yellow, few	
	33-3	50-100	①	5.5	5Y6/3	Pale olive	10YR5/8	Yellowish brown, many	
			③	5.0	2.5YR8/2	White	10YR7/8	Yellow, common	
	33-4	100-150	①	7.0	N5	Gray	none		Pyrite-enriched horizon
			③	3.7 *	5Y6/1	Gray	none		
35 Ta ① Jan 23 ③ May 13	35-2	10-30	①	7.5	10YR6/2	Light brownish gray	10YR6/6	Brownish yellow, common	
			③	6.2	2.5Y7/2	Light gray	10YR7/8	Yellow, few	
	35-3	30-45	①	8.0	10YR7/2	Light gray	10YR6/6	Brownish yellow, many	
			③	7.1	2.5Y8/2	White	10YR7/8	Yellow, many	
	35-4	45-100	①	8.0	N7	Light gray	10YR7/8	Yellow, many	
			③	7.4	5Y8/1	White	10YR6/8	Brownish yellow, many	
38 Tsl ① Jan 25 ③ May 13	38-2	12-32	①	4.5	2.5Y6/2	Light grayish brown	10YR6/6	Brownish yellow, common	
			③	4.6	2.5Y7/2	Light gray	10YR5/6	Yellowish brown, common	
	38-3	32-42	①	5.5	2.5Y6/2	Light grayish brown	10YR6/6	Brownish yellow, common	
			③	5.2	10YR7/2	Light gray	10YR7/8	Yellow, few	
	38-4	42-100	①	4.5	10YR5/8	Yellowish brown	none		
			③	5.4	10YR6/6	Brownish yellow	none		
39 Ra Potential ① Jan 25 ③ May 13	39-2	8-25	①	4.5	10YR5/3	Brown	7.5YR5/6	Strong brown, common	
			③	4.0	10YR8/1	White	10YR6/8	Brownish yellow, few	
	39-3	25-20	①	4.5	10YR6/1	Light gray	7.5YR5/6	Strong brown, few	Pyrite-enriched horizon
			③	3.9 *	10YR8/1	White	7.5YR5/8	Strong brown, few	
	39-4	50-110	①	4.5	10YR7/2	Light gray	none		Pyrite-enriched horizon
			③	3.9 *	10YR8/1	White	none		
	39-5	110-130	①	4.5	10YR5/2	Grayish brown	none		Pyrite enriched horizon
			③	3.6 *	10YR6/3	Pale brown	none		
	39-6	130-150	①	4.5	10YR3/2	Very dark grayish brown	none		Pyrite enriched horizon
			③	2.7 **	10YR6/2	Dark grayish brown	none		
40 Ts ① Jan 26 ③ May 13	40-2	12-30	①	5.0	10YR6/3	Pale brown	7.5YR5/8	Strong brown, many	
			③	4.3	10YR7/1	Light gray	7.5YR7/8	Reddish yellow, common	
	40-3	30-45/50	①	5.0	10YR7/2	Light gray	10YR5/8	Yellowish brown, common	
			③	4.2	10YR8/1	White	7.5YR6/8	Reddish yellow, few	
	40-4	45/50-70	①	4.5	10YR6/2	Light brownish gray	10YR5/8	Yellowish brown, common	
			③	4.4	7.5YR7/2	Pinkish gray	7.5YR5/3	Strong brown, few	
	40-5	70-120	①	4.5	10YR7/2	Light gray	10R4/8	Red, common	
			③	4.3	7.5YR8/1	White	10R4/8	Red, common	
	40-6	120-150	①	4.5	10YR7/1	Light gray	10YR5/8	Yellowish brown, few	
			③	4.4	7.5YR8/1	White	none		
41 Ba ① Jan 26 ③ May 13	41-2	10-25	①	6.5	10YR5/1	Gray	7.5YR4/6	Strong brown, common	
			③	5.7	10YR6/2	Light brownish gray	7.5YR5/6	Strong brown, few	
	41-3	25-40	①	5.5	10YR6/1	Light gray	7.5YR5/8	Strong brown, many	
			③	4.9	10YR8/1	White	7.5YR7/8	Reddish yellow, many	
	41-4	40-90	①	5.0	N6	Light gray	10R4/8	Red, many	
			③	5.0	7.5YR8/1	White	10R4/4	Weak red, many	
	41-5	90-130	①	5.0	10YR6/1	Light gray	10YR5/8	Yellowish brown, many	
			③	5.0	7.5YR8/1	White	7.5YR6/8	Reddish yellow, many	
	41-6	130-150	①	5.5	10YR6/1	Light gray	10R4/8	Red, many	
			③	5.0	10YR8/1	White	7.5YR6/8	Reddish yellow, many	
44 Ba ① Jan 30 ③ May 13	44-2	15-28	①	6.0	10YR5/3	Brown	7.5YR4/6	Strong brown, common	
			③	5.2	2.5Y6/2	Light brownish gray	5YR7/8	Reddish yellow, few	
	44-3	28-100	①	6.0	10YR7/2	Light gray	10R4/6	Red, many	
			③	5.5	10YR8/1	White	10YR7/8	Yellow, common	

No.	Sample No.	Depth(cm)		pH	Color		Mottling		Remarks
45 Kd Potential ① Jan 31 ③ May 13	45-2	20/25-45	① ③	4.0 4.0	10YR7/2 10YR8/1	Light gray White	10YR6/8 none	Brownish yellow, few	
	45-3	45-70	① ③	4.0 4.1	10YR4/2 7.5YR6/2	Dark grayish brown Pinkish gray	none none		
	45-4	70-110	① ③	5.5 6.4	10YR5/2 5YR8/1	Grayish brown White	none none		
	45-5	110-150	① ③	6.0 2.6 **	10YR4/1 10YR5/1	Dark gray Gray	none none		Pyrite-enriched horizon
46 Ptl ① Jan 31 ③ May 13	46-3	32-50/55	① ③	5.0 4.9	10YR6/2 10YR7/1	Light brownish gray Light gray	7.5YR5/8 7.5YR7/8	Strong brown, common Reddish yellow, few	
	46-4	50/55-100	① ③	4.5 4.6	10YR6/1 10YR7/1	Light gray Light gray	5YR5/8 5YR6/8	Yellowish red, many Reddish yellow, common	
47 Cyt ① Jan 31 ③ May 13	47-2	10-30	① ③	5.5 4.7	10YR6/2 5YR7/1	Light brownish gray Light gray	7.5YR4/6 7.5YR6/8	Strong brown, common Reddish yellow, few	
	47-3	30-70	① ③	5.0 4.9	10YR3/1 5YR4/1	Very dark gray Dark gray	10YR6/8 5YR5/8	Brownish yellow, few Yellowish red, few	
	47-4	70-120	① ③	5.0 4.6	10YR6/1 5YR6/1	Light gray Light gray	10YR6/8 10YR6/8	Brownish yellow, many Brownish yellow, many	
	47-5	120-150	① ③	6.5 4.4	N7 / 10R4/8 10YR8/1	Light gray/red White	10YR6/8 5R5/4	Brownish yellow, common Weak red, common	
48 Kd Potential ① Feb 1 ③ May 13	48-2	50-110	① ③	7.0 5.1	2.5Y6/2 10YR5/3	Light brownish gray Brown	none none		
	48-3	110-150	① ③	7.0 3.2 *	N4 N6	Dark gray Light gray	none none		Pyrite-enriched horizon
49 Ptl ① Feb 2 ③ May 13	49-5	100-150	① ③	6.0 4.8	5Y6/1 10YR7/1	Gray Light gray	none 10YR7/8	Yellow, few	
50 Mu Actual ① Feb 3 ③ May 13	50-2	25/30-70	① ③	4.5 3.9 *	10YR7/3 10YR7/1	Very pale brown Light gray	7.5YR4/6 7.5YR5/6	Strong brown, common Strong brown, common	Pyrite-enriched horizon
	50-3	70-110	① ③	4.5 3.2 *	10YR5/3 7.5YR6/2	Brown Pinkish gray	none none		Pyrite-enriched horizon
	50-4	110-150	① ③	7.0 2.4 **	5G5/1 10YR6/1	Greenish gray Light gray	none none		Pyrite-enriched horizon
53 Ba ① Feb 5 ③ May 13	53-2	15-40	① ③	5.0 4.9	10YR6/1 10YR8/1	Light gray White	7.5YR5/8 7.5YR7/8	Strong brown, common Reddish yellow, common	
	53-3	40-90	① ③	5.0 4.8	10YR7/1 7.5YR8/1	Light gray White	7.5YR5/8 7.5YR7/8	Strong brown, common Reddish yellow, common	
	53-4	90-120	① ③	5.5 4.9	5YR3/1 5YR4/2	Very dark gray Dark reddish gray	10YR5/6 5YR5/4	Yellowish brown, common Reddish brown, few	
	53-5	120-150	① ③	5.0 4.9	5Y7/1 10YR8/1	Light gray White	7.5YR6/8 5YR7/8	Reddish yellow, common Reddish yellow, common	
54 Ba ① Feb 5 ③ May 13	54-2	15-40	① ③	5.5 4.9	10YR6/1 10YR7/2	Light gray Light gray	10YR5/8 10YR7/8	Yellowish brown, many Yellow, many	
	54-3	40-70	① ③	5.0 4.9	10YR6/1 10YR7/2	Light gray Light gray	10YR5/6 10YR7/8	Yellowish brown, many Yellow, many	
	54-4	70-110	① ③	5.0 4.9	N7 10YR8/1	Light gray White	10R4/8 10R5/8	Red, many Red, many	
	54-5	110-150	① ③	5.5 5.2	N8 7.5YR8/1	White White	10YR5/8 5YR6/8	Yellowish brown, common Reddish yellow, common	
56 Ba ① Feb 5 ③ May 13	56-2	15-50	① ③	5.5 4.9	10YR6/1 10YR7/1	Light gray Light gray	7.5YR5/6 10YR6/8	Strong brown, many Brownish yellow, many	
	56-3	50-100	① ③	5.0 4.9	N7 N8	Light gray White	7.5YR5/8 10YR6/8	Strong brown, many Brownish yellow, many	
	56-4	100-150	① ③	5.5 5.1	10YR7/1 N8	Light gray White	10YR5/8 10YR6/6	Yellowish brown, common Brownish yellow, common	
57 Ba ① Feb 5 ③ May 13	57-4	110-150	① ③	5.0 5.0	10YR6/1 2.5YR8/1	Light gray White	10YR5/8 7.5YR6/8	Yellowish brown, common Reddish brown, common	
60 Ra ① Jan 22 ③ May 13	60-2	10-40	① ③	5.5 4.6	10YR6/1 10YR8/1	Light gray White	none none		
	60-3	40-90	① ③	5.0 4.5	10YR6/1 10YR8/2	Light gray White	10YR5/8 10YR7/8	Yellowish brown, many Yellow, many	
	60-4	90-110	① ③	5.0 4.9	10YR7/1 10YR8/1	Light gray White	none 10YR6/8	Brownish yellow, few	
	60-5	110-150	① ③	5.5 4.4	10YR7/1 10YR8/1	Light gray White	10R4/8 10R4/3	Red, common Weak red, common	
61 Ptl Potential ① Jan 23 ③ May 13	61-2	15-40	① ③	6.5 4.6	10YR6/3 10YR7/2	Pale brown Light gray	none none		
	61-3	40-70	① ③	6.5 5.1	5YR5/3 10YR5/2	Brown Grayish brown	none none		
	61-4	70-150	① ③	7.0 2.3 **	N4 10YR5/1	Dark gray Gray	none none		Pyrite-enriched horizon
62 Ta Potential ① Jan 23 ③ May 13	62-2	15-40	① ③	5.0 4.8	10YR7/2 10YR8/1	Light gray White	10YR6/6 10YR7/8	Brownish yellow, common Yellow, common	
	62-3	40-70	① ③	5.5 5.2	5Y7/1 N8	Light gray White	7.5YR5/6 10YR6/8	Strong brown, many Brownish yellow, many	
	62-4	70-120	① ③	6.0 5.3	5Y7/1 10YR8/1	Light gray White	2.5YR5/6 10YR6/8	Strong brown, common Brownish yellow, common	
	62-5	120-150	① ③	6.5 2.8 **	N4 10RY6/1	Dark gray Light gray	none none		Pyrite-enriched horizon

No.	Sample No.	Depth(cm)		pH	Color		Mottling		Remarks
63 Ta ① Jan 24 ③ May 13	63-2	15-40	① ③	8.0 6.8	2.5Y6/2 N8	Light brownish gray White	10YR6/8 10YR7/8	Brownish yellow, common Yellow, common	
	63-3	40-80	① ③	8.0 7.5	N6 5Y8/2	Gray White	10YR6/8 10YR7/8	Brownish yellow, many Yellow, many	
	63-4	80-150	① ③	8.0 7.6	N6 N8	Gray White	10YR5/8 10YR6/8	Yellowish brown, many Brownish yellow, many	
65 Ra Forenttal ① Jan 24 ③ May 13	65-2	15-60	① ③	4.5 4.4	10YR6/2 10YR7/1	Light brownish gray Light gray	none 10YR6/8	Brownish yellow, few	
	65-3	60-80	① ③	4.5 4.4	10YR6/2 10YR7/2	Light brownish gray Light gray	none none		
	65-4	80-130	① ③	4.5 2.8 **	10YR5/1 10YR5/2	Gray Grayish brown	none none		Pyrite-enriched horizon
66 Ra ① Jan 25 ③ May 13	66-2	15-40	① ③	5.0 4.8	10YR6/2 10YR8/1	Light brownish gray White	7.5YR5/6 7.5YR7/8	Strong brown, common Reddish yellow, common	
	66-3	40-60	① ③	5.0 5.1	N7 N8	Light gray White	10YR5/8 10YR7/8	Yellowish brown, few Yellow, few	
	66-4	60-90	① ③	5.0 5.2	N7 10YR8/1	Light gray White	10YR5/8 10YR6/8	Yellowish brown, few Brownish yellow, few	
	66-5	90-150	① ③	5.0 5.6	N7 N8	Light gray White	10YR5/8 7.5YR6/8	Yellowish brown, many Reddish yellow, many	
71 Ra ① Jan 29 ③ May 13	71-2	15-40	① ③	6.5 4.8	5Y6/1 10YR7/2	Light gray Light gray	7.5YR6/8 7.5YR6/8	Reddish yellow, common Reddish yellow, few	
	71-3	40-70	① ③	5.5 5.0	N7 10YR7/1	Light gray Light gray	7.5YR6/8 7.5YR6/8	Reddish yellow, many Reddish yellow, many	
	71-4	70-110	① ③	5.5 5.2	N7 5Y8/1	Light gray White	7.5YR6/8 7.5YR6/8	Reddish yellow, common Reddish yellow, common	
	71-5	110-150	① ③	6.0 5.1	5Y7/1 N8	Light gray White	none 7.5YR7/8	Reddish yellow, few	
74 Ra ① Jan 29 ③ May 13	74-2	10-40	① ③	6.0 5.1	N7 N8	Light gray White	5YR4/6 2.5YR5/6	Yellowish red, many Red, many	
	74-3	40-70	① ③	5.5 5.2	N7 10YR8/1	Light gray White	7.5YR5/8 7.5YR6/8	Strong brown, many Reddish yellow, many	
	74-4	70-100	① ③	5.5 5.2	10YR7/1 10YR8/1	Light gray White	10YR5/8 10R5/8	Yellowish brown, few Yellowish brown, few	
	74-5	100-150	① ③	6.0 5.3	10YR7/1 5Y8/1	Light gray White	none 7.5YR7/8	Reddish yellow, few	
77 Pil ① Jan 30 ③ May 13	77-2	20-70	① ③	6.0 4.9	N7 N8	Light gray White	none none		
	77-3	70-150	① ③	5.5 5.2	N7 5Y8/1	Light gray White	10R4/8 7.5YR6/8	Red, common Reddosh yellow, many	
78 Ra ① Feb 1 ③ May 13	78-2	15-40	① ③	4.5 4.5	10YR7/3 5Y8/1	Very pale brown White	10YR5/8 7.5YR6/8	Yellowish brown, common Reddish yellow, common	
	78-3	40-70	① ③	5.5 4.7	10YR4/2 10YR7/1	Dark grayish brown Light gray	none none		
	78-4	70-150	① ③	6.5 5.6	N7 5Y8/1	Light gray White	10YR6/8 10YR6/8	Brownish yellow, many Brownish yellow, many	
82 Ra ① Feb 2 ③ May 13	82-2	15-40	① ③	7.0 5.1	5Y6/1 10YR8/1	Light gray White	7.5YR5/8 10YR7/8	Strong brown, few Yellow, few	
	82-3	40-70	① ③	5.0 5.2	N7 10YR7/2	Light gray Light gray	10YR6/6 10YR7/8	Brownish yellow, many Yellow, many	
	82-4	70-110	① ③	5.0 5.2	N7 10YR8/1	Light gray White	10R4/6 2.5YR5/6	Red, many Red, many	
	82-5	110-150	① ③	4.5 5.0	N7 10YR8/1	Light gray White	10R4/8 7.5YR6/8	Red, many Reddish yellow, many	
84 Ta ① Feb 3 ③ May 13	84-2	15-40	① ③	5.5 5.4	7.5YR7/2 5YR8/2	Pinkish gray Pinkish white	10RY5/6 7.5YR5/8	Yellow brown, few Strong brown, few	
	84-3	40-100	① ③	6.4 6.1	10YR7/1 10YR8/1	Light gray White	7.5YR5/8 10YR6/8	Strong brown, many Brownish yellow, many	
	84-4	100-150	① ③	5.0 4.9	5B6/1 5Y7/2	Bluish gray Light gray	none 10YR7/8	Yellow, few	
86 Ts ① Feb 3 ③ May 13	86-2	10-40	① ③	5.0 4.8	10YR6/1 5Y8/1	Light gray White	7.5YR5/8 7.5YR6/8	Strong brown, common Reddish yellow, common	
	86-3	40-80	① ③	5.0 4.7	N7 10YR8/1	Light gray White	10YR5/8 10YR6/8	Yellowish brown, many Brownish yellow, many	
	86-4	80-120	① ③	4.5 4.9	5Y6/1 10YR8/1	Light gray White	10YR5/8 7.5YR6/8	Yellowish brown, many Reddish yellow, many	
89 Ea ① Feb. 4 ③ May 13	89-2	10-30	① ③	5.0 4.9	5Y7/1 10YR7/2	Light gray Light gray	7.5YR5/8 5YR7/8	Strong brown, many Reddish yellow, many	
	89-3	30-70	① ③	4.5 5.1	10YR7/1 5Y8/1	Light gray White	10YR6/8 7.5YR6/8	Brownish yellow, common Reddish yellow, many	
	89-4	70-100	① ③	5.0 5.1	10YR6/1 5Y8/1	Gray White	7.5YR5/8 7.5YR6/8	Strong brown, many Reddish yellow, many	
	89-5	100-150	① ③	4.5 5.0	2.5Y6/1 5Y8/1	Gray White	5YR5/8 7.5YR7/8	Yellowish red, common Reddish yellow, common	
90 Ea ① Feb 4 ③ May 13	90-2	10-30	① ③	5.5 4.9	10YR6/1 10YR7/1	Light gray Light gray	10YR6/8 10R5/8	Brownish yellow, many RED, many	
	90-3	30-100	① ③	5.5 5.2	5Y6/1 5Y8/1	Light gray White	10R4/8 10R5/8	Red, common Red, common	
	90-4	100-150	① ③	5.0 5.1	5Y7/2 5Y8/2	Light gray White	10YR5/8 7.5YR6/8	Yellowish brown, many Reddish yellow, many	

No.	Sample No.	Depth(cm)		pH	Color		Mottling		Remarks
93 Ba ① Feb 4 ③ May 13	93-2	10-30	① ③	6.5 4.7	N6 10YR8/1	Light gray White	10YR5/8 10YR6/8	Yellowish brown, many Brownish yellow, many	
	93-3	30-70	① ③	5.5 5.0	N6 10YR8/1	Light gray White	10R4/8 7.5YR6/8	Red, common Reddish yellow, many	
	93-4	70-110	① ③	5.5 5.0	N6 5Y8/1	Light gray White	10YR5/8 7.5YR6/8	Yellowish brown, many Reddish yellow, many	
	93-5	110-150	① ③	5.5 4.9	N6 5Y8/1	Light gray White	none 7.5YR6/8	Reddish yellow, few	
102 Ba ① Feb 7 ③ May 13	102-1	0-15	① ③	4.5 4.7	10YR4/2 10YR6/2	Dark grayish brown Light brownish gray	none none		
	102-2	15-40	① ③	4.5 4.7	10YR5/1 2.5Y7/2	Gray Light gray	7.5YR4/6 10YR6/8	Strong brown, few Brownish yellow, few	
	102-3	40-70	① ③	4.5 5.0	10YR7/2 5Y7/2	Light gray Light gray	10YR5/4 7.5YR6/8	Yellowish brown, common Reddish yellow, few	
	102-4	70-100	① ③	4.5 5.1	N6 5Y7/2	Light gray Light gray	7.5YR5/8 7.5YR6/8	Strong brown, many Reddish yellow, common	
	102-5	100-120	① ③	4.5 4.9	N7 N8	Light gray White	10YR6/8 7.5YR6/8	Brownish yellow, common Reddish yellow, many	
	102-6	120-150	① ③	4.5 4.8	10RY3/1 5YR4/1	Very dark gray Dark gray	none none		
104 Ta ① Feb 8 ③ May 13	104-2	15-40	① ③	5.0 4.5	10YR4/2 10YR6/2	Dark grayish brown Light brownish gray	7.5YR5/6 10YR6/8	Strong brown, common Brownish yellow, few	
	104-3	40-90	① ③	4.5 4.7	10YR6/1 10YR8/1	Light gray White	7.5YR6/8 10YR7/8	Reddish yellow, many Yellow, many	
	104-4	90-120	① ③	5.0 4.9	10YR6/1 10YR7/1	Light gray Light gray	10YR5/8 7.5YR7/8	Yellowish brown, many Reddish yellow, many	
	104-5	120-150	① ③	6.5 4.8	N7 10YR7/2	Light gray Light gray	10YR5/8 10YR7/6	Yellowish brown, common Yellow, common	
105 Ta ① Feb 8 ③ May 13	105-2	20-40	① ③	4.5 4.4	5YR7/1 10YR8/1	Light gray White	7.5YR5/8 10YR7/8	Strong brown, common Reddish yellow, common	
	105-3	40-100	① ③	4.5 4.7	N7 N8	Light gray White	5YR5/8 10YR6/8	Yellowish red, many Brownish yellow, many	
	105-4	100-130	① ③	4.5 4.6	10YR7/1 10YR7/1	Light gray Light gray	10YR5/8 10YR6/8	Yellowish brown, common Brownish yellow, many	
	105-5	130-150	① ③	4.5 2.4 **	N5 5Y6/1	Gray Light gray	none none		Pyrite-enriched horizon
106 Ba Potential ① Feb 8 ③ May 13	106-2	10-40	① ③	4.5 4.1	10YR5/1 10YR7/1	Gray Light gray	none none		
	106-3	40-100	① ③	5.5 3.2 *	5GY4/1 5Y6/1	Dark greenish gray Light gray	none none		Pyrite-enriched horizon
	106-4	100-120	① ③	5.5 3.2 *	5B4/1 5Y6/1	Dark bluish gray Light gray	none none		Pyrite-enriched horizon
108 Mu Actual ① Feb 8 ③ May 13	108-2	5-20	① ③	4.5 3.9 *	10YR7/1 10YR8/1	Light grey White	10YR5/8 10YR6/8	Yellowish brown, many Brownish yellow, many	Pyrite-enriched horizon
	108-3	20-60	① ③	4.5 3.7 *	N8 5Y8/1	White White	10YR5/8 7.5YR5/8	Yellowish brown, common Strong brown, common	Pyrite-enriched horizon
	108-4	60-120	① ③	4.5 3.9 *	10YR4/2 7.5YR6/2	Dark grayish brown Pinkish gray	none 7.5YR5/6	Strong brown, few	Pyrite-enriched horizon
	108-5	120-150	① ③	6.5 3.4 *	5BG4/1 5Y5/1	Dark greenish gray Gray	none none		Pyrite-enriched horizon
109 AC ① Feb 9 ③ May 13	109-2	10-40	① ③	6.0 4.9	10YR7/1 10YR8/1	Light gray White	10YR5/6 10YR6/8	Yellowish brown, common Brownish yellow, few	
	109-3	40-90	① ③	8.0 5.5	10YR6/1 10YR8/1	Light gray White	none 7.5YR5/8	Strong brown, few	
	109-4	90-130	① ③	8.0 7.4	10YR6/2 10YR6/2	Light gray Light brownish gray	10YR3/6 10YR6/8	Dark yellowish brown, common Brownish yellow, common	
	109-5	130-150	① ③	8.0 6.5	7.5YR4/1 5Y5/1	Dark gray Gray	none none		
111 Ko ① Feb 9 ③ May 13	111-2	10-30	① ③	5.0 5.0	10YR6/2 10YR8/1	Light brownish gray White	10YR5/8 7.5YR6/8	Strong brown, common Reddish yellow, common	
	111-3	30-60	① ③	5.5 4.9	N7 N8	Light gray White	7.5YR5/8 7.5YR6/8	Strong brown, many Reddish yellow, common	
	111-4	60-100	① ③	5.5 5.1	N7 N8	Light gray White	7.5YR6/8 7.5YR7/8	Reddish yellow, common Reddish yellow, many	
	111-5	100-130	① ③	5.5 5.1	N7 N8	Light gray White	10YR5/8 10YR6/8	Yellowish brown, many Brownish yellow, many	
	111-6	130-150	① ③	6.0 4.9	N6 N7	Light gray Light gray	none 10YR7/8	Yellow, few	Many mica flakes
113 Kd Potential ① Feb 9 ③ May 13	113-2	10-60	① ③	4.5 3.5 *	7.5YR3/2 7.5YR5/2	Dark brown Dark brown	none none		Muck Pyrite-enriched horizon
	113-3	60-150	① ③	4.5 1.9 **	5YR3/1 10YR3/1	Dark brown Dark gray	none none		Muck Pyrite-enriched horizon
	113-4	150-270	① ③	4.5 2.7 **	5Y5/1 10YR4/1	Gray Dark gray	none none		Muck Pyrite-enriched horizon
114 Kd Potential ① Feb 10 ③ May 13	114-3	60-90	① ③	5.5 4.9	10YR4/1 10YR6/1	Dark gray Light yellowish brown	none none		
	114-4	90-120	① ③	4.5 3.0 *	10YR4/2 10YR5/1	Dark grayish brown Gray	none none		Pyrite-enriched horizon
	114-5	120-150	① ③	7.0 3.8 *	5Y4/1 5Y4/1	Dark gray Dark gray	none none		Pyrite-enriched horizon

No.	Sample No.	Depth(cm)		pH	Color		Mottling		Remarks
115 Cyl Potential ① Feb 10 ③ May 13	115-2	90-150	① ③	7.5 3.3 *	5Y4/1 5Y5/1	Dark gray Gray	none none		Pyrite-enriched horizon
116 Cyl Potential ① Feb 10 ③ May 13	116-2	10-90	① ③	5.0 4.6	5YR5/3 10YR6/3	Reddish brown Pale brown	none none		
	116-3	90-150	① ③	5.5 2.0 **	5Y4/1 10YR5/1	Dark gray Gray	none none		Pyrite-enriched horizon
118 Ra Potential ① Feb 10 ③ May 13	118-2	10-50	① ③	4.0 3.9 *	10YR7/1 10YR8/1	Light gray White	7.5YR5/8 10YR6/8	Strong brown, common Brownish yellow, common	Pyrite-enriched horizon
	118-3	50-110	① ③	4.5 3.9 *	10YR5/3 7.5YR6/2	Brown Pinkish gray	none none		Pyrite-enriched horizon
	118-4	110-150	① ③	6.0 2.6 **	5Y4/1 5Y5/1	Dark gray Gray	none none		Pyrite-enriched horizon
119 Tkt Potential ① Feb 10 ③ May 13	119-2	10-60	① ③	6.5 5.5	10YR6/3 10YR7/2	Grayish broan Light gray	none none		
	119-3	60-80	① ③	5.5 4.9	10YR3/2 7.5YR5/2	Very dark grayish brown Brown	none none		
	119-4	80-150	① ③	5.5 2.8 **	5GY4/1 5Y4/1	Dark greenish gray Dark gray	none none		Pyrite-enriched horizon
120 Tkt Potential ① Feb 10 ③ May 13	120-2	20-40	① ③	8.0 6.8	10YR6/2 10YR7/2	Light brownish gray Light gray	10YR6/8 10YR6/8	Brownish yellow, few Brownish yellow, few	
	120-3	40-80	① ③	8.0 7.0	10YR6/3 10YR7/2	Pale brown Light gray	10YR5/8 10YR7/8	Yellowish brown, common Yellow, few	
	120-4	80-120	① ③	8.0 3.6 *	10YR4/1 10YR5/1	Dark gray Gray	none none		Pyrite-enriched horizon
	120-5	120-150	① ③	7.5 2.8 **	5G4/1 5Y5/1	Dark greenish gray Gray	none none		Pyrite-enriched horizon

APPENDIX 4-11. List of References

4-11-1 Previous Studies

- Australian Development Assistance Bureau (1985). Golok River Basin Development Study, Soils and Land Use Report.
- DLD (1975). Detailed Reconnaissance Soil Map of Narathiwat Province (scale 1:100,000).
- DLD (1985). Semi-Detailed Soil Map of Lowlands in Coastal Plain in Narathiwat Province (scale 1:25,000).
- DLD (1976). Survey of Soils in Narathiwat Province, Soil Survey Bulletin 134 (in Thai).
- RID (1984). Report on the Environment of Bang Nara Project, Project Plannig Division (in Thai).
- Moormann, F.R. & Rojanasoonthon, S. (1972). The Soil of the Kingdom of Thailand, Explanatory Text of the General Soil Map.
- Scholten, J.J. & Siriphant, C. (1973). Soils and Land Forms of Thailand, DLD/FAO.
- Dent, F.J. (1972). Reconnaissance Soil Survey of Peninsular Thailand, DLD/FAO.

4-11-2 Soil Survey Method

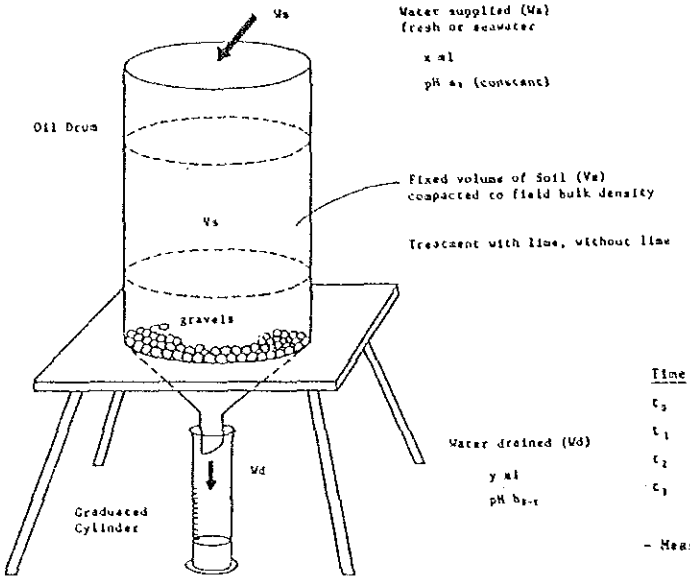
- FAO (1977). Guidelines for Soil Profile Description.
- Dent, F.J. & Changprai, C. (1973) Soil Survey Handbook for Thailand, DLD/FAO.
- DLD/FAO (1973). Soil Interpretation Handbook for Thailand.
- FAO (1986). Guidelines: Land Evaluation for Irrigated Agriculture, FAO Soils Bulletin 55.
- FAO (1979). Soil Survey Investigations for Irrigation, FAO Soils Bulletin 42.
- Soil Survey Staff, USDA (1975). Soil Taxonomy: A Basic System of Soil Classification for Making and Interpreting Soil Surveys, USDA Agric. Handbook 436.

4-11-3 Problem Soils

- Dent, D. (1986). Acid Sulphate Soils: A Baseline for Research and Development, ILRI Publication 39.
- Dost, H. & van Breemen, N. eds. (1982). Proceedings of the Bangkok Symposium on Acid Sulphate Soils, ILRI Publication 31.
- Vacharotayan, S., Attanandana, T. & Vicharnsorn, P. (1984). Acid Sulfate Soils: Their Characteristics, Genesis, Amelioration and Utilization.
- Pons, L. J. & van der Kevie, W. (1969). Acid Sulphate Soils in Thailand: Studies on the Morphology, Genesis and Agricultural Potential of Soils with Cat Clay.
- Second International Soil Management Workshop (1986). Classification, Characterization and Utilization of Peat Land: Characteristics of Peat and Associated Soils in Peninsular Thailand (Handouts).
- Moneharoen, P. (1984) Amelioration of Swamp Soils, Land Development p.21-46 (in Thai).
- Vijarnsorn, P. & Charoenpong S. (1983). Organic Soils in Narathiwat Province (in Thai).
- Pikulthong Center (1985). Research Programme on Acid Sulfate Soils and Organic Soils in Swamp Area, DLD (in Thai).
- Koga, H. (1964). Studies on the Young Polder Soils along the Ariake Bay, Saga Pretecture (in Japanese).
- Tanaka, A. (1985). Acid Soils and Their Agricultural Utilization (in Japanese).

4.11.4 Sulfate Flushing Test of Acid Sulfate Soil

In order to find out the most practicable method and water requirement for improvement of acid sulfate soils, the SO_4 fushing test is recommended to carry out at both laboratory and field plot levels. An example of the laboratory test apparatus is shown below:



Time	Water volume(ml)		PH of drain water
t_3	x_0	y_3	b_0
t_1	x_1	y_1	b_1
t_2	x_2	y_2	b_2
t_3	x_3	y_3	b_3

- Measure the soil pH before and after flushing.

By checking the pH and volume of drain water as well as the volume of water supplied using the apparatus, the water requirement to flush the sulfate accumulated in the soil could be determined. Supplying fresh water or seawater and applying lime or not would give some useful keys for determining the amelioration of acid sulfate soils. Moreover, these principle could be extended to the field plot experiment.

APPENDIX V. LAND USE AND AGRICULTURE

V-1. Land Use Classification

1. Urban Land
   - Residential land (U2)
   - Commercial land (U2)
   - Institutional land (U3)
   - Transportation land (U4)
   - Industrial land (U5)

2. Agricultural Land
   - Horticultural land (A1)
   - Perennial crop land (A2)
   - Field crop land (A3)
   - Pasture and range land (A5)

3. Forest Land
   - Evergreen forest (F1)
   - Deciduous forest (F2)

4. Water Body
   - Reservoirs, lakes and ponds (W1)
   - Fish ponds (W2)

5. Miscellaneous Land
   - Salt flats (M1)
   - Marsh and swamp (M2)
   - Rocky land (M3)
   - Waste land (sand dune, river or coastal waste land) (M4)
   - Others (M5)

Interpretation by Utilizing Aerial Photographs

Aerial photographs reappear the existing status of ground surface as various pictures on films. In accordance with the intensity of radiation and the length of wave, reappeared pictures on films have different tone and darkness. Even though the films are printed, the existing status of ground surface is also reappeared on the prints as pictures.

In general, photo-interpretation is done by recognizing such pictures with different tone and darkness. So-called patterns shown on aerial photographs are formed by individual pictures with different tone and darkness. Phenomenon which could not be recognized on topographic maps are recognized by this technique of photo-interpretation. Furthermore, undulations of ground surface also can be observed stereo-scopically through aerial photographs.

Land use survey is largely classified into three; namely, preliminary work, field survey, and data arrangement and mapping work. Preliminary work is conducted in order to perform effectively the field survey. A most important problem in drawing preliminary maps is to interpret aerial photographs. The photo-interpretation consists of two kinds; namely, theone is to recognize matters appearing on the pictures, and another is to explain scientifically based on the academic knowledge on geography, agriculture, geology, hydrology, socio-economy, etc.

For the photo-interpretation, keys for it are provided. Shadow, sunspot and linearment which appear on aerial photographs are available for the photo-interpretation respectively. Therefore, all of these are considered to be keys for the interpretation. Strictly speaking, however, the explanation for photo-interpretation arranged systematically is called keys for interpretation. Keys are divided into two of dictionary type and guidepost type. Table shows the keys belonging to guidepost type.

On the basis of results obtained from preliminary work, in other words, preliminary maps, all of the items which can not be recognized through only the photo-interpretation are confirmed during the field survey, and further various data necessary for making draft maps are collected. After the preliminary work and field survey mentioned above, preliminary maps are revised on the basis of data obtained during the field survey. Next to this, draft maps are drawn, and consequently the final draft maps are drawn checking with additional information. These works are generally called mapping.

Key for Photo-interpretation (in case of Nepal)
(Guidepost Type)

Class	Recognition	Judgement
1A	Any marks of cultivation as well as ridges are not found.	Noncultivated land
B	Ridges are clearly found, or marks of cultivation are recognized.	See Class 2
2A	Kind of individual crops are not recognized, but it is recognized that paddy or ordinary upland crops are grown.	See Class 3
B	Individual pictures are regularly distributed respectively compared with those of paddy or ordinary upland crops, and those shadows are conspicuous.	See Class 4
3A	Farm lands which are mainly distributed around rivers and ponds are recognized. Groups of relatively regular rectangular form are often found, but most are groups of unregular quadrilateral and polygon.	Paddy field
B	Ground color is relatively whitish. Blackish or grayish unclear spots vary with locality. Shape of farm field is unregular and in addition, irrigation facilities are not found generally.	Upland field
4A	An interval among every individuals is 5 meters or more.	Orchards, especially mango garden

Remarks :
1. Check downwards looking at aerial photographs.
2. When any applicable item is found, read Class number shown in "Judgement".
3. If any item coincides with something to look for read downwards in turn.

V-2. Agriculture

V-2-1. Crop Specifications

(1) Groundnut (Arachis hypogaea)

Varieties: Virginia, Valencia and Spanish varieties.

Climate:

The Spanish Variety is especially adapted to shorter growing seasons with lower rainfall (100-120 days: rainfall 100-150 mm/month rainfed) than the Virginia and Valencia varieties (135-150 days: rainfall 150-250 mm/month rainfed). Average temperature during the growing season should be at least 22°C but preferably much higher. For harvesting a relatively dry period is necessary. So high rainfall months should be harvesting time. Extremely high rainfall periods (more than 250 mm/month for four or more months) are poorly suited to grow groundnuts.

Soils:

Well drained sandy loam soils with pH 5.0 are best suited. The higher the rainfall, the important are the texture and permeability of the surface soil. Dark colored soils caused staining of the hulls, which is objectionable for many commercial uses. For mechanical harvesting the surface soil should not have large quantities of small stones.

Management:

Examples of varieties and management practices which may be important in determining soil suitability include:

1) The Spanish variety, grown in low rainfall areas in the period of March-July.

2) The Spanish variety, grown at the beginning of the dry season extending to January.

3) The Spanish variety, grown during the dry season extending to the early rainy season.

4) Various varieties, grown druing the dry season, but irrigated.

5) The Virginia and Valencia varieties, grown during the drainy season.

(2) Mungbeans (Phaseolus aureus)

Varieties: small and large pod.

Climate:

The legume is adapted to a wide range of rainfall and temperature conditions. Length of growing season is usually within two months.

Soils:

Fertile loams which are well drained during the growing season of the mungbeans are preferable. Short periods of waterlogging are possible for mungbeans.

Management:

Examples of management practices which may be important in determining soil suitability are:

1) Cultivation during the rainy seaosn, and mostly as a second crop after corn.

2) Cultivation in paddy fields at the beginning of the dry season, right after the paddy harvest.

3) Cultivation in paddy fields during the dry season, extending to the early rainy season.

4) Cultivation during the dry season, but irrigated.

V-2-2. Tolerance of Various Crops to Acidic Water

Strong (Above pH 5.0)

1.	Food crops:	Rice, Upland rice, Rye, Millet, Potato
2.	Vegetables:	Radish, Scallion
3.	Industrial crops:	Rush, tea
4.	Forage crops:	Torpedo grass
5.	Fruit:	Orange, nut
6.	Flower	
7.	Tree:	Cedar, Pine, Oak

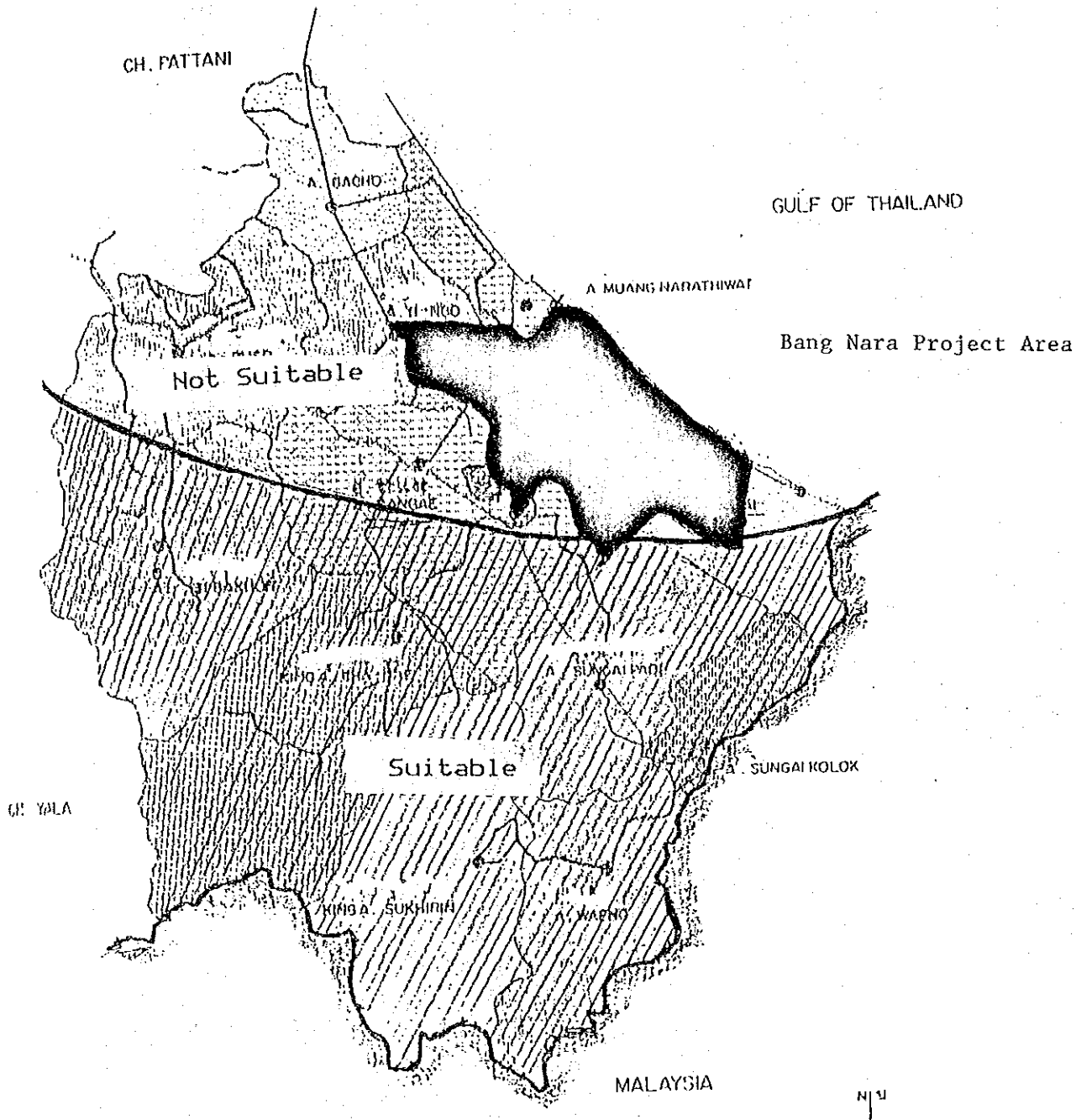
Weak (Above pH 5.5)

1.	Food crops:	Oats, Corn, Wheat, Sweet potato, Buckwheat
2.	Vegetables:	Onion, Water melon, Strawberry, Taro, Turnip
3.	Industrial crops:	Tobacco, Mulberry, Peppermint, Flax
4.	Forage crops:	Green corn, Orchard grass, Italian rye grass, Para grass
5.	Fruit:	Apple, Pear, Peach

Very Weak (Above pH 6.0)

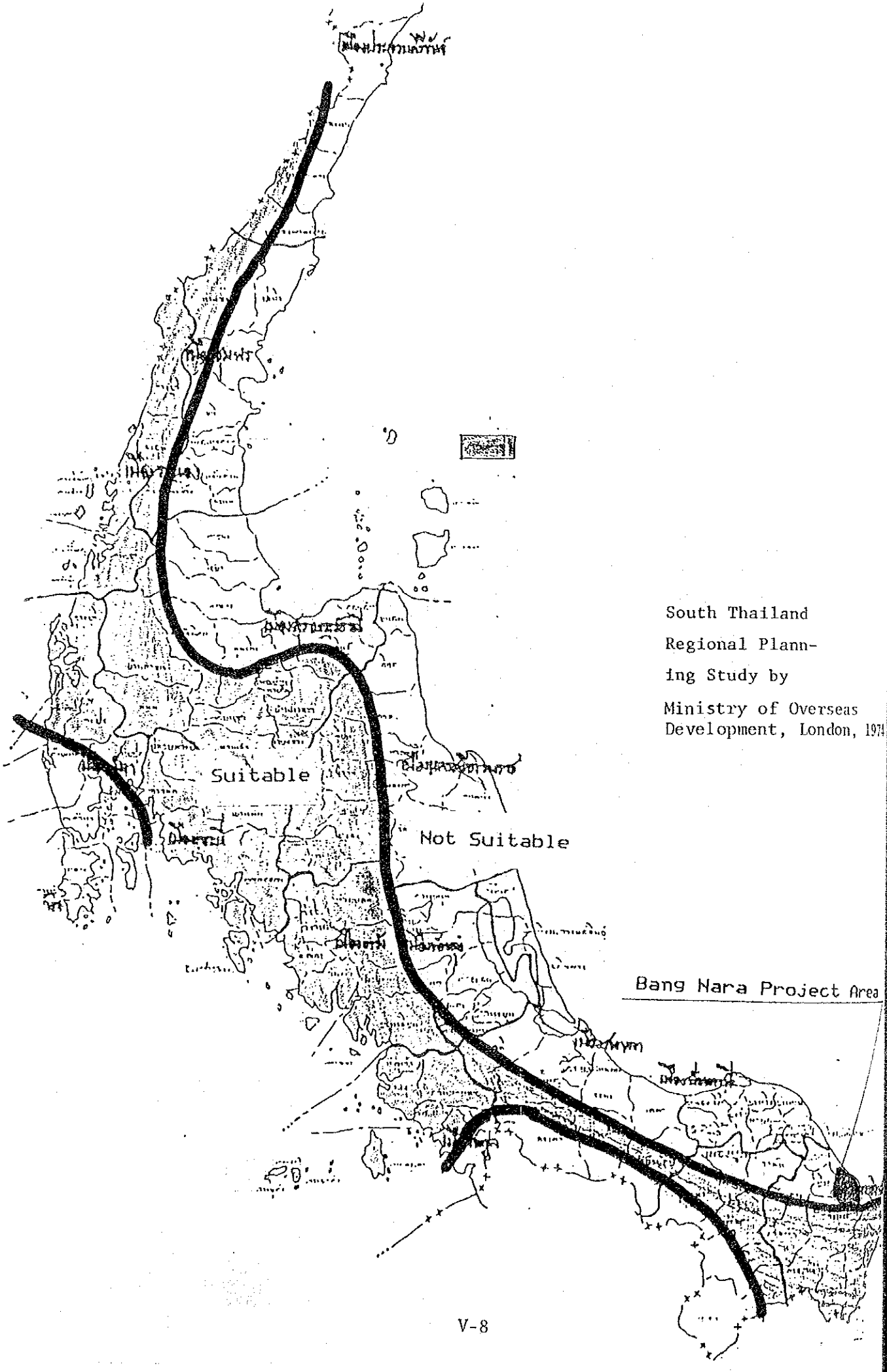
1.	Food Crops:	Barley, Naked barley, Soybean, Red bean, Groundnut, French bean, Pea
2.	Vegetables:	Carrot, Common onion, Pumpkin, Cucumber, Melon, Red beet, Lettuce, Spinach, Califlower, Pepper, Chinese cabbage, Asparagus, Celery
3.	Industrial crops:	Beet, Sugarcane, Cotton, Hemp, Rape seed, Vermifuge chrysanthemum (Pyrethrum),
4.	Forage crops:	Red clover, White clover, Betch, Green soybean, Vetch, Lucerne
5.	Fruit:	Grape
6.	Flower:	Rose, Kiku, Dahlia

V-2-3. Suitability of Oil Palm Plantation in Changwat Narathiwat



Remarks:

Suitability was determined taking into account climatic and soil conditions.



South Thailand Regional Planning Study by Ministry of Overseas Development, London, 1971

V-2-4. Present Labor Requirement by Crop in Changwat Narathiwat

(฿/ha)

		Rice			Corn		Mungbeans		Groundnut	
		Transplanting		Direct seeding						
		Local	Improved	Germinated seed	Local	HYV	Local	HYV	Local	HYV
Seeding		125	219	438	500	500	1,250	500	1,500	1,750
Land Preparation	1st plowing	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250	1,250
	2nd plowing	625	625	625	625	625	625	625	625	625
	Harrowing	313	313	313	313	313	313	313	313	313
Fertilizer application	Chemical	94	750	1,500	375	1,125	438	1,094	438	1,094
	Organic	-	-	-	-	-	63	63	63	63
Agro-chemicals application	Weed control	-	-	938	-	-	-	-	-	-
	Disease control	-	-	-	-	-	-	-	-	375
	Insect control	125	125	406	94	313	125	125	-	-
	Pest control	94	94							
Labor	Puddling	313	313	-	-	-	-	-	125	125
	Transplanting	625	625	-	-	-	-	-	-	-
	Irrigation	-	-	-	-	-	-	-	-	-
	Nursery bed preparation	313	313	-	-	-	-	-	-	-
	Harvesting	938	938	1,250	750	750	438	438	625	625
	Hauling	313	313	313	438	438	313	313	375	375
	Threshing	563	563	-	-	-	125	125	-	-
	Winning	-	-	-	-	-	63	63	-	-
	Others	-	-	-	-	-	-	-	-	-

V-2-5. Projected Crop Yield after On-Farm Work

(Unit: ton/ha)

Crop	Year after On-Farm Work 1st	2nd	3rd	4th	5th	6th	7th
1. Rice, Photosensitive Local Improved Variety, Lower Land	2.2	2.5	2.8				
2. Rice, Photosensitive Improved Variety (RD 13), Upper Land	2.7	3.1	3.4				
3. Rice, Non-photosensitive HYV (RD 7), Upper Land	3.0	3.3	3.7				
4. Groundnut	0.7	1.1	1.4	1.6	1.8		
5. Mungbeans	0.5	0.7	1.0	1.1	1.2		
6. Sweet Corn	1.2	1.8	2.4	2.7	3.0		
7. Vegetables (fresh tomatoes)	(6)	(8)	(11)	(14)	(15)		
(chili)	(5)	(6)	(8)	(11)	(12)		
8. Forage Crops	16	24	32	36	40		
9. Fruit Tree (Long Kong)	1.8	2.0	2.3	2.7	3.2	3.5	4.0

Marginality

Presently, there is no standard definition of marginality. The most frequently quoted definition is "when output equals input", but the terms "input" and "output" can be interpreted in many ways. The World Bank defines marginality as thepoint when annual returns from crops cover annual costs. The maximum preparation period for land in case of paddy field takes some years, and after this period, the land should be approaching its highest level of productivity.

In practice, the length of the pre-marginality period is the subject of considerable uncertainty and administrative confusion. First, marginality (or profitability) is a question of management as much as of soil texture and fertility. A good farmer on bad land often gets a better result than a bad one on good land. On one side of a ditch, land can be producing a surplus, and on the other, it may still be in the pre-marginal state. The length of the pre-marginality period is also a function of the level of technology and the value of the crop grown.

V-2-6. Vegetables Planted Ratio by Region, 1984

(%)

	Region						
	Northern	North-eastern	Central	Eastern	Western	Southern	Total
1. Bird pepper	47.4	25.8	5.2	2.2	14.2	5.2	100.0
2. Garlic	22.9	26.1	3.8	2.1	31.8	14.1	100.0
3. Yard long bean	86.1	13.2	0.4	0.1	0.2	-	100.0
4. Cucumber/*	43.8	50.4	1.1	0.6	4.8	0.1	100.0
5. Shallot	27.6	15.4	6.3	4.0	39.5	7.2	100.0
6. Cabbage	29.5	52.3	1.5	2.6	11.5	2.6	100.0
7. Pumpkin	47.4	37.7	0.2	0.1	11.1	3.5	100.0
8. Chinese kale	50.3	30.8	0.6	1.1	14.8	3.2	100.0
9. Tomatoes	27.3	31.4	15.0	2.7	9.7	13.9	100.0
10. White gourd	13.3	42.3	22.9	4.7	2.9	13.9	100.0
11. Ginger	29.8	29.9	12.9	1.8	15.1	10.5	100.0
12. Lettuce	37.7	1.8	3.0	1.4	36.9	9.2	100.0
13. Gorden pea	79.6	5.8	0.1	-	13.6	0.9	100.0
14. Onions	9.9	61.1	5.4	5.7	11.2	6.7	100.0

/*: Short size

V-2-7. Total Amount of Fertilizer Necessary for Demonstration Farm

(Unit : Kg)

Kind of crops		Kind of Fertilizer		No.1 Amphoe Muang Narathiwat (13.8 ha)	No.2 Amphoe Rangae (23.5 ha)	No.3 Amphoe Tak Bai (26.1 ha)	Total
			(Kg/ha)				
Paddy	Improved phto-sensitive, Upper land	Urea	60	828	1,410	1,566	3,804
		Superphos-phate	60	828	1,410	1,566	3,804
		Potassium Chloride	30	414	705	78.3	1,902
	HYV non-photo-sensitive, Upper land	Urea	70	966	1,645	1,827	4,938
		Superphos-phate	70	966	1,645	1,827	4,938
		Potassium Chloride	40	552	940	1,044	2,536
Upland Crops	Mungbeans	Compound 12-24-12	180	621	1,058	1,175	2,854
	Groundnut	Compound 12-24-12	160	552	940	1,044	2,536
	Sweet corn	Compound 16-20-0	150	518	881	979	2,378
	Vegetables	Compound 15-15-15	250	863	1,469	1,631	3,963

Remarks:
1. Total annual amount of fertilizer after the Project year 5 in case of No.1 and No.3, and that after the Project year 9 in case of No.2.
2. It is assumed that upland crops are grown in part of the area during the dry season.

V-2-8. Characteristics of Improved Rice Varieties

(1) RD 7

RD 7 is the most popular short-saturated variety to date and is planted in all parts of Thailand. RD 7 was selected from the cross C4-63/Gow Ruang 88/Sigadis at the Suphanburi Rice Experiment Station under the designation SPR 6726-134-2-26. Official release was in 1975. The C4-63 parent is a popular, short-strawed, highly palatable rice developed at the University of the Philippines at Los Banos. Gow Ruang 88 is a traditional tall high quality, long grain Thai variety, and Sigadis is a disease resistant cultvar from Indonesia. Although RD 7 does not contain the semi-dwarf gene as in RD 1 and RD 3, it is considered a short-height cultivar and has good response to heavy applications of nitrogen fertilizer. In recent years it has suffered severe damage from Rice Ragged Stunt Virus. Its widespread use is probably due to excellent cooking quality and grain appearance although the planted area dropped after Rice Ragged Stunt Virus became serious.

(2) RD 13

RD 13 was released in 1978 specifically for the southern Peninsula rice-growing region since cultvars introduced from other regions such as the Central Plain mature too early for the southern rainfall pattern. RD 13 originated from the cross of Nahng Phraya 132 and Pak Sian 39. Both parents are traditional tall, photoperiod sensitive types well adapted to the rainfed culture of the region. RD 13 inherited its long, slender grain from Nahng Phraya 132 and its late maturity and good yielding ability from Pak Sian 39. It retains the height and photoperiod sensitivity of both parents, an important requirement for rainfed monsoon conditions.

V-2-9. Estimate of Proposed Rubber Replanting Area

(1) Total Rubber Area, Young Rubber (not in tapping) Area, Young Rubber in Tapping) Area, and Old Rubber Area of Four Amphoe Concerned in Changwat Narathiwat, 1984.

(Rai)

	Muang Narathiwat	Rangae	Tak Bai	Yingo	Total
Total	33,631	139,438	3,800	43,442	220,361
Young	7,763	41,673	1,284	5,699	56,419
Young (in tapping)	14,262	71,345	2,070	35,840	123,517
Old	11,606	26,470	446	1,903	40,425

(2) Percentages of the above

(%)

	Narathiwat	Rangae	Tak Bai	Yingo	Total
Total	100	100	100	100	100
Young	23.1	29.9	33.8	13.1	25.6
Young (in tapping)	42.4	51.1	54.5	825	56.1
Old	34.5	19.0	11.7	4.4	18.3

(3) Respective Old Rubber Areas in Four Amphoe Concerned in Changwat Narathiwat, 1984

(ha)

	Muang Narathiwat	Rangae	Tak Bai	Yingo	Total
Total /1	3,010	4,590	320	400	8,320
Old (A) /2	1,038	872	37	176	2,123
(A x 50/100)	519	436	19	88	1,062

/1 Respective old rubber areas
/2 Calculated on the basis of "Old Rubber Areas of Four Amphoe Concerned" shown in (1) and "Old Rubber Percentages" shown in (2).

V-2-10. Project Labor Requirement by Crop

(man-day/ha)

Item	Improved Local	HYV (RD 13)	HYV (RD 7)
1. Land preparation	7.0	7.1	7.2
2. Puddling	8.1	8.3	8.4
3. Nursery bed preparation	5.8	6.0	6.1
4. Transplanting	19.1	19.3	19.3
5. Irrigation	10.2	10.5	10.5
6. Application of Fertizer & Chemicals	6.5	7.6	8.1
7. Harvesting	31.4	31.2	31.6
8. Others	6.9	9.0	9.8
Total	95.0	99.0	101.0

(man-day/ha)

Item	Groundnut	Mungbeans	Sweet Corn	Vegetable (tomatoes)	Vegetables (chilli)	Forage Crops	Tree Fruits
1. Land preparation	12	7	13	25	60	12	25
2. Planting	13	9	14	25	85	9	23
3. Application of fertilizer	2	1	2	9	26	3	14
4. Application of chemicals	4	3	6	25	52	8	34
5. Irrigation	9	6	12	31	70	9	-
6. Cultivation incl. weeding	9	7	10	25	70	9	30
7. Harvesting	56	31	52	158	465	54	140
8. Others	5	3	7	12	34	4	14
Total	110	67	116	310	862	108	280

Farm Labor Balance per Hectare

(Unit: man-day)

Item	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Total
1. Rice													
1.1 Rice, Rainfed -Photosensitive Lower Land	-	5	24	18	5	4	7	23	9	-	-	-	95
1.2 Rice, with Irrigation -Photosensitive Upper Land	-	-	6	26	17	6	4	8	23	9	-	-	99
1.3 Rice, with Irrigation Non-photosensitive Upper Land	-	-	16	30	11	4	8	23	9	-	-	-	101
2. Field Crops													
2.1 Groundnut with Irrigation	47	16	-	-	-	-	-	-	7	24	8	6	110
2.2 Mungbeans with Irrigation	11	-	-	-	-	-	-	-	2	24	8	22	67
2.3 Sweet corn with Irrigation	15	-	-	-	-	-	-	-	2	22	37	40	116
3. Vegetables													
3.1 Tomatoes with Irrigation	67	54	-	-	-	-	-	-	9	45	67	68	310
3.2 Chili with Irrigation	320	350	-	-	--	-	-	-	5	17	65	105	862
4. Forage Crops	15	7	7	7	15	7	7	7	15	7	7	7	108
5. Fruit Tree	16	16	16	19	37	50	45	21	15	15	15	15	280

V-2-11. Reason for Setting the Project Cropping Intensity
- Labor Balance-

Monthly farm labor forces available in the Project area are estimated at 217,500 man-days:

a) Number of farm family ---------- 8,700
b) Number of the proposed farm labor forces per family out of the available farm labor forces per family --- 1.0
c) Available working days per month --- 25 days
d) Monthly farm labor forces --- 217,500 man-days

Based upon the attached table "Farm Labor Requirement per Ha" of each of the crops to be introduced, the monthly farm labor requirements in line with the proposed cropping patterns are calculated. In addition, the monthly farm labor requirements for rubber tapping work are estimated below:

Rubber planted area ----------	6,250 ha
Tapping rate ----------	60%
Area in tapping ----------	3,750 ha
Tapping labor per ha ----------	0.5 man-day
Tapping days in month ----------	20
Monthly farm labor ----------	37,500 man-days

Total monthly farm labor requirements thus calculated are summarized below:

Month	Monthly Labor Requirements		
	Crops	Rubber Tapping	Total
		(man-day)	
March	170,420	37,500	207,920
April	108,210	37,500	145,710
May	76,080	37,500	113,580
June	98,090	37,500	135,590
July	169,190	37,500	206,690
August	154,370	37,500	191,870
September	137,700	37,500	175,200
October	236,260	37,500	273,760
November	121,440	37,500	158,940
December	53,140	37,500	90,640
January	69,730	37,500	97,230
February	155,450	37,500	192,950

In comparison with the monthly farm labor forces available in the Project Area, it is understood that the cropping patterns proposed for the with-project case especially the field crops and vegetables to be introduced at 25 percent of the paddy field would be possible for actual cultivation.

V-2-12. Ratio of Improved Paddy Variety Occupied in Total Planted Area of Four Amphoe Concerned - 1984 -

(ha)

Item	Muang Narathiwat	Rangae	Tak Bai	Yingo	Mean
Total Paddy Area	5,385	14,619	8,589	3,542	-
Total Paddy Planted Area (B	4,316	8,764	5,447	3,317	-
Area Occupied by Improved Variety (A)	1,488	2,077	1,889	908	-
Area Occupied by Local Variety	2,828	6,687	3,558	2,409	-
Ratio of Improved Paddy Variety (A/B x 100)	34.5	23.7	34.7	27.4	30.1

Source: DOAE, Narathiwat

V-2-13. Proposed Forage Crop Cultivation Area

Paddy fields to be regarded as not so suitable for paddy cultivation are shown as map symbol such as Ta-ly, Ta-fc and Ta-fc-na in the "Soil Suitability Classes of Soil Series and Association" compiled in the main report. It summarized below:

Soil Series	Map Symbol	Soil Suitability Class for Forage & Pasture
Former Tidal Flat		
Tai Bai	Ta-ly	2 f
	Ta-fc	2 f
	Ta-fc-na	2 f
	Ta-ly-na	2 f
Rangae	Ra-ly-a	3 fs
	Ra-ly-a[2]	3 fsa
	Ra-m.sub[3]	3 fs
	Ra-o	3 fs
	Ra-dm.sub	3 fsa
	Ra-o/Ra-dm.si	3 fsa
	Ra/kd-o	4 fsa
Muno	Mu-ly	4 fsa
Chian Yai	Chi-ly	3 fsa
	Chi-o	3 fsa
	Cyi-r.sub	3 fsa
	Cyi/Mu-ly	4 fsa
Thon Sai	Ts-ly	3 fa
	Ta-col	3 fa
	Ts-o	3 fsa

V-2-14. Certain Characteristics of Mungbean, Corn and Groundnut Grown after Mungbeans

Crops / Character	Planted two weeks after mungbean (plot 10)	Planted two weeks not after mungbean (plot 00)	Planted ten months after mungbean (plot 11)	Planted ten months not after mungbean (plot 01)
Mungbean				
(1) Plant height (cm)	47	60	51	61
(2) No. of compound leaves/plant	9	9	11	11
(3) Internodes/plant (no.)	9	9	9	9
(4) Leaf area/plant (cm^2)	497	907	1,886	1,984
(5) Dry weight/plant (g)	3.07	8.24	-	-
(6) Pods/plant (no.)	5	9	12	12
(7) Yield/plant (g)	1.16	1.89	2.52	2.74
(8) Grain yield (kg/ha)	488	794	1,057	1,152
(9) 100-seed weight (g)	4.20	5.17	6.67	7.39
(10) Cercospora leaf spot (score)(1)	4.5	3.0	-	-
Corn				
(1) Plant height (cm)	180	165	176	182
(2) Grain weight/ear (g)	81	58	75	83
(3) Grain yield (kg/ha)	3,263	2,500	3,006	3,346
Groundnut				
(1) Pods/plant (no.)	-	-	14	18
(2) Weight of pods/plant (g)	-	-	14.08	19.50

(1) cercospora leaf spot disease was rated on a scale of 1 to 5 1 = immune or highly resistant, 2 = resistant, 3 = moderately susceptible, 4 = susceptible, 5 = highly susceptible.

Source : Sonkhla University

V-2-15. Yield of Upland Rice, Corn, Mungbeans, Soybeans, Groundnut, Banana and Pineapple Planted between Rows of Young Rubber (1)

Intercrop	Year	Age of rubber (2) (month)	Yield (3) (kg/ha)	Light transmission (4) (%)
Upland rice	1981	4	1,838	-
	1982	16	1,437	89
	1983	28	1,950	50
	1984	40	1,952	
Corn	1981	4	1,744	
	1982	16	2,150	-
	1983	28	2,713	89
	1984	40	3,128	50
Mungbean	1981	12	688	-
	1982	24	513	-
Peanut	1981	3	1,188	-
	1982	15	1,444	-
	1983	27	1,281	-
Banana	1983		2,084 (bunches/ha year)	-
Pineapple	1983		11,572 (fruits/ha year)	-

(1) Rubber was planted on Sept. 1, 1981, spaced 7 m between rows and 3 m between plants, in East-West row direction.
(2) Age of rubber at harvest of intercrop.
(3) Yield of intercrops from plots obtained low rates of fertilizer.
(4) Light transmission measured around planting dates of intercrops.

Source : Sonkhla University

V-2-16. Yield and Other Characteristics of Mungbeans Obtained Different Rates of Inputs (1)

Input Level (2)	Yield (kg/ha)	Pods/ plant (no.)	100-seed weight (g)	Disease CLS (3) (score)	Weeds (3) (score)
Weeding					
0	790	5	7.32	2.33	5.00
1	1,234	7	7.51	2.73	1.93
2	1,480	8	7.51	2.87	1.35
F-test	**	ns	ns	ns	**
Fungicide					
0	1,002	5	7.51	4.00	2.74
1	1,139	7	7.44	1.91	2.85
2	1,307	7	7.39	2.02	2.69
F-test	**	ns	ns	**	ns
Insecticide					
0	1,033	6	7.33	2.70	2.27
1	1,163	7	7.44	2.71	2.75
2	1,309	7	7.58	2.52	2.80
F-test	*	ns	ns	ns	ns

(1) From a factorial experiment using mungbean variety U-thong 1

(2) Level of inputs : Weeding : 0 = no weeding, 1 = one weeding at 20 days after planting plus one uphilling, and 2 = weeding every two weeks. Fungicide application : 0 = none, 1 = sprayed twice at 35 and 55 days after planting, and 2 = sprayed every two weeks. Insecticide application : 0 = none, 1 = sprayed twice at 40 and 55 days after planting, and 2 = sprayed every two weeks.

(3) Disease (Cercospora leaf spot) and weeds were rated on a scale from 1 when there was no disease or weeds to 5 where the disease o weeds was most severe.

Source : Sonkhla University

V-2-17. Certain Characteristics of Mungbeans Grown at Hadyai (1981-1984)

Variety/line	Height		Days to first		Disease (CLS)
	ED	LD	flower	ripe pod	ED
	(cm)	(cm)	(no.)	(no.)	(score)
8-50-16	50	40	35	47	2.5
13-7-1	45	41	35	54	2.5
CES 14	64	42	33	51	3.0
CES 55	44	38	34	49	2.5
Darmo	50	43	35	50	2.5
Bhacti	45	44	-	-	3.0
6-50-12	48	44	34	52	2.5
CES 87	53	45	36	52	4.0
MG 50-10A (G)	40	37	34	52	3.0
OM-910	51	45	35	53	2.5
U-thong 1	53	47	35	53	2.5
Eg Glabrous # 3	40	42	34	50	2.0
VC 1560 D	51	-	34	49	1.0
CES 1D-21	43	-	33	49	-

Source : Sonkhla University

V-2-18. Unit Yield of Crops Concerned

Groundnut with Shell (kg/ha)

	1969-71	1979	1980	1981
World (Average)	916	976	912	1,002
Africa (Average)	787	737	714	804
North and Central America (Average)	1,981	2,448	1,611	2,940
South America (Average)	1,231	1,603	1,297	1,314
Europe (Average)	1,890	2,135	2,015	2,079
Oceania (Average)	851	1,567	1,176	1,281
USSR	428	1,200	1,300	1,200
Asia (Average)	900	957	963	994
Bangladesh	1,601	1,147	1,010	1,021
Burma	751	735	740	907
China	1,191	1,366	1,503	1,431
Cyprus	2,099	1,894	2,059	2,167
Gaza Strip	-	3,000	2,500	2,500
India	797	797	727	800
Indonesia	1,230	1,497	1,564	1,641
Iran	-	1,500	1,500	1,500
Iraq	1,175	1,733	1,867	1,867
Israel	3,684	4,020	4,248	4,184
Japan	2,038	1,985	1,651	1,818
Kampuchea DM	1,070	1,053	1,300	1,400
Korea REP	1,177	1,101	1,058	2,273
Lao	913	726	740	766
Lebanon	1,151	1,000	1,000	1,000
Malaysia	1,873	3,833	3,833	3,833
Pakistan	1,433	1,236	1,232	1,200
Philippines	534	920	908	909
Sri Lanka	983	616	590	592
Syria	1,836	1,779	1,777	1,915
Thailand	1,317	1,316	1,083	933
Turkey	2,528	2,300	2,158	2,174
Viet Nam	1,007	899	908	800

Source : FAO Production Yearbook, 1981

Tomato	1969--71	1979	(kg/ha) 1980	1981
World (Average)	17,957	21,258	20,865	20,810
Africa (Average)	12,856	13,630	13,802	13,819
North and Central America (Average)	26,009	30,365	30,620	27,757
South America (Average)	15,990	21,304	23,018	23,128
Europe (Average)a	24,605	31,119	29,401	30,445
Oceania (Average)	24,096	24,860	26,397	26,804
USSR (Average)	14,336	16,197	15,765	15,570
Asia (Average)	13,210	16,697	17,067	17,474
Bahrain	23,107	53,191	45,740	45,217
Bangledesh	8,841	4,571	4,532	7,402
China	11,294	13,878	14,536	14,698
Cyprus	15,910	26,809	26,778	26,667
Gaza Strip	-	40,625	37,143	37,143
Hong Kong	21,683	21,020	24,912	24,909
India	9,538	9,125	9,146	9,375
Indonesia	4,887	4,887	4,722	4,704
Iran	8,571	11,636	11 785	11,929
Iraq	8,855	10,714	10,698	10,802
Israel	36,129	45,680	45,248	43,902
Japan	41,347	54,632	52,539	51,813
Jordan	9,115	17,049	14,652	14,676
Korea DPR	13,397	13,214	13,103	13,333
Korea REP	15,872	44,443	28,267	28,056
Kuwait	12,424	21,538	21,296	21,071
Lao	2,924	2,808	2,667	3,000
Lebanon	13,062	13,636	13,636	13,818
Malaysia	5,000	4,839	4,844	4,776
Philippines	5,651	8,089	8,580	8,750
Qatar	-	16,499	15,625	15,625
Saudi Arabia	11,075	10,438	10,625	10,625
Sri Lanka	1,860	5,113	5,940	5,833
Syria	11,890	16,016	18,590	18,048
Thailand	2,889	4,545	4,507	4,471
Turkey	23,680	37,407	32,870	34,544
U A Emirates	8,868	39,202	45,845	45,696

Chilli (Fresh)

(kg/ha)

	1969-71	1979	1980	1981
World (Average)	7,336	7,527	7,291	7,308
Africa (Average)	7,009	4,368	4,385	4,343
North and Central America (Average)	7,173	9,448	9,209	9,230
South America (Average)	6,360	9,587	9,684	9,753
Europe (Average)	13,103	14,488	13,987	14,550
Asia (Average)	5,389	5,118	5,057	4,986
Bahrain	-	100,000	57,143	40,000
China	8,610	9,453	9,750	9,789
Cyprus	10,167	17,333	15,857	15,714
Indonesia	2,633	2,038	1,923	1,894
Iraq	5,927	8,235	8,333	8,333
Israel	22,136	30,559	29,944	30,889
Japan	27,724	37,446	34,123	34,776
Jordan	8,508	6,265	8,925	8,961
Korea DPR	2,326	2,414	2,400	2,533
Korea REP	1,730	1,029	942	914
Pakistan	1,220	1,600	1,665	1,660
Qatar	-	5,208	6,944	6,944
Sri Lanka	1,248	1,290	1,331	1,325
Syria	6,245	11,214	11,301	11,500
Turkey	12,215	13,293	14,146	14,148
U A Emirates	3,222	15,992	12,973	13,333

V-2-19. Relationship between Application of Amount of Lime Dust and Fertilizer, and Rice Yield, 1986

Soil Series	Amount of Lime Dust (ton)	Fertilizer (kg/ha)	Rice Yield (ton)	Variety
Muno	17.5	1/	1.53	RD 23
Muno	20	do	2.33	RD 21
Rangae	17.5	do	1.34	RD 21
Rangae	10	do	1.44	RD 7
Rangae	0	do	1.44	RD 23
Muno	10	do	1.89	RD 21
Muno	10	do	1.50	RD 7
Muno	20	do	1.25	RD 7

Remarks :
1/ : Fertilization...
N...Urea 62.5 kg/ha
P...Superphosphate 62.5 kg/ha
K...Potassium Chloride 31.25 kg/ha

Source : Pikul Thong Centre, Changwat Narathiwat

V-2-20. Unit Yield of Rice in the Project Area obtained from Sampling Survey, Pikul Thong Center, Changwat Narathiwat, 1986

(kg/ha)

Location	1984	1985	Remarks
Yabee	4.1	4.4	No liming
Kiree	3.0	2.6	No liming
Koksya	2.1	1.8	Liming
Pikul Thong	2.7	-	Liming
Kao Tanyong	6.4	3.4	Liming
Ban Mai & Sedom	2.0	-	Liming
Bang Manao	4.4	4.0	Liming
Rle	3.7	4.2	Liming

Note :
1. Fertilization :
Basic ..... 156 kg/ha of compound (15-15-15)
Top dressing ..... 50 kg/ha of urea
2. Sampling was conducted on farmers; fields.

V-2-21. Unit Yield of Maize in Thailand (Crop Year 1975/76 - 1984/85)

	(kg/ha)
1975/76	2.4
1976/77	2.4
1977/78	1.7
1978/79	2.2
1979/80	2.0
1980/81	2.2
1981/82	2.4
1982/83	2.3
1983/84	2.3
1984/85	2.4

Source : Agricultural Statistics of Thailand
Crop Year 1984/85
Issued by Ministry of Agriculture & Co-Operatives,
Bangkok, Thailand, 1985

V-2-22. Unit Yield of Tomatoes by Region in Thailand, 1984

	(kg/ha)
Country (Average)	7.8
Northern (Average)	8.0
North-Eastern (Average)	5.2
Central Plain (Average)	5.0
Eastern (Average)	5.0
Western (Average)	9.0
Southern (Average)	4.6
Krabi	10.5
Chumphon	7.2
Trang	12.5
Nakhon Si Thammarat	6.3
Narathiwat	-
Song Khla	9.4
Patthalung	-
Phu Ket	15.0
Yala	7.5
Ranong	12.3
Satun	10.8
Surat Thani	7.1
Phanganga	12.5

Source : Agricultural Statistics of Thailand
Crop Year 1984/85
Issued by Ministry of Agriculture & Co-Operatives,
Bangkok, Thailand, 1985

V-2-23. Agricultural College at Rangae

The Agricultural College at Rangae is the only one in Changwat Narathiwat devoted to the aspect of general agriculture and the first of its kind in Changwat Narathiwat. It was established also for providing training and technical services to agricultural extension staff and farmers.

This college is situated on a large campus comprising 1.6 sq.km. of land, closed to the railway of Bangkok to Sg. Kolok. It cna be reached also by car through the highway of Narathiwat to Rangae.

Purpose of the agricultural college is:

1) to train students who want to learn and study the Thai agriculture and agricultural activities, especially in South Thailand;

2) to carry out extension programs for introducing improved techniques in agriculture;

3) to train personnel working in agricultural extension activities with a view of improving agricultural techniques; and

4) to conduct applied researches for improving the technical and economic aspects of the agriculture in South Thaialnd, especially in Changwat Narathiwat.

V-2-24. Countermeasures to Actual Acid Sulphate Soils and Acid Irrigation Water

As a result of the feasibility study, the countermeasures to be taken by farmers themselves for the actual acid sulphate soils and acid irrigation water widely distributed in the Project area are provisionally established as below:

1) to conduct monitoring pH values of field soils and irrigation water flowing in the fields;

2) to make immediate study on the result obtained from the above, and to predict damages derivable from such acidity;

3) to take an immediate countermeasure if any, for example, to stop the acidic irrigation water flows in the fields. At that time, an adequate step should be taken in accordance with the degree of pH values considering the growing stage of respective crops;

4) to apply lime in order to neutralize acidic soils and/or irrigation water; and

5) to apply more fertilizers in accordance with the degree of damages, or to replant crops, if any.

APPENDIX VI. AGRO-ECONOMY AND RURAL SOCIOLOGY

Table VI-1-1 . Comparison of Gross Domestic Product (at 1983 Current Market Prices)

	Narathiwat			Southern Region			Northern Region			Northeastern Region			Whole Kingdom		
	GDP		Growth Rate	GDP		Growth Rate	GDP		Growth Rate	GDP		Growth Rate	GDP		Growth Rate
	10^6 ฿	%	'78-'83	10^6 ฿	%	'78-'83	10^6 ฿	%	'78-'83	10^6 ฿	%	'78-'83	10^6 ฿	%	'78-'83
Agriculture	2,758.0	46	0.44	38,534.9	39	2.9	48,101.6	38	2.6	47,172.5	38	3.8	202,797.1	22	2.2
Crops	2,490.1	41	0.27	23,055.3	23	1.9	37,650.5	30	2.3	30,057.6	30	3.8	148,981.0	16	2.9
Livestock	200.3	3	5.7	3,794.0	4	2.8	7,728.9	6	6.8	7,945.3	6	5.4	27,922.5	3	3.6
Fisheries	38.3	1	18.3	5,394.0	5	6.1	605.3	0.5	-0.7	1,492.3	1	6.3	14,998.1	2	-2.6
Forestry	29.3	1	-22.9	6,291.6	6	1.3	2,117.0	2	-5.1	677.3	0.5	-16.5	10,895.5	1	-3.9
Mining & Quarring	18.5	0.3	-10.7	3,536.9	4	-9.2	2,544.1	2	7.0	890.9	0.7	1.6	16,301.9	2	1.3
Manufacturing	121.5	2	1.4	4,024.6	4	3.9	5,545.3	4	4.2	6,240.1	5	5.3	172,532.0	19	6.5
Construction	418.4	7	21.7	4,302.4	4	-1.0	6,020.5	5	-1.5	6,334.2	5	-0.1	46,880.5	5	3.1
Public Admin & Defence	229.1	5	10.0	4,998.5	5	9.4	6,751.6	5	9.1	9,418.7	8	9.9	42,261.5	5	7.2
Services	482.9	8	4.8	11,007.0	11	6.8	12,359.6	10	5.3	14,845.3	12	8.9	98,636.4	11	8.3
Others	1,902.0	32	0.26	32,374.6	33	2.7	45,203.1	36	5.3	40,079.3	32	7.7	349,140.0	38	7.2
Total(GDP)	6,000.4	100	2.7	98,778.9	100	2.8	126,525.8	100	3.9	124,990	100	5.6	928,549.4	100	5.6
Population(10^3)	465.7		2.11	6,117.1		2.10	1,017.1		1.7	1,749.2		2.2	4,947.0		2.2
Per Capita GDP(10^3 ฿)	12.88		0.59	16.15		0.67	12.44		2.2	7.14		3.4	18.77		3.4

Source: National Income of Thailand, NESDB

Table VI-1-2. Growth of Per Capita Income of Agricultural Population by Region, 1978-1983

(Unit: Baht)

	Whole Kingdom			Northeast	North	Central	South
	Agri.Pop*.	Non-Agri.Pop*	Ratio				
	(A)	(B)	(B)/(A)				
1978	4,199	n.a.	n.a.	2,285	4,399	6,697	5,695
1979	4,696	27,143	5.78	2,769	4,874	7,036	6,496
1980	5,445	32,346	5.94	3,221	5,444	8,355	7,499
1981	5,773	36,154	6.26	3,068	6,207	9,528	7,104
1982	5,743	38,357	6.68	3,047	6,003	9,421	7,421
1983	6,109	40,925	6.70	n.a.	n.a.	n.a.	n.a.
Growth Ratio (%)	7.8	8.6	-	7.5	8.1	8.9	6.8

Source: Agricultural Statistics of Thailand, Crop Year 1983/84,
Center for Agricultural Statistics
Office of Agricultural Economics, MOAC

Note : * Population

Table VI-1-3. Population and Household in the Study Area, Mid-1985

Province District (Amphoe) Concerned	Sub-District (Tambol) Concerned	Number of Villages (Mu) Concerned	Population		Household		Area (km^2)
			Total	Agri.	Total	Agri	
Narathiwat							
Muang	1. Kaluwonua	7	6,103	4,605	1,084	825	10.3
	2. Kaluwo	7	5,585	5,127	1,160	1,072	68.0
	3. Banpo	9	5,681	5,313	971	907	38.7
	4. Lamphu	4	6,813	6,130	1,203	1,091	35.0
	5. Manantayo	7	4,888	4,027	734	608	20.2
	Sub-Total	34	29,070	25,202	5,152	4,503	172.2
Yingo	1. Lahan	3	1,604	1,207	616	479	12.8
	Sub-Total	3	1,604	1,207	616	479	12.8
Rangae	1. Tayongmat	4	1,819	1,204	583	367	7.7
	2. Tanyongmilo	6	6,309	3,948	913	569	51.5
	3. Marubo-ook	5	1,929	1,358	461	47	41.1
	4. Chuab	5	4,643	3,697	687	556	47.2
	Sub-Total	20	14,700	10,207	2,644	1,899	147.5
Takbai	1. Chaehae	8	540	459	107	91	6.4
	2. Phraiwan	4	6,240	4,644	1,191	914	71.0
	3. Phron	1	2,175	1,612	382	279	6.8
	4. Salamai	6	5,341	5,290	867	793	16.0
	5. Bangkhunthong	3	4,140	4,140	706	706	34.3
	Sub-Total	22	18,436	16,145	3,253	2,783	134.5
Total		79	63,810	52,761	11,665	9,664	467.0

Source: Amphoe Offices, National Village Household Survey & Tambol Boundary Map, National Statistical Office

Table VI-1-4. Population Increase, 1975-1985

Amphoe	1975 Population	Ave. Annual Increase 1975-1980	1980 Population	Ave. Annual Increase 1980-1985	1985 Population
Muang- Municipal	28,480	733(2.5)	32,146	956(2.8)	36,928
- Non-municipal	36,327	730(1.9)	39,978	736(1.8)	43,659
Yingo	26,751	521(1.9)	29,355	102(0.3)	29,866
Rangae	67,711*	1,334(1.9)	74,381*	2,396(3.0)	86,359
Takbai	41,165	838(2.0)	45,357	661(1.4)	48,662
Total	200,434	4,157(2.0)	221,217	4,851(2.1)	245,474

Note: - 1975 & 1980 data are those of December 31 of the respective year.
- 1985 data are those of the mid-1985.
- Figures in parentheses refer to annual average increase in percentage.
* Adjusted by excluding the population of King Amphoe Sukhirin which was then part of Rangae.

Source: Amphoe Offices and DOLA

Table VI-1-5. Vital Statistics in the Study Area

(Unit: Per 1,000)

	Narathiwat		Muang		Yingo		Rangae		Takbai	
	1980	1984	1980	1984	1980	1984	1980	1984	1980	1984
Birth Rate	25.2	27.2	23.1	24.9	26.1	24.5	18.6	27.4	23.1	25.6
Death Rate	4.9	5.0	5.5	5.4	4.6	6.0	4.0	4.4	4.8	5.0
Infant Mortality	6.9	6.4	13.0	4.9	2.8	6.6	12.2	5.7	2.6	2.5
Maternal Mortality	2.3	1.9	n.a.	2.9	n.a.	2.6	5.6	2.8	3.5	2.5
Population Increase	20.3	22.2	17.6	19.5	21.5	19.4	14.6	23.0	18.3	20.6

Source: Department of Public Health, Narathiwat

Table VI-1-6. Average Family Size in the Study Area, Mid-1985

District	Population	Household	Ave.Family Size
Muang-Municipal	43,659	7,807	5.59
-Non-municipal	36,928	8,397	4.40
Yingo	29,866	6,842	4.37
Rangae	86,359	13,459	6.42
Takbai	48,662	8,087	6.02
Total/Ave.	245,474	44,592	5.50

Source: Amphoe Offices

Table VI-1-7. Dimensions of Sample Households Surveyed

Item	Paddy Farm	Mixed Farm	Total/Average
No. of Households	59	85	144
No. of Household Members	304	466	770
Size of Household	5.2	5.5	5.3
Size of Labor Force Per Household*	3.0	3.5	3.3
% of Labor Force Engaged in			
- Own Farm Employment	88	80	83
- Other Farm Employment	27	12	17
- Non-Agri Employment	42	33	37
Sex Composition (%)			
Male	52	52	52
Female	48	48	48
Age Composition (%)			
0 - 6	14	10	11
7 - 13	19	17	18
14 - 19	15	18	17
20 - 29	14	17	16
30 - 39	11	11	11
40 - 49	12	13	13
50 - 59	9	9	9
60 - 69	4	2	3
70 -	3	2	2
Average Family Age	26.0	26.5	26.3
No. of Days Worked per Labor Force in			(%)
- Own Farm Work	55	65	62 (55)
- Other Farm Work	21	7	12 (11)
- Non-Farm Work	41	36	38 (34)
Total	117	108	112(100)
Working Place for Non-Farm Work			(%)
- Village	25	24	49 (28)
- Tambol	29	35	64 (36)
- Amphoe	10	17	27 (15)
- Changwat	13	16	29 (16)
- Malaysia	3	5	8 (5)
- Total	80	97	177(100)
- Total Labor Force	177	298	475

* Note: Size of Labor Force per Household is estimated by imputing the following value.

Age:		
0 - 6	:	0
7 - 13	:	0.1
14 - 18	:	0.5
19 - 22	:	0.8
23 - 59	:	1.0
60 -	:	0.5

Source: Farm Economic Survey

Table VI-1-8. Farm Area Operated by Sample Households* (Unit: Rai)

	Paddy Farm				Mixed Paddy/Rubber Farm				Total			
	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
Sample Size	25	20	14	59	23	29	33	85	48	49	47	144
Paddy Area	6.3	10.2	16.6	10.1	4.7	6.4	7.5	6.4	5.5	8.0	10.2	7.9
Rubber Area	0.0	0.0	0.0	0.0	3.6	5.4	11.1	7.2	1.7	3.2	7.8	4.2
Upland Area	0.0	0.0	0.0	0.0	0.0	0.4	0.3	0.3	0.0	0.3	0.2	0.2
Fallow Area	1.1	1.9	1.8	1.6	0.6	1.4	2.9	1.8	0.9	1.6	2.6	1.7
Total	7.4	12.1	18.4	11.7	8.9	13.6	21.8	15.7	8.1	13.1	20.8	14.0
Homestead Area	2.4	2.5	3.3	2.6	1.5	1.8	2.3	1.9	2.0	2.1	2.6	2.2

* Note; Inclusive of area rented in and operated free of charge
Source; Farm Economic Survey

Table VI-1-9. Past & Present Farm Size Distribution by Amphoe

Amphoe	Farm Size Distribution S (%)	M (%)	L (%)	Ave. Farm Size (rai)
1963				
Narathiwat(Changwat)	38.6	16.9	44.5	20.2
Muang	43.6	20.0	36.4	16.4
Yingo	51.7	18.1	30.2	14.0
Rangae	38.3	15.6	46.1	21.3
Takbai	37.4	23.3	39.3	15.4
1978				
Narathiwat(Changwat)	43.6	18.0	38.4	16.2
Muang	n.a	n.a	n.a	13.5
Yingo	n.a.	n.a.	n.a.	12.7
Rangae	n.a	n.a	n.a	18.3
Takbai	n.a	n.a	n.a	13.4

Source: Census of Agriculture 1963, Agricultural Census Report
1978, Changwat Narathiwat, National Statistical Office.

Table VI-1-10. Farm Inventory

Type of Farm Inventory	Number of Owners	No. of Units	Unit per Owner	Estimated Value (฿)			Age of Inventory in Use (Years)			Estimated Useful Life (Years)		
				Max.	Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.
House	142 (99%)	143	1.0	300000	3000	58134	52	1	14	70	10	34
Storage Barn	117 (81%)	118	1.0	80000	500	12340	35	1	10	50	4	21
Livestock Pun	78 (54%)	87	1.1	10000	100	1021	20	1	4	25	1	8
Building for Rubber Sheet	8 (6%)	8	1.0	10000	200	3350	15	1	6	15	6	11
Puddling Machine	69 (48%)	70	1.0	37200	10000	19080	12	1	6	19	6	12
Iron Baffalow	16 (11%)	16	1.0	34000	16000	22406	10	2	5	17	4	9
Plow	4 (3%)	5	1.3	500	40	210	10	3	5	15	4	9
Harrow	7 (5%)	11	1.6	800	10	251	8	2	6	15	3	9
Hand Sprayer	16 (11%)	16	1.0	1100	25	475	9	1	3	14	2	6
Motor Sprayer	16 (11%)	16	1.0	1600	120	725	12	1	4	15	3	8
Water Pump	19 (13%)	19	1.0	5000	300	2789	8	1	3	20	6	11
Push Cart	63 (44%)	65	1.0	20000	200	1051	20	1	6	25	1	10
Winnowing Machine	4 (3%)	11	2.8	45000	520	31380	8	2	5	19	10	14
Fattening & Rolling Machine	44 (31%)	77	1.8	70000	500	3986	24	1	8	30	4	14
Kae	104 (72%)	284	2.7	20	2	6	10	1	1	11	1	2
Hoe	129 (90%)	249	1.9	600	20	151	10	1	3	20	1	6
Shovel	25 (17%)	39	1.6	320	15	72	19	1	3	25	2	7
Spade	72 (50%)	79	1.1	150	8	40	9	1	3	12	1	6
Knife	136 (94%)	245	1.8	325	18	110	20	1	3	30	2	6
Knife Rubber Tapping	53 (37%)	111	2.1	260	15	59	5	1	2	7	1	3
Tang	2 (1%)	2	1.0	100	80	90	1	1	1	5	4	5
A Pair of Piculs	5 (3%)	8	1.6	100	30	60	10	1	4	15	3	6
Takong	44 (31%)	313	7.1	675	10	173	10	1	3	20	1	6
Lamp	11 (8%)	17	1.5	160	30	74	3	1	2	4	2	4
Basket for Rubber	28 (19%)	81	2.9	400	40	123	6	1	2	7	1	4
Small Cup	3 (2%)	12804	26.7	1500	900	1200	4	1	2	20	5	11
B.F.R.	3 (2%)	3	1.0	1000	300	600	13	5	9	14	6	10
Wire	1 (1%)	30	30.0	540	540	540	4	4	4	7	7	7

Source: Farm Economic Survey

Table VI-1-11. Number of Holdings by Tenure in the Study Area

Size of Holding (rai)	No. of Holdings without Land	No. of Holdings with Land				Total No. of Holdings
		No. of Holdings Operated Under			No. of Holdings Operated Under more than One Form of Tenure	
		One Form of Tenure				
		Owned by the Holder	Rented from Others	Others		
Muang	6	3,802	32	4	659	4,503
Yingo	1	405	3	0	70	479
Rangae	2	1,603	14	2	278	1,899
Takbai	4	2,349	20	2	408	2,783
Total	13	8,159	69	8	1,415	9,664
%	0.1	84.4	0.7	0.1	14.6	100

Source: Estimation based on 1983 Intercensal Survey of Agriculture, National Statistical Office.

Table VI-1-12. Land Title and Land Tax

	Sample Size	Total Area Owned (rai)	Title Deed		N.S.3K, N.S.3		S.K.1		Others*	
			Area (rai)	Tax (฿/rai)	Area (rai)	Tax (฿/rai)	Area (rai)	Tax (฿/rai)	Area (rai)	Tax (฿/rai)
Paddy Farm										
- Small	25	216	0	-	171	Paddy 3-5	0	-	45	-
- Medium	20	284	15	Paddy 5	215	Paddy 4-10	4	Paddy 5	50	-
- Large	14	315	0	-	245	Paddy 4-5	0	-	70	-
Sub-Total	59	815	15	-	631	-	4	-	165	-
Mixed Paddy/Rubber Farm										
- Small	23	221	5	Paddy 5	216	Paddy 3-5 Rubber 5-10	0	-	0	-
- Medium	29	410	5	Rubber 8	398	Paddy 2-5 Rubber 7-10	7	Paddy 3	0	-
- Large	33	806	0	-	735	Paddy 2-10 Rubber 4-10	71	Paddy 4-5 Rubber 7-10	0	-
Sub-Total	85	1,437	10	-	1,349	-	78	-	0	-
Total/Average	144	2,252	25	-	1,980	-	82	-	165	-
% Distribution		100	1.1		87.9		2.6		7.3	

* Note: Settlement Area in Ban Pileng
Source: Farm Economic Survey

Table VI-1-13. Price of Land (Unit: Baht/Rai)

	Sample Size	Paddy Area	Upland Area	Rubber Area	Homestead Area
Raddy Farm					
- Small	25	9,620	11,453	15,868	22,580
- Medium	20	17,617	16,350	16,000	29,025
- Large	14	14,371	10,000	18,329	20,143
Sub-Total	59	13,458	13,202	16,497	24,186
Mixed Paddy/Rubber Farm					
- Small	23	9,782	12,968	13,212	16,609
- Medium	29	9,260	11,586	16,000	21,105
- Large	33	9,300	16,727	14,825	23,792
Sub-Total	85	9,417	13,956	14,790	20,932
Total/Average	144	11,073	13,673	15,489	22,265

Source: Farm Economic Survey

Table VI-1-14. Credit

	Paddy Farmers				Mixed Farmers				Total			
	Small	Medium	Large	Total	Small	Medium	Large	Total	Small	Medium	Large	Total
Sample Size	25	20	14	59	23	29	33	85	48	49	47	144
Sample Concerned (%)	8	35	7	17	17	38	27	28	13	37	21	24
Credit Status Per Sample Concerned												
Debt at the Beginning (฿)	250	2,850	22,500	4,300	3,000	6,750	4,100	5,150	2,100	5,200	5,950	4,900
Loan Made (฿)	500	7,800	30,000	8,550	9,250	13,250	1,600	8,200	6,350	11,500	4,450	8,300
Interest Rate (%)	0	14	14	14	14	14	14	14	14	14	14	14
Repayment (฿)	0	7,750	18,700	7,300	5,300	8,100	3,800	6,000	3,550	9,950	5,250	6,380
Debt at the End of Year(฿)	750	4,400	40,400	7,250	8,200	14,800	2,600	9,100	5,700	10,750	6,350	8,600
Borrowed from	R.N.	R.C. B.	C.B.	-	C.B. N.	C.B.	B.N. R.	-	-	-	-	-

Note : R:Relatives, N:Neighbor, C:Cooperative, B:Bank,
Source : Farm Economic Survey

Table VI-1-15. Credit Purpose

(Unit : Percentage)

	Paddy Farmers	Mixed Farmers	Total
Purpose			
Agriculture			
Land Preparation	28	10	15
Input Materials*	5	1	2
Tools/Equipment	3	0	1
Labor Employment	0	1	1
Others (Livestock)	3	42	31
Non-Agriculture	60	47	50
Regular Use			
Yes	0	15	10
No	100	85	90
Adequate Amount			
Yes	100	100	100
No	0	0	0

Note : * Out of the credit for input materials, the credit for fertilizer dominates and about one half is provided in kind.

Source : Farm Economic Survey

Table VI-1-16. Planted Area, Harvested Area, Production of Sample Households (Unit: Area ... Rai, Production ... kg, Yield ... kg/Rai)

Crop and Farm Type	Crop Year 1982/83				Crop Year 1983/84				Crop Year 1984/85				Average Yield	
	Planted Area	Harvested Area	Production	Yield Planted Area Base	Planted Area	Harvested Area	Production	Yield Planted Area Base	Planted Area	Harvested Area	Production	Yield Planted Area Base	Planted Area Base	Harvested Area Base
Paddy, Non-Glutinous, Local														
- Paddy Farm	469	379	90,715	193	529	425	102,390	194	506	401	92,668	183	190	237
- Mixed Farm	497	401	94,663	190	489	406	100,086	205	488	360	87,317	179	191	242
Paddy, Non-Glutinous, HYV														
- Paddy Farm	37	29	6,900	186	45	31	9,570	213	87	77	15,700	180	190	235
- Mixed Farm	22	20	5,584	254	32	29	6,910	216	33	30	7,400	224	229	252
Paddy, Glutinous, Local														
- Paddy Farm	5	4	500	100	5	4	1,000	200	5	2	500	100	133	200
Rubber, Local														
- Mixed Farm	325	232	31,677	97	315	217	32,627	104	329	231	33,847	103	101	144
Rubber, HYV														
- Mixed Farm	195	65	9,685	50	214	68	10,255	48	280	137	19,655	70	57	147
Sweet Corn														
- Paddy Farm	-	-	-	-	0.5	0.5	500	1,000	0.5	0.5	500	1,000	1,000	1,000
- Mixed Farm	-	-	-	-	-	-	-	-	1.0	1.0	561	561	561	561
Cucumber														
- Paddy Farm	1	1	1,500	1,500	3	3	2,850	950	3	3	2,900	967	1,036	1,036
- Mixed Farm	2	2	3,000	1,500	3	3	3,500	1,167	3	3	4,530	1,510	1,523	1,523
String Bean														
- Paddy Farm	0.5	0.5	400	800	1	1	700	700	1	1	731	731	732	732
- Mixed Farm	2	2	1,200	600	2	2	1,200	600	2	2	1,500	750	650	650
Gourd														
- Paddy Farm	0.5	0.5	400	800	0.5	0.5	400	800	0.5	0.5	450	900	833	833
Coconut														
- Mixed Farm	9.5	9.5	8,300	874	9.5	9.5	8,300	874	9.5	9.5	8,200	863	870	870
Longkong														
- Mixed Farm	4	-	-	-	4	-	-	-	4	-	-	-	-	-
Rambutan														
- Mixed Farm	2	-	-	-	2	-	-	-	2	-	-	-	-	-

Source: Farm Economic Survey

Table VI-1-17. Crop Disposition

Crop and Farm Type	Total (ton)	Consumed (%)	Seed (%)	Rent (%)	Stored (%)	Sold (%)	Others (%)
Paddy, Non-Glutinous, Local							
- Paddy Farm	103.8	62	3	7	4	15	9
- Mixed Farm	88.5	80	4	4	4	6	2
Paddy, Non-Glutinous, HYV							
- Paddy Farm	15.7	68	2	10	14	6	0
- Mixed Farm	6.7	96	4	0	0	0	0
Paddy, Glutinous							
- Paddy Farm	1.0	65	4	0	0	30	1
Rubber, Local, HYV							
- Mixed Farm	53.4	0	0	1	0	89	10
Cucumber							
- Paddy Farm	2.9	3	1	0	0	96	0
- Mixed Farm	4.7	5	0	0	0	95	0
Stringbean							
- Paddy Farm	0.7	10	1	0	0	89	0
- Mixed Farm	1.7	9	1	0	0	90	0
Gourd							
- Paddy Farm	0.5	6	1	0	0	93	0
Sweet Corn							
- Paddy Farm	0.5	10	4	0	0	86	0
- Mixed Farm	0.6	18	0	0	0	82	0
Coconut							
- Mixed Farm	4.2	1	0	0	0	99	0

Source: Farm Economic Survey

Table VI-1-18. Amount and Value of Crops Sold

Crop and Farm Type	Household Concerned	Month	Amount (kg)	Value (฿)	Price (฿/ton)	Purchaser	Place	Trans-porter	Expenditure (฿)
Paddy, Non-Glutinous, Local									
- Paddy Farm	13/59	Jun-Sept	15,985	46,370	2,901	Miller Merchant	Mill Market	Seller Buyer	2,175
- Mixed Farm	9/85	Jan-Dec	5,350	14,815	2,769	Merchant Neighbor	Market Home	Seller Buyer	75
Paddy, Non-Glutinous, HYV									
- Paddy Farm	2/59	Mar-Apr	1,000	3,150	3,150	Marchant	Market	Seller	210
Paddy, Glutinous									
- Paddy Farm	1/59	July	300	900	3,000	Merchant	Market	Seller	50
Rubber									
- Mixed Farm	68/85	Jan-Dec	47,583	627,116	13,179	Marchant	Home Market	Seller Buyer	2,532
Cucumber									
- Paddy Farm	2/59	Jun-Jul	2,798	17,636	6,303	Merchant	Home Market	Seller Buyer	50
- Mixed Farm	2/85	Jul-Sept	4,500	26,000	5,778	Merchant	Market	Seller	100
String Bean									
- Paddy Farm	3/59	Jun-Jul	650	6500	10,000	Merchant	Market Home	Seller Buyer	50
- Mixed Farm	1/85	Jul-Sept	1,500	15,000	10,000	Merchant	Market	Seller	-
Gourd									
- Paddy Farm	2/59	Jun-Jul	420	2,940	7,000	Merchant	Market	Seller	25
Sweet Corn									
- Paddy Farm	1/59	June	430 (ears)	430	1,000	Merchant	Field	Buyer	-
- Mixed Farm	1/85	Oct	461 (ears)	600	1,302	Merchant	Market	Seller	80
Coconut									
- Mixed Farm	4/85	Jan-Dec	4,140 (fruit)	10,488	2,533	Merchant	Market Field	Seller Buyer	80

Source: Farm Economic Survey

Table VI-1-19 Average Household Farm Cash Income from Farm Products Sold

(Unit: Baht)

Farm Type & Size	Paddy		Rubber		Other Crops		Livestock		Total
	Household Concerned	Income	Household Concerned	Income	Household Concerned	Income	Household Concerned	Income	
Paddy									
Small	3/25	434	-	-	-	-	19/25	5,111	5,545
Medium	2/20	63	-	-	-	-	9/20	1,336	1,399
Large	9/14	3,332	-	-	4/14	1,433	7/14	6,804	10,136
Total/Average	14/59	996	-	-	4/35	573	35/59	4,233	5,229
Mixed Paddy/Rubber									
Small	3/23	211	17/23	4,198	-	-	14/23	5,927	10,336
Medium	1/29	121	22/29	5,636	2/29	262	19/29	5,418	11,437
Large	5/33	196	28/33	11,316	4/33	1,348	19/33	4,375	17,235
Total/Average	9/85	174	67/85	7,452	6/85	612	52/85	5,151	13,389
Grand Total/Ave.	23/144	511	67/144	4,399	10/144	501	87/144	4,775	10,186

Source: Farm Economic Survey

Table V1-1-20. Household Off-Farm Agricultural Employment and Income

Farm Type & Size	Proportion Concerned	Ave.No.of Members Concerned	Ave. No. of Days Worked	Ave. Income (฿)	Source of Off-Farm Agricultural Income (in Percentage)			
					Paddy Work	Rubber Tapping	Others	Total
Paddy								
Small	16/25	1.0	70	3,508	12	83	6	100
Medium	6/20	0.6	35	982	3	97	-	100
Large	5/14	1.0	93	3,583	-	100	-	100
Total/Average	27/59	0.8	63	2,669	7	90	3	100
Mixed Paddy/Rubber								
Small	9/23	0.6	31	1,749	11	61	28	100
Medium	7/29	0.5	25	1,106	-	99	1	100
Large	6/33	0.2	12	772	2	88	10	100
Total/Average	22/85	0.4	22	1,150	5	81	14	100
Grand Total/Average	49/144	0.6	39	1,773	6	86	7	100

Source: Farm Economic Survey

Table VI-1-21. Household Off-Farm Non-Agricultural Employment and Income

Farm Type & Size	H.H. Concerned	Members Concerned	Days Worked	Ave. Income (¥)	Type of Employment (%)									
					Cottage Industry	Trans-port	Fishery	Forestry	Construction	Repair	Gov't	Trading	Product	Others
Paddy														
Small	20/25	1.4	113	7,588	-	-	1	2	17	-	32	11	13	24
Medium	19/20	1.9	153	9,029	10	-	1	-	7	3	52	7	11	9
Large	8/14	0.8	97	4,385	-	-	-	-	8	9	48	-	13	21
Total/Average	47/59	1.4	123	7,316	4	-	1	1	12	2	42	8	12	17
Mixed Paddy/Rubber														
Small	19/23	1.5	121	6,523	-	-	0.4	5	10	-	41	4	16	24
Medium	21/29	1.1	104	5,300	-	-	-	-	8	18	21	6	26	21
Large	22/33	1.2	152	9,809	-	1	1	7	8	10	38	6	6	23
Total/Average	62/85	1.2	127	7,382	2	1	0.4	5	8	9	35	6	13	23
Grand Total/Average	109/144	1.3	125	7,355	2	0.4	0.7	3	10	7	38	7	13	21

Source: Farm Economic Survey

Table V1-1-22. Annual Farm Household Income

(Unit: Baht)

Farm Type & Size	On-farm		Off-farm		Total	Family Size	Per Capita Income	
	Cash	Non Cash*	Agri.	Non-Agri.			Baht	US $
Paddy Farm								
Small	5,550	8,200	3,500	7,600	24,850	4.8	5,200	200
Medium	1,400	8,200	1,000	9,050	19,650	4.8	4,100	158
Large	10,150	10,750	3,600	4,400	28,900	6.3	4,600	177
Average	5,250	8,850	2,650	7,300	24,050	5.2	4,650	179
Mixed Farm								
Small	10,350	6,550	1,750	6,500	25,150	5.0	5,050	194
Medium	11,450	6,800	1,100	5,300	24,650	5.2	4,750	183
Large	17,250	7,950	750	9,800	35,750	6.1	5,850	225
Average	13,400	7,200	1,150	7,400	29,150	5.5	5,300	204
Grand Total/Average	10,200	7,800	1,750	7,350	27,100	5.3	5,100	196

Note: *Estimated
Source: Farm Economic Survey

Table V1-1-23. Household Expenditure

(Unit: Baht)

	Paddy Farm				Mixed Paddy/Rubber Farm				Average
	Small	Medium	Large	Average	Small	Medium	Large	Average	
Sample Size	18	9	7	34	9	11	19	39	73
Food									
Rice	436	111	286	319	478	564	1,032	772	561
Other Gain	149	125	187	151	574	258	145	276	218
Meat/Fish/Egg	2,362	2,300	1,903	2,251	3,055	2,200	4,305	3,423	2,877
Vegetable	283	762	600	475	1,111	832	1,274	1,112	815
Sub-Total	3,230	3,298	2,976	3,196	5,218	3,854	6,756	5,583	4,471
Soft Drink	302	440	250	328	604	787	932	815	588
Cigarette	284	357	221	290	725	455	592	584	447
Clothing	760	947	1,186	897	866	1,118	1,271	1,135	1,024
Housing Repair	-	4,111	429	1,176	333	-	9,110	4,515	2,960
Furniture/Appliances	47	119	50	67	489	221	734	533	316
Fuel/Electricity	336	1,036	491	553	327	425	526	451	499
Medical Fee	297	167	2,343	684	310	465	225	312	485
Transport/Communication	368	599	1,177	596	680	692	999	839	726
Leisure/Travel	61	156	329	141	194	230	166	190	168
Ceremonies	800	1,140	1,086	955	734	814	700	740	840
Education	533	3,261	1,764	1,509	456	3,218	2,095	2,033	1,789
Tax/Fee	19	51	71	38	37	19	34	31	34
Miscellaneous	524	544	457	516	581	427	828	658	592
Sub Total	4,331	12,928	9,883	7,750	6,336	8,871	18,211	12,836	10,467
Grand Total	7,561	16,226	12,859	10,946	11,554	12,725	24,968	18,419	14,938

Source: Farm Economic Survey

VI-2. Rural Sociology

Table VI-2-1. Education Status

Age Cohort	Schooling Status	Paddy Farmers Persons	(%)	Ave. Years	Mixed Farmers Persons	(%)	Ave. Years	Total/Average Persons	(%)	Ave. Years
0 - 6	Pre-School	41	(100)	-	44	(100)	-	85	(100)	-
7 - 13	Attending	51	(88)	3.5	75	(91)	3.7	126	(90)	3.6
	Completed	7	(12)	3.1	7	(9)	3.9	14	(10)	3.5
14 - 18	Attending	12	(29)	9.5	3.9	(50)	9.5	51	(43)	9.5
	Completed	30	(71)	7.2	3.9	(50)	6.2	69	(57)	6.7
19 - 22	Attending	4	(20)	9.3	6	(16)	11.2	1.0	(17)	10.4
	Completed	16	(80)	7.0	32	(84)	6.9	48	(83)	6.9
Above 23	Attending	1	(1)	10.0	0	(0)	0	1	(0)	10.0
	Completed	142	(99)	3.8	224	(100)	3.2	366	(100)	3.4
Total/Average		304		4.0	466		4.1	770		4.1

Source: Farm Economic Survey

Table VI-2-2 Rural Employment Generation Project, 1980 - 1984

Project Type	Muang (1980-1984)	Yingo (1982-1984)	Rangae (1983-1984)	Takbai (1982-1984)	Total
Road Construction/Repair	27	8	10	10	55
Bridge Construction/Repair	12	3	7	1	23
Farm Pond Construction/Repair	6	1	2	2	11
Canal Construction/Cleaning	29	5	2	10	46
Shallow Well Construction	5	0	2	1	8
Water Supply/Storage	7	1	0	11	19
Weir/Regulator	5	7	10	1	23
Others	7	6	4	2	19
Total	98	31	37	38	204

Source: Amphoe Offices

Table VI-2-3. Dimensions of Rural Employment Generation Projects

Description	Unit	1980	1981	1982	1983	1984
Amphoe Muang (Non-Municipal)						
-Project	No.	32	28	17	8	13
-Labor Days Generated	'000	n.a	1.1*	3.1°	6.4	5.1
-Labor Days/Project	No.	n.a	280*	521°	797	394
-Total Project Cost	Mil฿	5.0	2.7	1.8	1.4	1.4
-Average Cost of Project	1,000฿	158	96	104	181	106
Note: *4 Projects Total °6 Projects Total						
Amphoe Yingo						
-Project	No.	n.a	n.a	10	10	11
-Labor Days Generated	'000	n.a	n.a	11.0	6.6	5.6
-Labor Days/Project	No.	n.a	n.a	1,103	656	511
-Total Project Cost	Mil฿	n.a	n.a	1.2	1.3	1.0
-Average Cost of Project	1,000฿	n.a	n.a	116	132	95
Amphoe Rangae						
-Project	No.	n.a	n.a	n.a	26	11
-Labor Days Generated	'000	n.a	n.a	n.a	19.6	6.8
-Labor Days/Project	No.	n.a	n.a	n.a	753	616
-Total Project Cost	Mil฿	n.a	n.a	n.a	5.9	2.2
-Average Cost of Project	1,000฿	n.a	n.a	n.a	229	199
Amphoe Takbai						
-Project	No.	n.a	n.a	11	15	12
-Labor Days Generated	'000	n.a	n.a	8.2	n.a	14.6
-Labor Days/Project	No.	n.a	n.a	743	-	1,216
-Total Project Cost	Mil฿	n.a	n.a	1.5	1.2	2.5
-Average Cost of Project	1,000฿	n.a	n.a	140	83	212

Source: Amphoe Offices

Table VI-2-4. Dimensions of Extension Service

Item	Muang	Yingo	Rangae	Takbai
1. Officials & Staffs				
Chief	1	1	1	1
Assistant Chief	1	1	1	1
Home Economist	1	1	1	1
Ext. Agent	6	5	9	7
Administrator	1	1	1	1
Employee, Typist	1	1	0	1
Volunteer	4	4	6	6
2. Staff Training				
Duration	Every Month	Every Month	Every Month	Every Month
No. of Paticipants	9	9	10	10
3. Extension Groups				
Farmer Group (Membership)	1 (32)	2(131)	2(n.a.)	6(250)
Woman Group (")	8(135)	5(117)	4(n.a.)	14(350)
Youth Group (")	4 (50)	6(128)	2(n.a.)	7(150)
No. of Farm Households	6,259	5,128	9,626	6,304
4. Field Work				
No. of Days/Month	16	16	16	16
Training/Month	2-3	n.a.	n.a.	n.a.
5. Equipment				
Car	0	0	0	0
Motorcycle	1	0	0	0
Pick Up	1	1	1	1
Pump	3	2	3	3
Sprayer	5	0	6	12
6. Budget/Year (1,000฿)				
Salary	386	405	599	n.a.
Material	146	36	197	n.a.
Fuel		12	20	n.a.
Income	19	22	29	n.a.
Admin.	73	95	n.a.	n.a.
Others	28	-	-	n.a.
7. Problems	o laziness o soil o language o education o low price	o laziness o language o water	o language o low technology	o language o small budget o no cooperation o off-farm employment

Note: n.a.: not available
- : no entry
Source: Field Survey

Table VI-2-5. Dimensions of Agricultural Cooperatives (as of Feb. 1986)

Item	Muang	Yingo	Rangae	Takbai
1. Established since	1973	1976	1951	1973
2. Officials (persons)	2	4	-	-
3. Staffs (persons)	4	3	2	5
4. No. of Agricultural Households	6,412	5,128	11,937	6,058
5. Membership	491	568	352	1,327
6. No. of Groups	23	22	19	28
7. Capital (1,000฿)	693	319	223	2,501
8. Legal Reserve (1,000฿)	649	0	0	838
9. Other Reserve (1,000฿)	131	3	11	187
10. Member Deposit (1,000฿)	258	n.a.	1,182	1,912
11. Borrowing from BAAC (1,000฿)				
- Borrowing during the year	2,288	0	429	5,020
- Repayment during the year	1,815	255	332	4,989
- Balance at the end of year	3,139	2,846	1,383	9,445
12. Borrowing from Other Sources (1,000฿)				
- Balance at the end of year	27	0	18	0
13. Loan Provided to Members (1,000฿)				
- Loan Provided during the year				
Short-Term	808	0	141	2,105
Mid-Term	1,721	52	272	2,815
- Loan Repayment during the year				
Short-Term	390	160	89	1,718
Mid-Term	1,379	22	264	1,937
- Balance at the end of the year				
Short-Term	871	833	185	4,238
Mid-Term	3,656	121	998	10,848
14. Loan Recovery Ratio (%)				
Short-Term	49	50	67	65
Mid- Term	44	50	27	52
15. Purchasing Business (1,000฿)				
Seed	0	0	0	n.a.
Fertilizer/Chemical	46	203	56	n.a.
Fodder	200	0	190	n.a.
Farm Machinery/Tool	23	0	14	n.a.
Milled Rice	56	99	146	n.a.
Consumer Goods	9	0	44	n.a.
Others	0	15	0	n.a.
16. Marketing Business	None	None	None	None
17. Storage Facility	None	300ton	None	500ton
18. Processing Facility	None	None	None	None
19. Other Services	None	Home Delivery	Home Delivery	Home Delivery
20. Problem	o Poor Repayment o Small Membership o Lack of Fund	o Lack of Fund	o Lack of Fund o Not Enough Service Poor Repayment	o Small Membership
21. Vehicle/Equipment	None	None	None	Pick-up
22. Profit (loss) (1,000฿)	208	(203)	(68)	513

Source: Field Survey

Table VI-2-6. Dimensions of Water User Groups under SSIP in Narathiwat

	Project & Group Name	Location	Project Area (Rai)	Membership (Persons)	Committee Members
1.	Khok Khian	Muang	5,000	87	7
2.	Khok Su Mu	"	2,000	77	11
3.	Pong Bu Ro	Yingo	1,500	33	9
4.	Pa Lo Ba Ta	"	2,000	51	17
5.	Ku Tong	Rangae	1,200	53	11
6.	Ai Bu Tong	"	1,300	42	9
7.	Klong Tan Yong	"	1,500	86	11
8.	To Lang	Takbai	3,000	64	9
9.	Pru Kab Daeng	"	4,000	85	13
10.	Cha Ku Chi	Ruso	1,500 —	104	17
11.	Ta Po	"	100 —		
12.	Ba Lu Bu Nae	"	1,200	32	11
13.	Pa Lu Ru	Sg. Padi	2,500	77	11
14.	Sg. Padi	"	3,000	285	21
15.	Ba Ngo Hu Mo	"	800	71	13
16.	Chu Rae	"	1,000	47	9
17.	Sa Ko	"	(2,500)	N.A.	(17)
18.	Pu Yo	Sg. Kolok	6,000	48	9
19.	Ai Da Hong	Sri Sa Korn	1,000	48	9
20.	Mo E Lo	Cha Nae	600	40	11
21.	Su Kae	"	800	47	11
22.	Ya Or	"	1,200	51	9
23.	Pa Ri	"	430	19	9
	Total		41,630	1,449	237
	Average		1,982	70	11

Source : RID, Narathiwat

Table VI-2-7. Dimensions of Water User Groups Under SSIP Surveyed in the Study Area

	Assisting Agencies	Types of Assistance	On-farm Works	Members Irrigable Area	O & M Works	Gate Operators	Cropping	Gov't Assistance Needed	Problems
1.	ARD RID	Canal Digging Maintenance	No farm ditch	94 members 2,000 rai	No maintenance	7	single	Gate Repairing Construction of Regulator	Insufficient Water Supply (insufficient rainfall)
2.	ARD RID	Ditch Digging Maintenance	N.A.	50 members 3,000 rai	- ditto -	11	single	Efficient Distribution	- ditto -
3.	ARD RID	Canal Digging Maintenance	Limited farm ditches	50 members 3,000 rai	N.A.	N.A.	double	Increase Crest Height of Weir	Not Much Problem
4.	RID	Maintenance	Some Farm Ditches	80 members 3,000 rai	Maintenance Conducted	13	single	Construction of Concrete Canal	Extension of Farm Ditch
5.	RID	Maintenance Advice on pipe connecting	Farm Ditches	60 members 1,500 rai	- ditto -	N.A.	double	Price Guarantee Marketing	Not Much Problem
6.	ARD RID	Ditch Dredging Maintenance	Farm Ditches	70 members 500 rai	- ditto -	N.A.	double	Construction of Farm Ditch	- ditto -
7.	RID Amphoe	Technical Advice on O&M Organization	Farm Ditches	300 members 4,000 rai	- ditto -	7	double	Concrete Canal Farm Pond Dredging Main Canal	Insufficient Knowledge and Cooperation among Members
8.	RID DOAE	Canal Dredging Water Use Plan Organization	Maintenance No Farm Ditch	60 members N.A.	- ditto -	N.A.	N.A.	Construction of Farm Ditches O&M House	Limited Cooperation among Members

Source: Field Survey

APPENDIX VII. EXISTING FLOODING, DRAINAGE AND IRRIGATION

VII-1 Existing Flooding

To grasp the current conditions of inundation and related damage by flooding water in the Study area, field interviews were carried out at several points, concentrating on the conditions of over-topping of flood from Mae Nam Yakang in the western part and also on the conditions of inundation along Mae Nam Bang Nara in the central and eastern parts. These interview points are shown in Figure VII-1-1.

(1) Ban Plak Pla

- o Serious Flooding Date — November 1984
- o Depth — 0.8 m (W.L. 2.3 m)

* After the completion of drainage canal, the suffering of road submerged in annual rainy season was alleviated.

(2) Ban Lahan

- o Serious Flooding Date — November and December 1984
- o Depth — 1.2 m (W.L. 6.2 m)

* The flood backwater that is fresh comes from Khlong Pa Ra Buke which is a tributary of Mae Nam Yakang. But, it may be caused by a fact that its flow course tends to cross the great inundation area of Yi-Ngo.

(3) Ban Lamphu

- o Serious Flooding Date — Every December and January
- o Depth & duration — 1.5 m, 3 - 4 days
- o Direction & velocity — To Mae Nam Bang Nara, with high velocity

* The emergence of flooding is rapid, so people and live stocks are evacuated to the upland.

(4) Ban Chalae Ko

o Serious Flooding Date — Every December

* The inundation water level rises up to nearly the floor level of residences. The public traffic is blocked for 1-3 days depending on the annual rainfall condition. The traffic on the national highway (Route 4055)stopped for only one day in the last year.

(5) Ban Bu Nae Lae

o Serious Flooding Date — Every December
o Depth & duration — 0.2 m, 2 - 3 days
o Direction & velocity — From Tan Yong Mat, slow

* Small livestocks are drawn in water flow.

(6) Ban Chu Nga

o Serious Flooding Date — Every Rainy Season
o Depth — 1.0 m (W.L. 9.0 m)
o Duration — 1 week

* The area of hilly side along national highway (Route 4056) submerges in annual rainy season. The flood water flows over crossing the national highway every rainy season because of less number of the road-crossing drainage ducts.

(7) Ban Kae Mae

o Serious Flooding Date — Every December
o Depth & duration — 1 m, 1 week
o Direction — From Tan Yong Mat

* The traffic on the national highway stopped.

(8) Ban Kadeng

o Serious Flooding Date — Every December and January
o Depth & duration — 1.2 m, 3 days

o Direction — From Tan Yong Mat to Mae Nam Bang Nara

(9) Ban Tan Yong Mat

o Serious Flooding Date — Every Rainy Season
o Depth — 1.0 m (W.L. 16.0 m)

* The depth of water is about 0.2 m at the crown of national highway (Route 4055). Vehicles are possible to traverse the way. People and livestocks evacuate themselves to the upland in Rangae. The emergence of flooding is rapid.

(10) Khlong To Che

o Serious Flooding Date — Every December
o Depth & duration — 1.4 m, 3 weeks
o Direction & velocity — From Mae Nam Bang Nara, fast

* The quality of water at this Khlong in dry season is deteriorated so that the water is not used for the irrigation.

(11) Ban Du Song

o Serious Flooding Date — Every December and January
o Depth & duration — 0.5 - 0.7 m, 1 week
o Direction & velocity — To Mae Nam Bang Nara, fast

* Since the flood water flows so rapidly, small livestocks are drown in water flow.

(12) Ban Khok Sumu

o Serious Flooding Date — Every Rainy Season
o Depth — 1.0 m (W.L. 8.0 m)
o Duration — -

* Khlong Ku Bo rises its water level and brings inundation. Boat is employed for transport.

(13) Ban Bang Po

o Serious Flooding Date	Every December
o Depth & duration	0.5 m, 10 days
o Direction	From mountainous area

* Small river locates nearby but its flow is blocked by the trees in the river.

(14) Ban Khok Ko

o Serious Flooding Date	December and January
o Depth & duration	2 m, 10 - 20 days
o Direction	From Mae Nam Bang Nara

(15) Ban Ku Bae Bo Ngo

o Serious Flooding Date	Every December
o Depth & duration	0.3 m, 3 - 6 days
o Direction	To Mae Nam Bang Nara

* No flooding has been seen last year.

(16) Ban Thung Kraeng

o Serious Flooding Date	Every December
o Depth & duration	0.5 m, 2 - 3 days
o Direction & velocity	- , slightly

(17) Ban Khok Niang

o Serious Flooding Date	Every Rainy Season
o Depth	1.0 m (W.L. 10.0 m)
o Duration	7-8 days

* The area of hilly side along national highway (Route 4056) suffers 1 m depth flooding, while the opposite area suffers about 0.3 m. The livestocks died in the upstream area last year. The

national highway suffers from time to time covering water for few days.

* A road-crossing drainage duct is composed of 2 row of 1 m - diameter pipe and 1 row of 0.8 m - diameter pipe.

(18) Ban Da Ma Bu Wo

o Serious Flooding Date	December
o Depth & duration	0.2 m, 1 week
o Direction & velocity	From Tan Yong Mat to Mae Nam Bang Nara, slow

* Last year there was no flooding on the paddy field.

(19) Ban Ba Ngo

o Serious Flooding Date	Every Rainy Season
o Depth	0.5 m (W.L. 16.0 m)
o Duration	4 - 5 days

* The flooding comes from Khlong Adeng where the railway bridge is located. Since the flooding phenomena emerges so rapidly, livestocks such as chicken are drawn in water flow.

(20) Ban Lu Bo Di Yae

o Serious Flooding Date	November, December and January
o Depth & duration	About 1.0 m, 3 - 4 days
o Direction & velocity	From mountains to Mae Nam Bang Nara, fast

* Since the flood water flows so rapidly, the livestocks are drawn in water flow.

(21) Ban Kho

o Serious Flooding Date	December
o Depth & duration	1.0 m, 4 - 5 days
o direction & velocity	From mountains to Mae Nam Bang Nara, fast

* Damage by flooding is little in this area.

(22) RID-Pileng Project Office

- o Serious Flooding Date — December 1984
- o Depth — 0.35 m (W.L. 2.25 m)

* The water level rose up to nearly floor level of Pileng Office. At that time, roads were all submerged so that boats were employed for the transport.

(23) Ban Yai

- o Serious Flooding Date — Every Rainy Season
- o Depth — 1.0 m (W.L. 2.5 m)

* Due to the accomplishment of Khlong Lan regulator, the duration of flooding is elongated. The national highway (Route 4057) suffered with the flooding water for 3-4 days in the last rainy season. Such water covering is annual.

(24) Ban Khok Phai

- o Serious Flooding Date — ---
- o Depth & duration — 3-4 m, 3-4 days
- o Direction — To Mae Nam Kolok

* The water in Khlong is acidic so that water is not used for paddy irrigation.

(25) Ban Pa Mang

- o Serious Flooding Date — ---
- o Depth & duration — 2-4 m, 3-4 days
- o Direction — From Mae Nam Kolok

* The inundation water in this area does not flow to Mae Nam Bang Nara due to the less number of drain culverts under the road.

(26) Ban Tha San

o Serious Flooding Date	January
o Depth & duration	1.5 m, 20 days
o Direction & velocity	Toward Narathiwat, fast

(27) Ban Ba Wong

o Serious Flooding Date	---
o Depth	0.5 m

* Flooding water flows to Mae Nam Pu Yu.

(28) Ban Plak Chang

o Serious Flooding Date	---
o Depth	1 m
o Duration	1 week

* Paddy field along Mae Nam Bang Nara suffers the damages by not flooding water but saline water.

(29) Ban Bang Noi

o Serious Flooding Date	December 1984
o Depth	0.25 m (W.L. 2.25 m)
o Duration	1 day

(30) Ban Tapang

o Serious Flooding Date	December
o Depth & duration	1 m, 5 days
o Direction & velocity	From Sg. Padi to Mae Nam Kolok, slow

(31) Ban Cha Ro

o Serious Flooding Date	December 1984
o Depth	0.7 m (W.L. 2.2 m)

o Duration 4 days

(32) Ban Cha Ro

o Serious Flooding Date ---
o Depth & duration 1 m, 5 - 7 days
o Direction & velocity To Mae Nam Bang Nara, slow
* Residential area submerges in annual rainy season. There are less number of the road-crossing drainage ducts.

(33) Ban To Lang

o Serious Flooding Date ---
o Depth & duration 0.6 m (max.) / 0.3 m (annually) } 3 days
o Direction & velocity To Mae Nam Bang Nara, fast

(34) Ban Khok Sila

o Serious Flooding Date December 1984
o Depth 0.35 m (W.L. 2.4 m)
o Duration 5 days

(35) Ban Ku Bae Ya Hae

o Serious Flooding Date March 1985
o Depth 0.2 m (W.L. 2.15 m)
o Duration 1 week

(36) Ban Ba Yo

o Serious Flooding Date December or January
o Depth & duration 0.3 m, 1 week
o Direction & velocity From mountainous area to Mae Nam Bang Nara, slow

* Paddy field sometimes suffers the flooding damage due to less number of the drainage canals.

(37) Ban Kamphaeng

o Serious Flooding Date ---
o Depth & duration 1.0 m, 1 week
o Direction & velocity From Mae Nam Bang Nara, slow

* Paddy cultivation is forced to suspend due to the damages by rats or salty water.

(38) Ban Ple

o Serious Flooding Date ---
o Depth & duration 1.0 m, 1 week
o Direction & velocity From Mae Nam Bang Nara, slow

* Mae Nam Bang Nara rises its water level and brings inundation, and the boats are employed for the transportation.