FIGURE 3B-13 SYSTEMATIZED COLUMNAR SECTION OF SOIL PROFILES

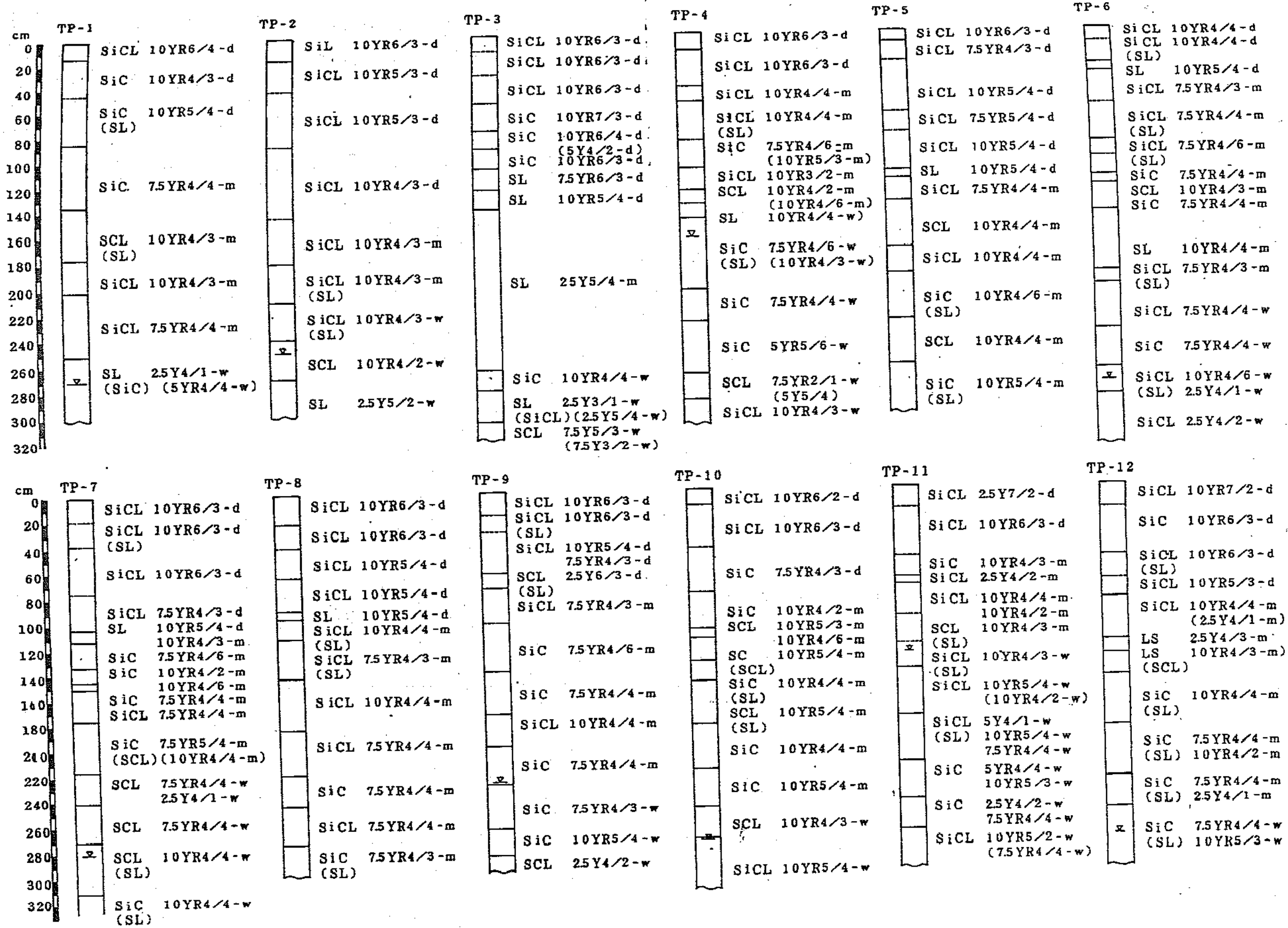
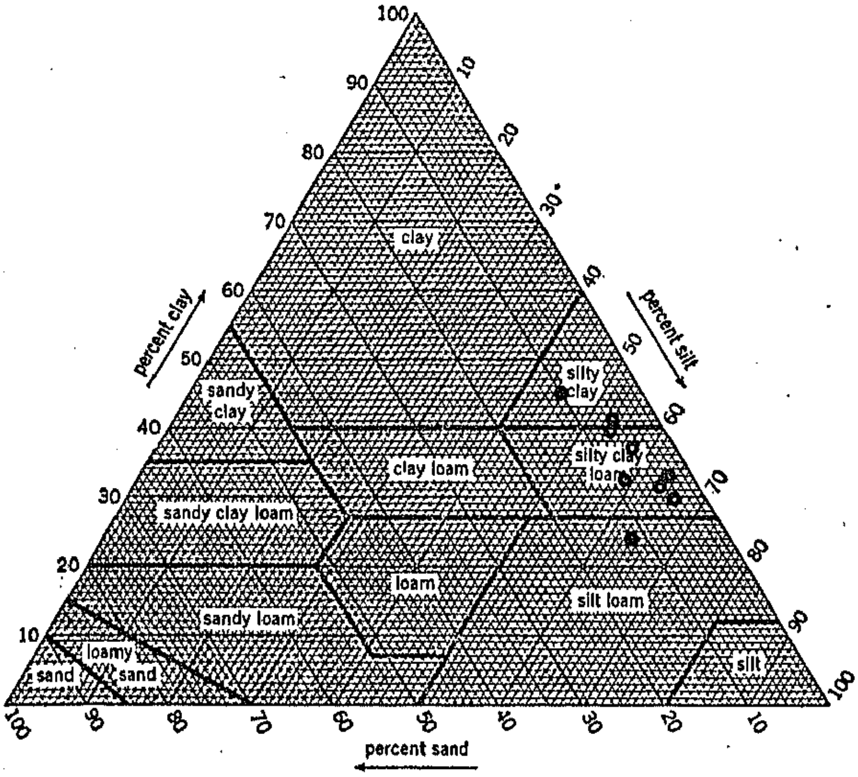


FIGURE 3B-14 PARTICLE SIZE DISTRIBUTION OF SOILS

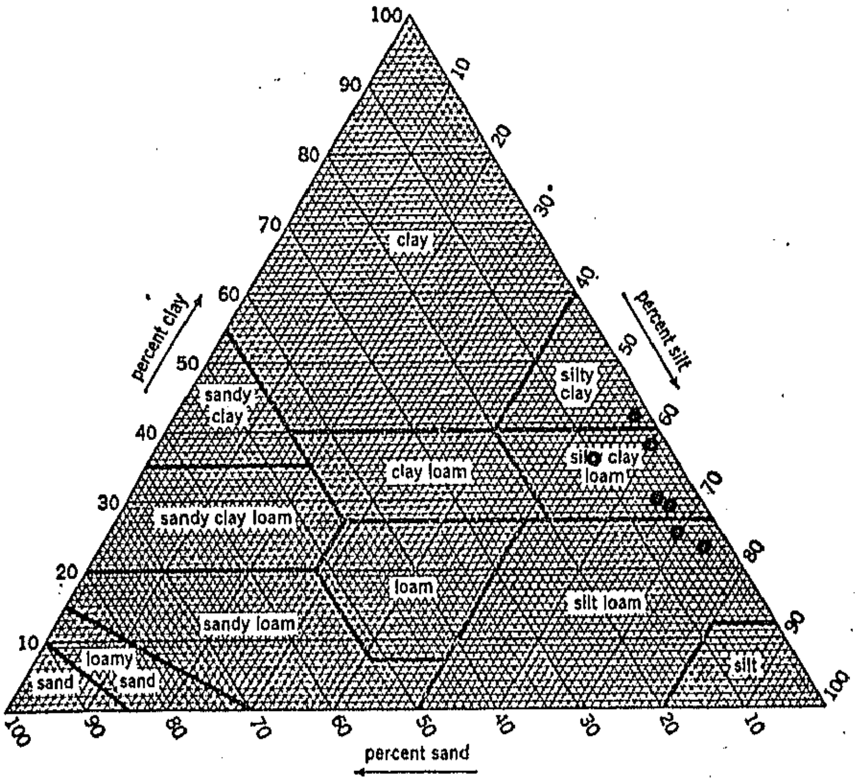
TP - I



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-15	6	57	37	SiCL
15-45	8	59	33	SiCL
45-84	12	64	24	SiL
84-115	7	53	40	SiCL
115-135	9	45	46	SiC
135-175	5	64	31	SiCL
175-200	3	64	33	SiCL
200-250	6	53	41	SiC
250-300	No.	Sample		

PARTICLE SIZE DISTRIBUTION OF SOILS

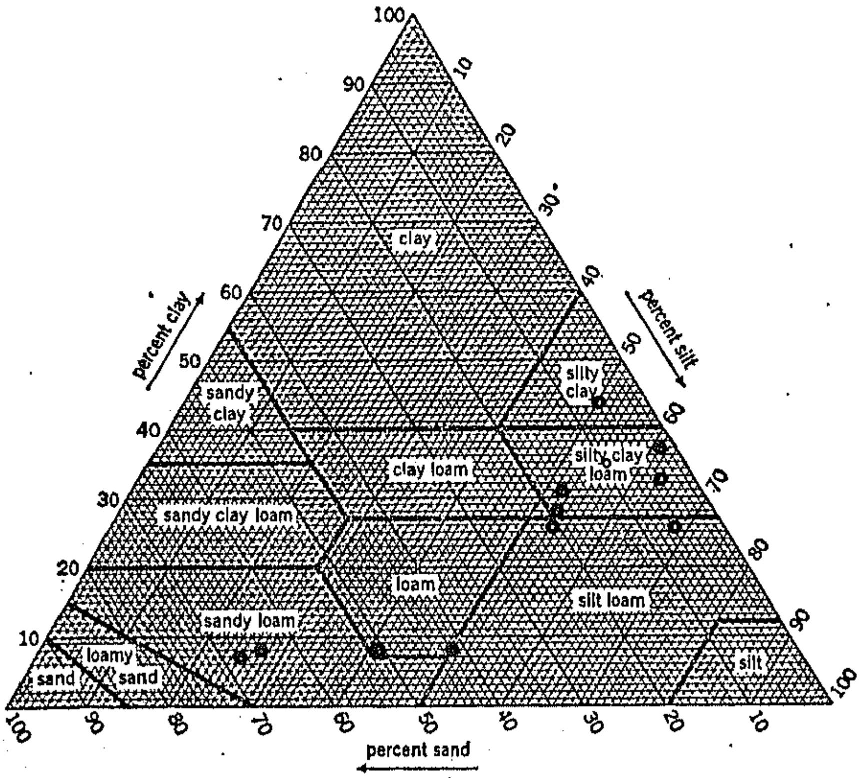
TP - 2



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-18	5	70	25	SiL
18-43	3	74	23	SiL
43-88	4	67	29	SiCL
88-145	2	56	42	SiC
145-180	10	54	36	SiCL
180-210	5	65	30	SiCL
210-240	2	60	38	SiCL
240-270	No. Sample			
270-300	No. Sample			

PARTICLE SIZE DISTRIBUTION OF SOILS

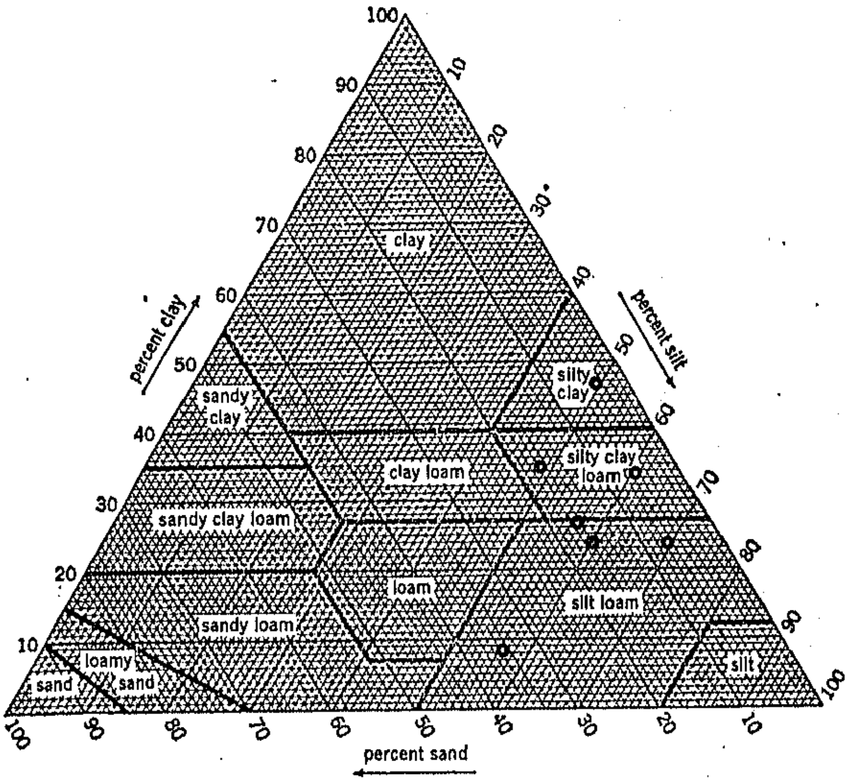
TP - 3



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-13	No.	Sample		
13-32	4	63	33	SiCL
32-56	2	61	37	SiCL
56-78	6	50	44	SiC
78-92	9	55	36	SiCL
92-108	6	68	26	SiL
108-124	42	50	8	L
124-140	51	41	8	L
140-205	68	25	7	SL
205-265	65	27	8	SL
265-280	16	52	32	SiCL
280-305	19	53	28	SiCL
305-320	21	53	26	SiL

PARTICLE SIZE DISTRIBUTION OF SOILS

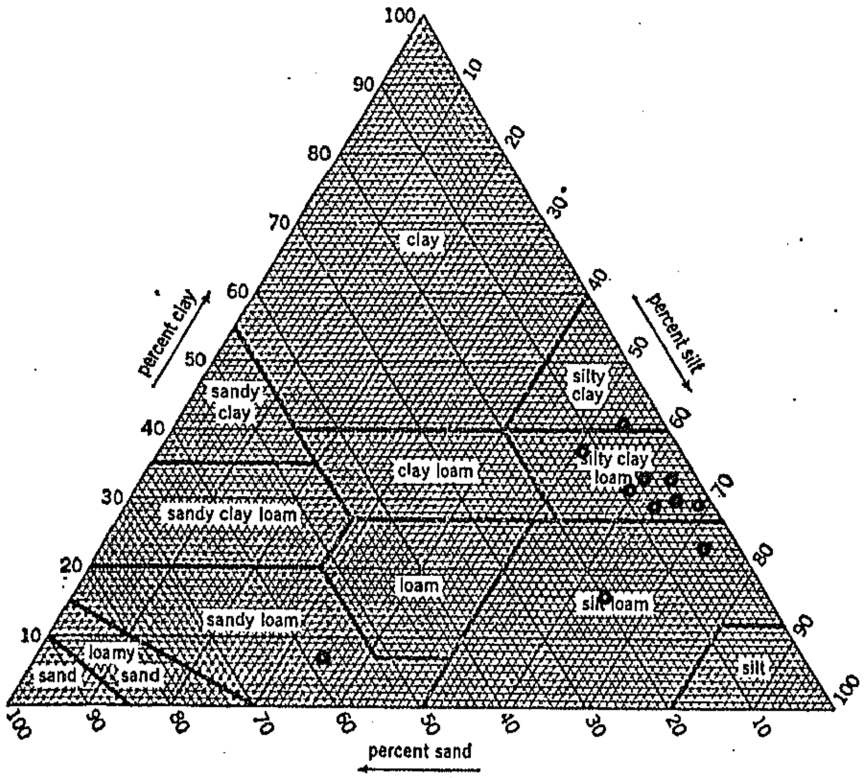
TP - 4



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-15	17	56	27	SiCL
15-44	6	60	34	SiCL
44-57	7	69	24	SiL
57-89	35	56	9	SiL
89-110	4	49	47	SiC
110-127	17	48	35	SiCL
127-138	16	60	24	SiL
138-150				
150-205				
205-230	missing			
230-270				
270-290				
290-310				

PARTICLE SIZE DISTRIBUTION OF SOILS

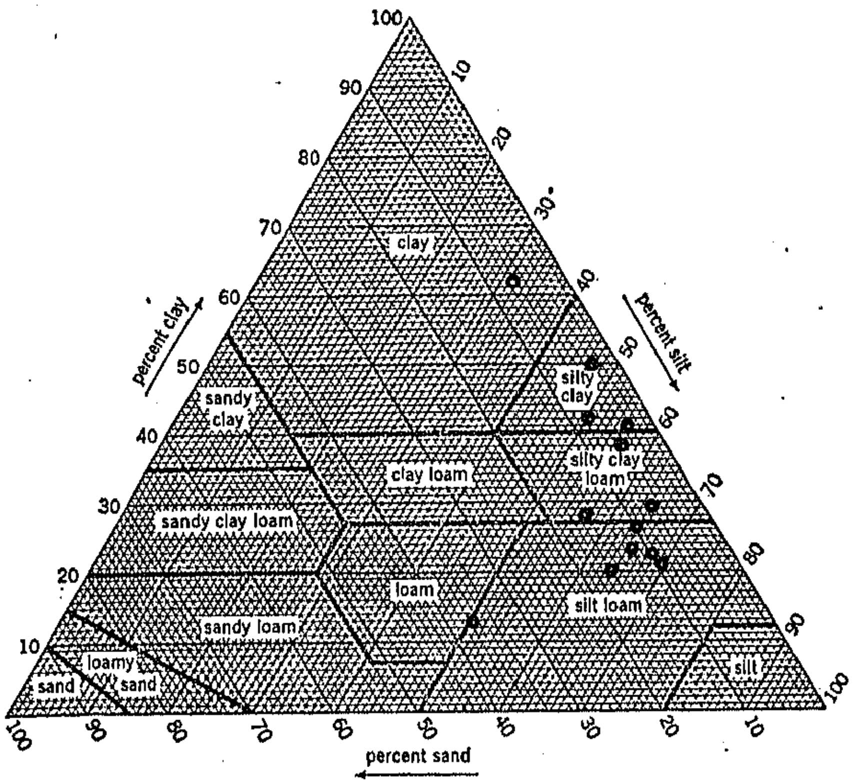
TP - 5



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0–10	7	64	29	SiCL
10–26	9	60	31	SiCL
26–68	4	66	30	SiCL
68–84	2	69	29	SiCL
84–114	4	73	23	SiL
114–120	58	35	7	SL
120–138	7	64	29	SiCL
138–175	20	64	16	SiL
175–195	3	64	33	SiCL
195–230	12	51	37	SiCL
230–265	6	61	33	SiCL
265–302	5	54	41	SiC

PARTICLE SIZE DISTRIBUTION OF SOILS

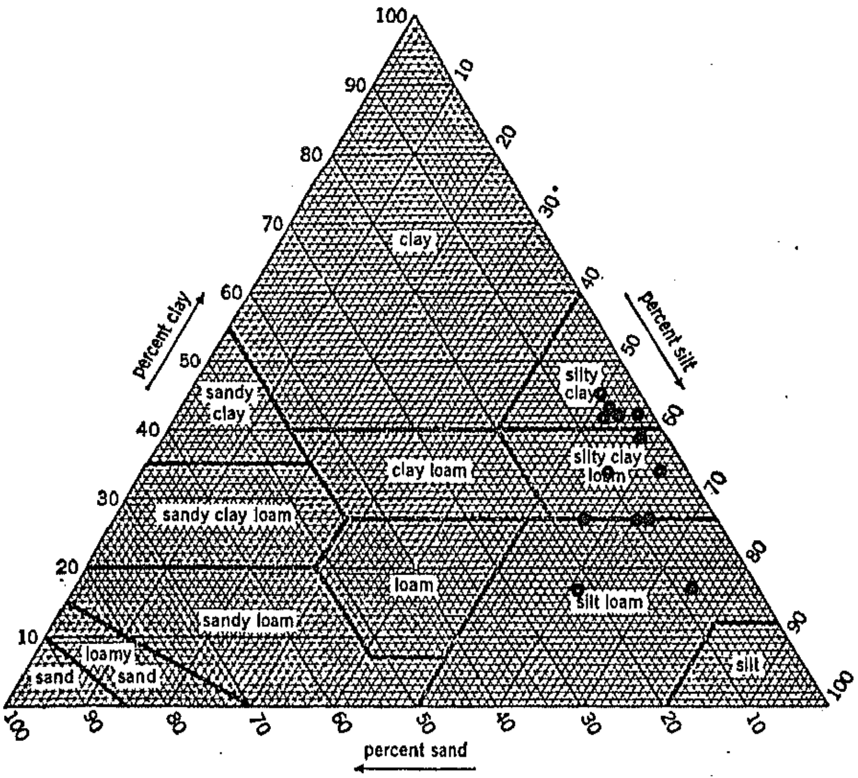
TP - 6



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-12	10	68	22	SiL
12-30	6	65	29	SiCL
30-37	37	50	13	SiL
37-63	15	57	28	SiCL
63-93	10	64	26	SiL
93-105	9	70	21	SiL
105-120	3	56	41	SiC
120-127	12	75	13	SiL
127-148	5	57	38	SiCL
148-195	3	47	50	SiC
195-205	16	64	20	SiL
205-240	6	32	62	C
240-270	7	51	42	SiC
270-290	missing			
290-330				

PERTICLE SIZE DISTRIBUTION OF SOILS

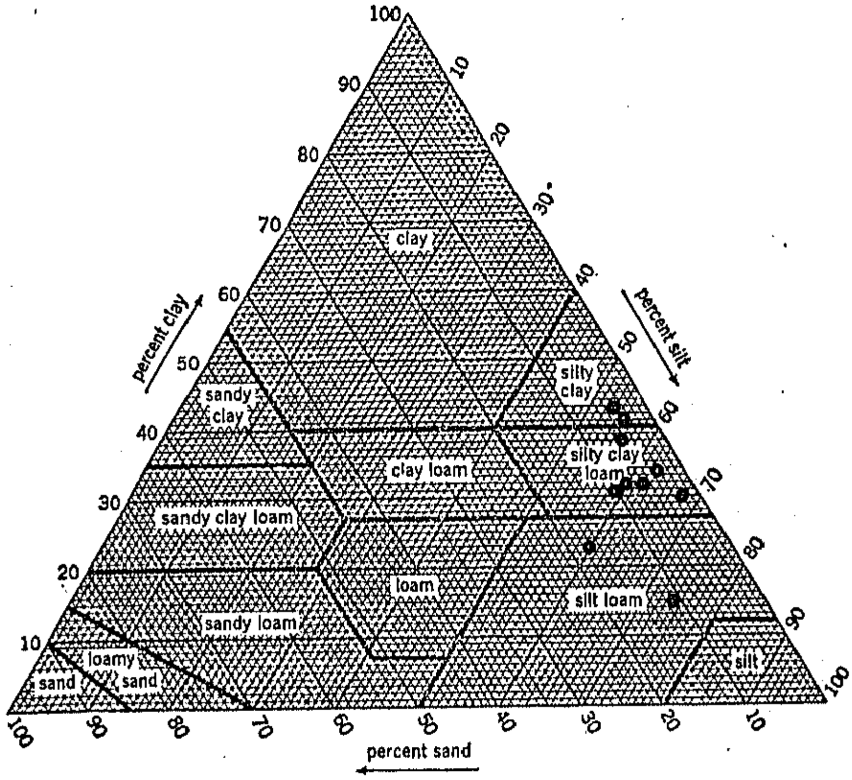
TP - 7



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-18	8	65	27	SiCL, SiL
18-36	22	61	17	SiL
36-74	3	63	34	SiCL
74-102	3	58	39	SiCL
102-111	8	75	17	SiL
111-132	4	54	42	SiC
132-144	6	52	42	SiC
144-150	5	50	45	SiC
150-175	5	52	43	SiC
175-215	2	56	42	SiC
215-240	9	64	27	SiCL, SiL
240-270	10	56	34	SiCL
270-310	missing			
310-330	16	57	37	SiCL, SiL

PERTICLE SIZE DISTRIBUTION OF SOILS

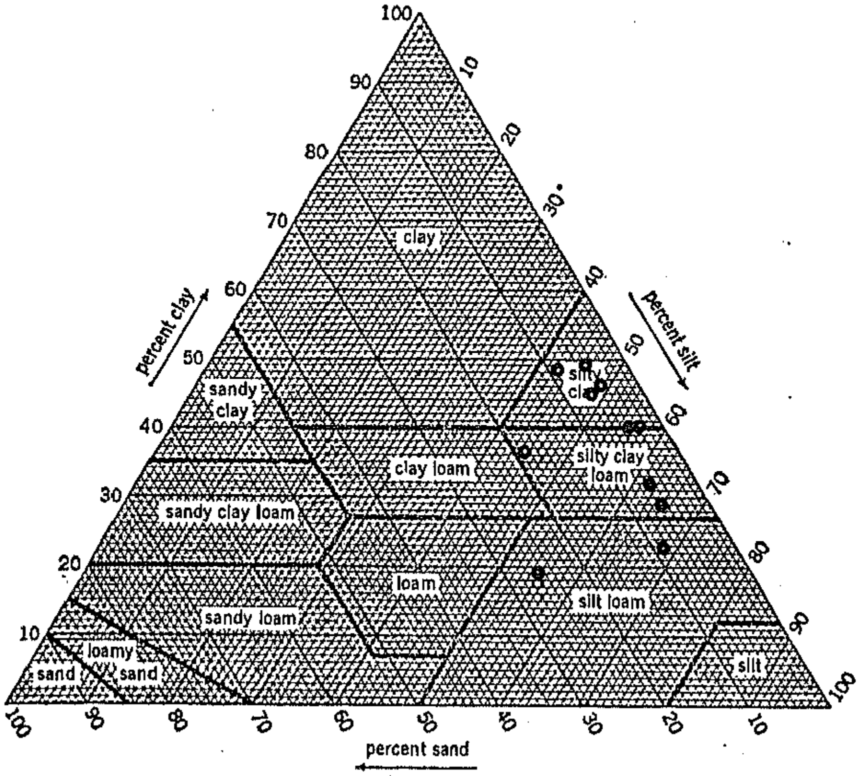
TP - 8



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-22	missing			
22-40	6	62	32	SiCL
40-64	3	63	34	SiCL
64-90	8	60	32	SiCL
90-96	11	74	15	SiL
96-112	17	60	23	SiL
112-144	10	59	31	SiCL
144-185	2	68	30	SiCL
185-220	5	56	39	SiCL
220-245	No Sample			
245-275	4	55	41	SiC
275-300	4	53	43	SiC

PERTICLE SIZE DISTRIBUTION OF SCALES

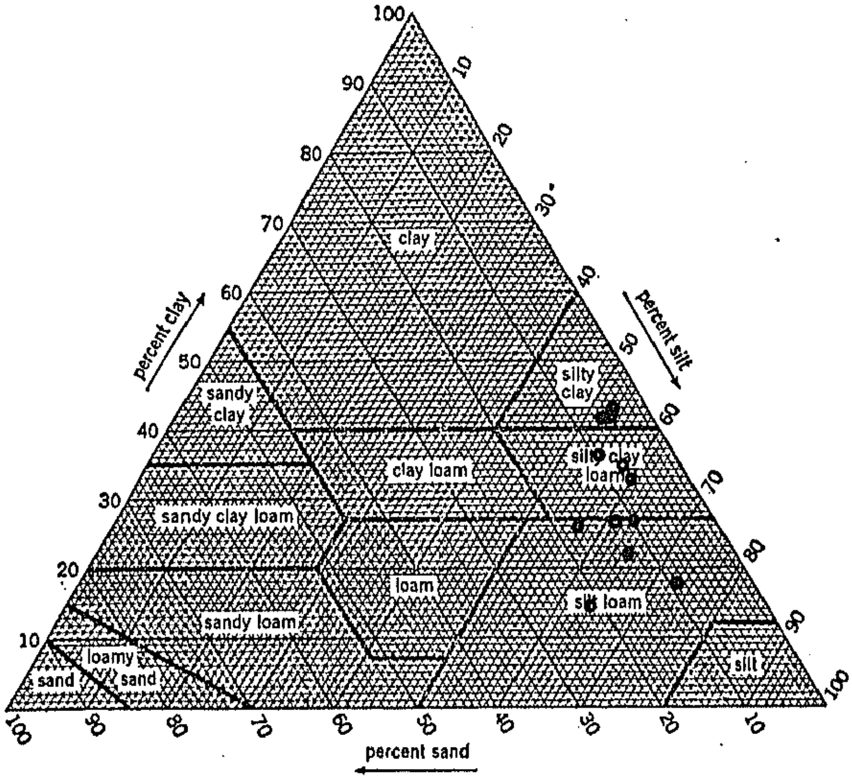
TP - 9



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-17	6	65	29	SiCL
17-30	26	55	19	SiL
30-63	6	62	32	SiCL
63-75	9	68	23	SiL
75-101	3	57	40	SiCL, SiC
101-140	4	56	40	SiCL, SiC
140-175	9	42	49	SiC
175-200	5	46	49	SiC
200-230	6	49	45	SiC
230-265	5	49	46	SiC
265-285	5	49	46	SiC
285-300	19	44	37	SiCL

PERTICLE SIZE DISTRIBUTION OF SOILS

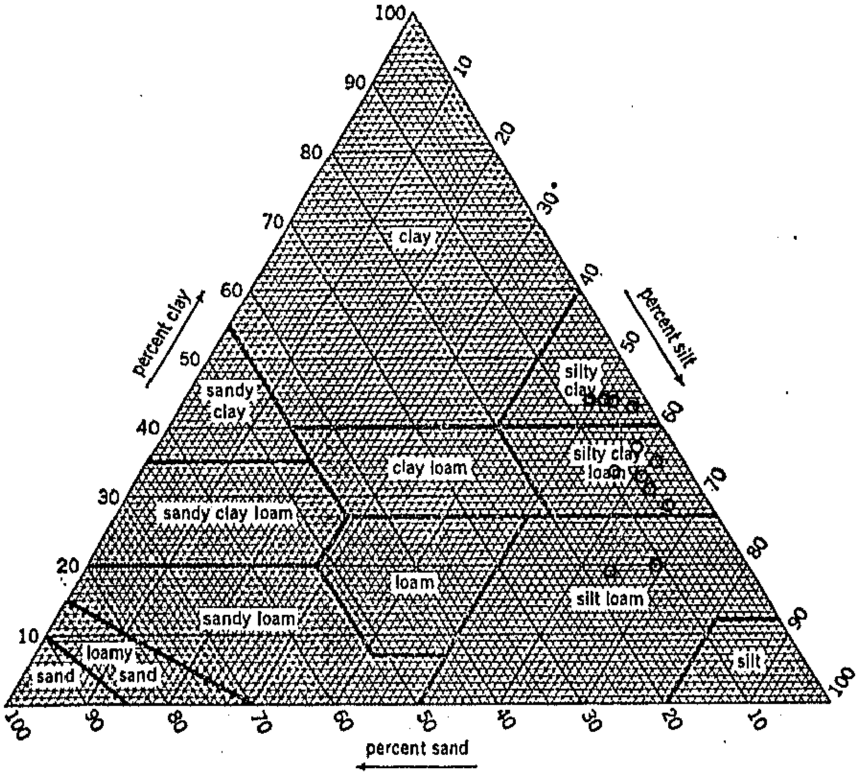
TP - 10



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-12	7	60	33	SiCL
12-44	7	58	35	SiCL
44-80	5	53	42	SiC
80-109	6	52	42	SiC
109-117	9	73	18	SiL
117-134	21	64	15	SiL
134-150	10	63	27	SiCL, SiL
150-185	13	65	22	SiL
185-220	17	57	26	SiL
220-250	4	53	43	SiL
250-275	9	54	37	SiCL
275-315	12	61	27	SiCL, SiL

PERTICLE SIZE DISTRIBUTION OF SOILS

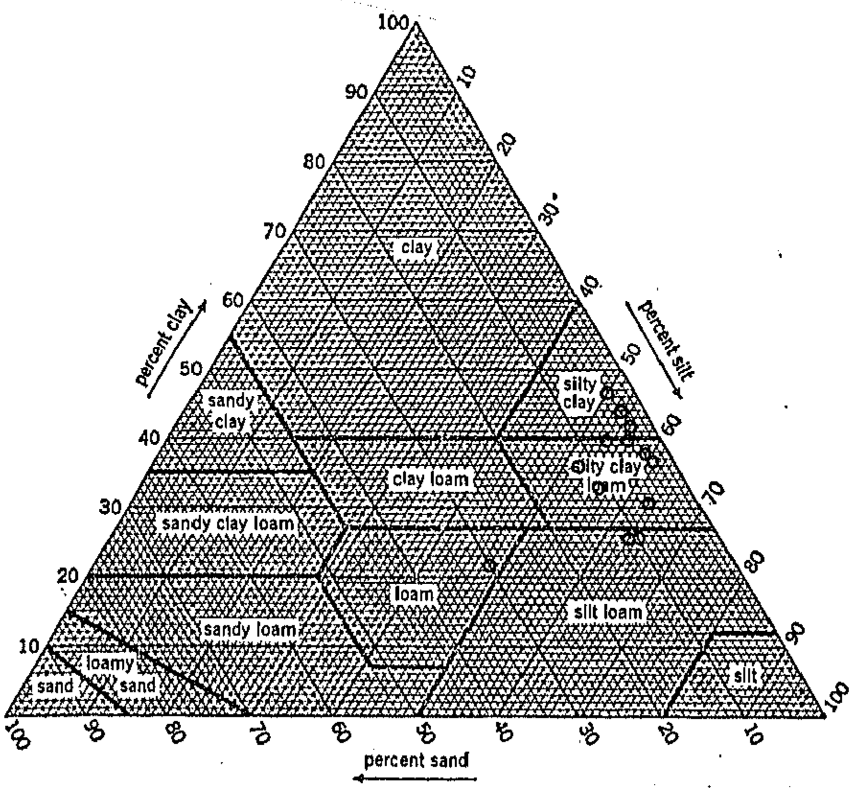
TP - 11



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-17	7	49	44	SiC
17-53	6	51	43	SiC
53-70	3	62	35	SiCL
70-76	6	63	31	SiCL
76-100	4	58	38	SiCL
100-121	17	64	19	SiL
121-142	11	69	20	SiL
142-180	9	57	34	SiCL
180-215	5	66	29	SiCL
215-245	6	61	33	SiCL
245-270	4	52	44	SiC
270-300	2	55	43	SiC

PERTICLE SIZE DISTRIBUTION OF SOILS

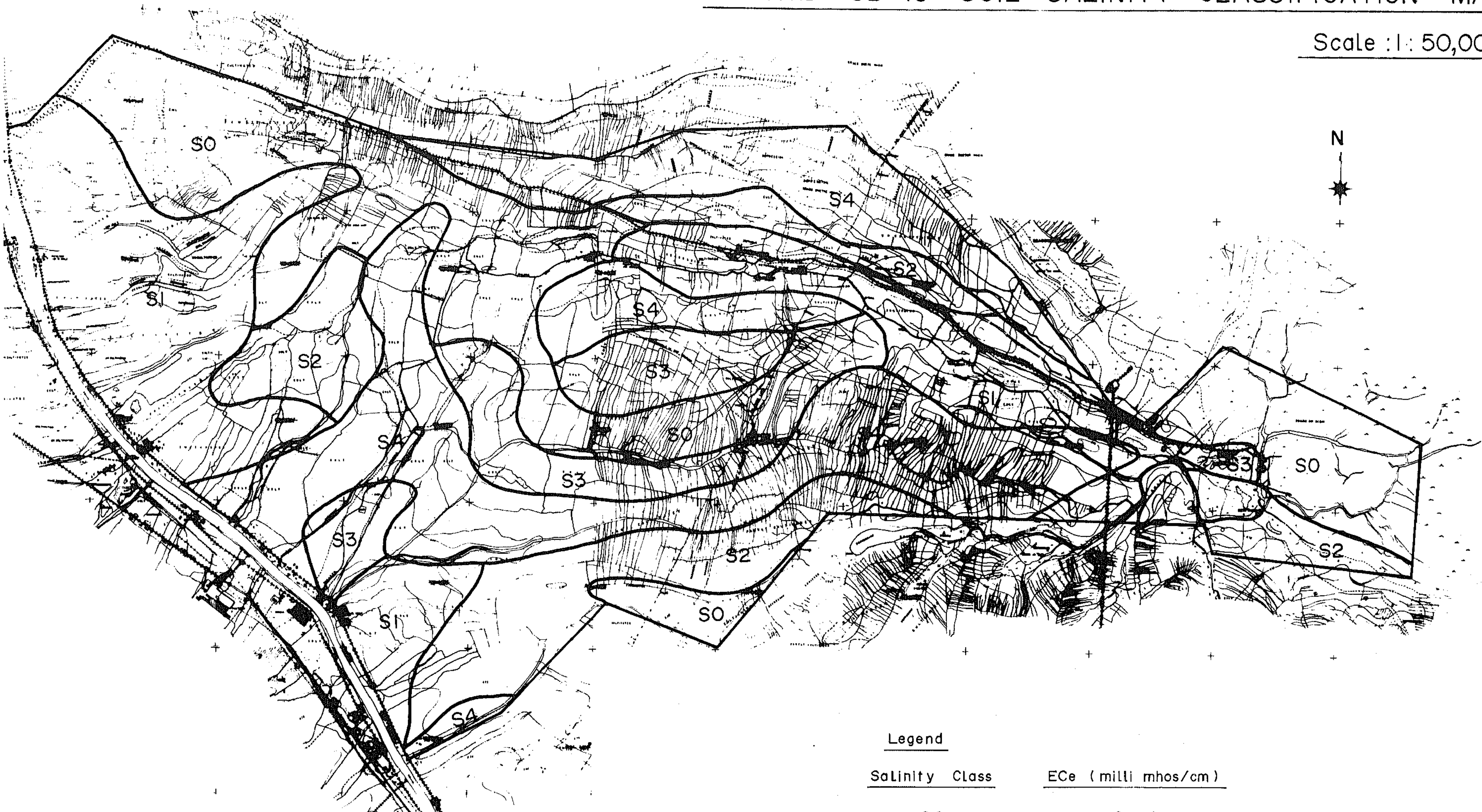
TP - 12



Sampling Depth cm	Mechanical Analysis			
	Sand %	Silt %	Clay %	Texture Laboratory
0-18	12	52	36	SiCL
18-54	7	53	40	SiCL, SiC
54-74	10	64	26	SiL
74-89	6	63	31	SiCL
89-122	11	63	26	SiL
122-133	67	23	10	SL
133-150	30	48	22	SiL, L
150-190	11	56	33	SiCL
190-230	4	56	40	SiCL, SiC
230-255	3	50	47	SiC
255-300	3	55	42	SiC

FIGURE 3B-15 SOIL SALINITY CLASSIFICATION MAP

Scale : 1 : 50,000



Legend

Salinity Class	ECe (milli mhos/cm)
S 0	0 - 4
S 1	4 - 8
S 2	8 - 16
S 3	16 - 25
S 4	>25

FIG. 3B-16 CORRELATION BETWEEN ECe AND TSS

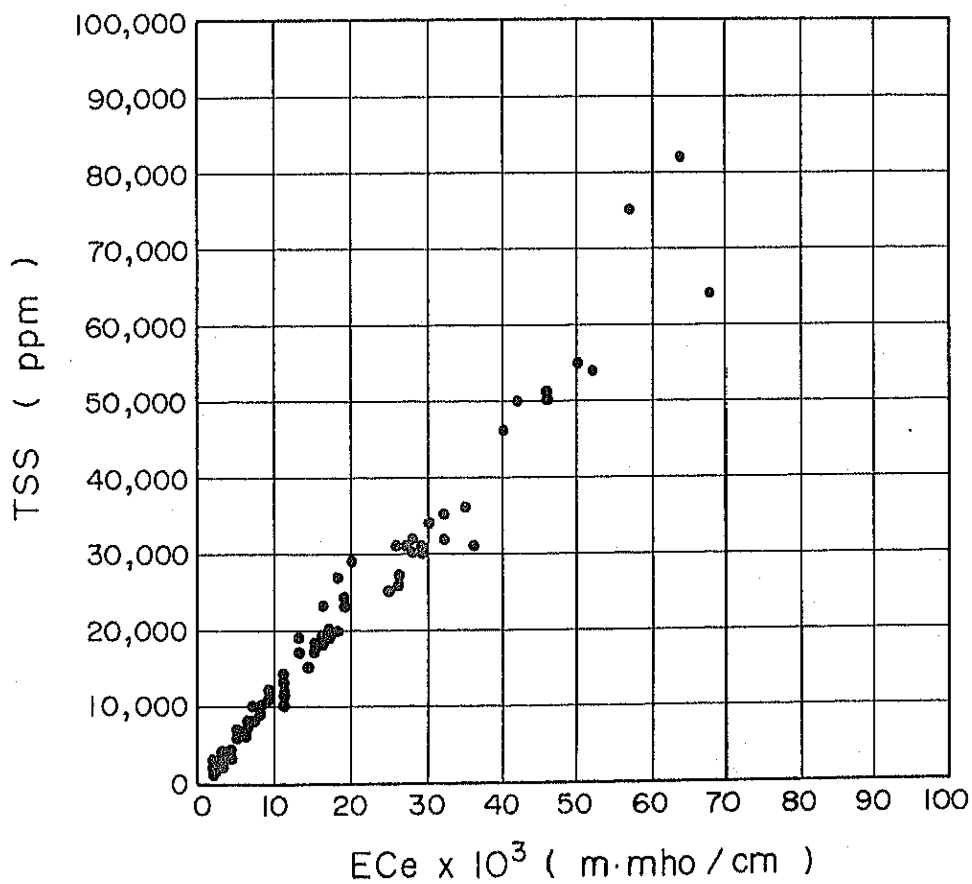
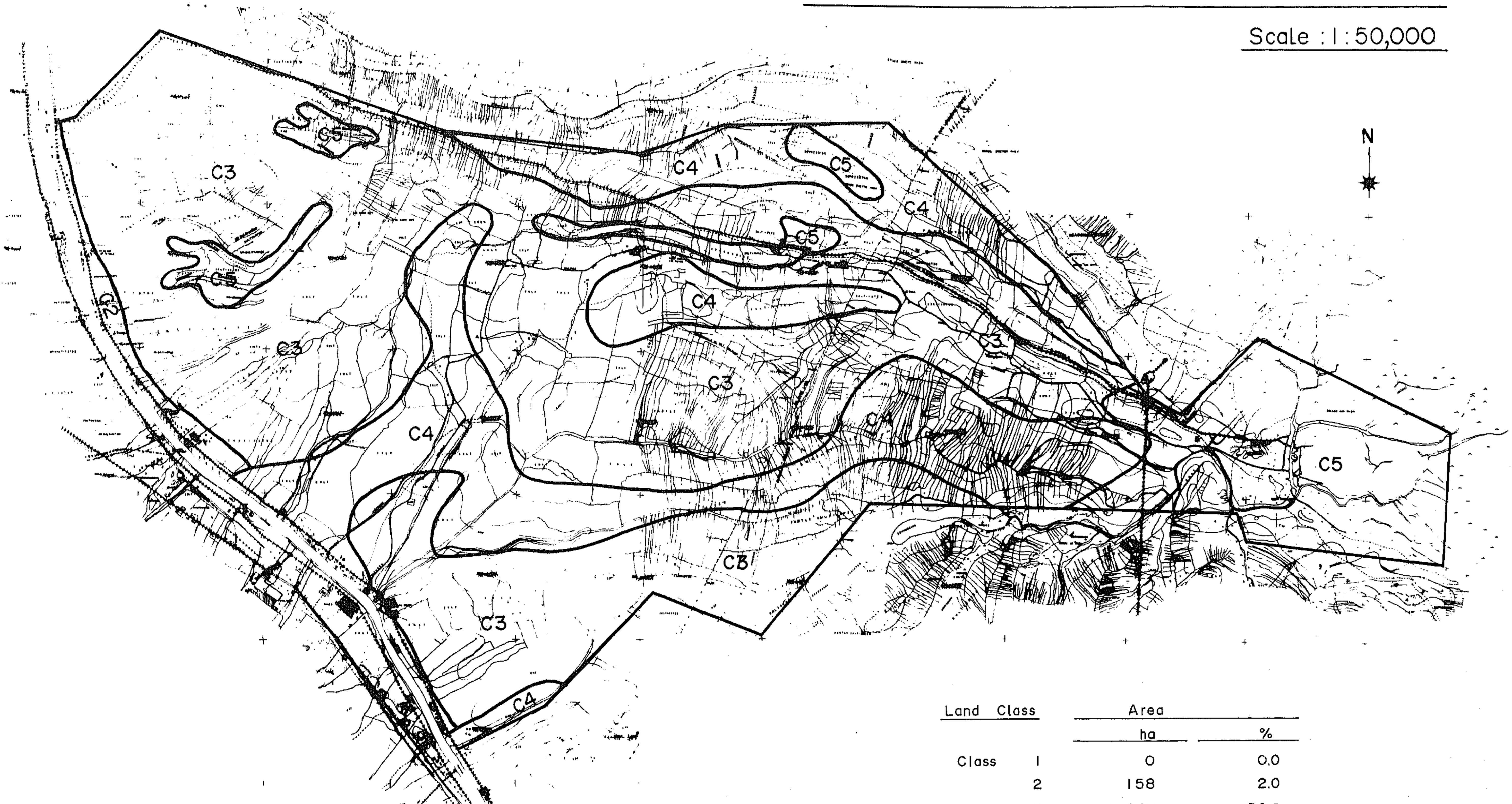


FIGURE 3B-17 LAND CLASSIFICATION MAP

Scale : 1 : 50,000



Land Class		Area (ha)	Area (%)
Class	1	0	0.0
	2	158	2.0
	3	4,647	56.9
	4	2,182	26.7
	5	1,173	14.4
Total		8,160	100.0

Table 3B-17 Soil Distribution

Soil Series	Symbol	Area ha	Area %	Area ha	Area %
River Levee Soils				220	2.7
Adla series	L11	220	2.7		
Silted Basin Soils				6,006	73.6
Al-Gheriba series	B2(2)	1,534	18.8		
Amara series	B3(1)	220	2.4		
	B32	1,954	23.9		
	B3(2)	334	4.1		
	B33	698	8.6		
	Sub-total			(4,720)	(57.8)
Al-Khasif series	B43	94	1.2		
	B4(3)	482	5.9		
	B4(4)	710	8.7		
	Sub-total			(1,286)	(15.8)
Basin & Irrigation Depression Soils				708	8.7
Al-Abith series	D63	246	3.0		
	D64	202	2.5		
Abu-Jawathel series	D75	260	3.2		
Silted Hor Soils				1,180	14.4
Muminah series	H83	484	5.9		
	H84	696	8.5		
Miscellaneous Soils				46	0.6
Arqub soils	SR	46	0.6		
Total				8,160	100.0

Table 3B-18 Physical and Chemical Properties of Soils (1979)

Test Pit No.	Sampling Depth cm	pH Past	Sat. Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory	Gypsum %	Lime %	Exchange Na meq/100g	Ext. K meq/100g	CEC meq/100g
TP-1	0-15	7.85	5.59	6	57	37	SiCL	Nill	25.0	2.4	1.22	38.46
	15-45	7.80	7.67	8	59	33	SiCL	Nill	27.7	5.0	0.69	35.54
	45-84	7.40	10.65	12	64	24	SiL	0.01	28.0	4.5	0.64	35.71
	84-115	7.50	15.80	7	53	40	(SiCL (SiC	Nill	25.8	9.4	0.65	36.91
	115-135	7.45	15.58	9	45	46	SiC	0.76	24.9	9.8	1.01	40.87
	135-175	7.50	14.74	5	64	31	SiCL	1.00	29.4	8.3	0.80	37.25
	175-200	7.40	14.21	3	64	33	SiCL	0.06	30.0	7.9	0.92	34.52
	200-250	7.50	13.51	6	53	41	SiC	Nill	26.3	7.2	1.04	42.78
	250-300	7.60	17.18	No.	Sample			Nill	28.2	4.2	0.76	35.19
TP-2	0-18	7.65	13.80	5	70	25	SiL	Nill	28.4	1.0	0.94	39.66
	18-43	7.60	0.68	3	74	23	SiL	0.03	29.1	1.2	0.48	33.49
	43-88	7.60	0.88	4	67	29	SiCL	0.07	28.8	1.3	0.66	40.36
	88-145	7.77	3.66	2	56	42	SiC	0.01	27.1	4.4	0.88	34.17
	145-180	7.50	10.92	10	54	36	SiCL	0.26	78.9	6.6	0.76	33.49
	180-210	7.40	13.96	5	65	30	SiCL	0.23	29.5	7.6	0.71	34.00
	210-240	7.55	14.63	2	60	38	SiCL	0.18	27.8	3.2	1.03	37.94
	240-270	7.60	3.50	No.	Sample			1.11	30.4	17.9	1.94	37.59
	270-300	7.55	18.28	No.	Sample			0.14	33.4	8.4	0.84	35.03
TP-3	0-13	7.85	0.89	No.	Sample			0.03	27.0	1.3	0.96	41.74
	13-32	7.65	1.47	4	63	33	SiCL	0.05	26.6	2.3	0.91	44.00
	32-56	7.50	6.86	2	61	37	SiCL	Nill	26.9	1.1	0.89	37.59
	56-78	7.50	7.00	6	50	44	Sic	1.35	25.3	1.3	0.99	38.46
	78-92	7.45	7.34	9	55	36	SiCL	Nill	28.1	4.6	0.87	37.59
	92-108	7.70	3.27	6	68	26	SiL	1.45	29.4	10.0	0.77	30.44
	108-124	7.60	3.64	42	50	8	L	Nill	30.5	7.6	0.32	11.49
	124-140	7.65	6.84	51	41	8	L	Nill	28.6	1.8	0.39	11.49
	140-205	7.75	11.99	68	25	7	SL	Nill	27.8	0.9	0.29	9.75
	205-265	7.70	20.89	65	27	8	SL	Nill	28.7	0.6	0.34	9.39
	265-280	7.70	24.72	16	52	32	SiCL	0.34	29.9	8.0	0.99	39.66
	280-305	7.50	19.65	19	53	28	SiCL	7.26	28.9	11.2	0.92	28.08

	ESP	O.M.	Cations in Saturation Extract					Anions in Saturation Extract				
			Calcium	Magnesium	Sodium	Potassium	Total Cation	Chloride	Sulphate	Bicarbonate	Nitrate	Total Anion
	%	%	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l
TP-1	7.52	2.00	22.96	17.50	25.13	0.73	66.32	-	-	2.62	0.42	-
	13.89	0.60	26.45	12.66	44.79	0.33	84.23	-	-	1.27	0.16	-
	14.74	0.50	35.93	26.59	56.37	0.47	119.36	67.74	62.46	1.60	0.14	131.94
	25.61	0.30	34.97	40.76	107.03	0.30	183.06	93.66	77.25	1.66	0.04	172.61
	24.10	0.50	36.44	43.32	102.86	0.50	183.12	100.05	71.57	1.80	0.02	173.44
	22.29	0.40	42.02	35.16	95.75	0.52	173.45	108.80	62.46	1.16	0.04	172.46
	23.07	0.40	41.91	34.10	94.49	0.51	171.01	108.88	54.90	1.15	0.17	165.10
	16.93	0.50	38.54	31.78	85.24	0.53	156.09	105.61	57.48	1.31	0.03	164.43
	12.17	0.40	39.02	42.22	103.28	0.68	185.20	141.40	30.61	1.84	0.03	173.88
TP-2	2.40	1.60	28.92	25.44	109.95	0.45	164.76	107.05	51.38	1.70	0.02	160.15
	33.49	0.50	2.40	1.02	3.63	0.06	7.11	1.41	4.23	1.56	0.02	7.22
	3.38	0.60	2.83	1.42	5.22	0.11	9.58	2.16	5.03	2.44	0.02	9.65
	13.03	0.40	8.93	6.69	30.32	0.21	46.15	10.20	34.53	2.05	0.02	46.80
	19.78	0.50	28.70	23.76	84.40	0.47	137.33	66.30	77.22	1.70	0.04	145.26
	22.64	0.40	29.24	22.70	110.37	0.64	162.95	73.87	87.42	1.51	0.00	162.80
	8.62	0.40	30.96	25.82	115.35	0.72	172.85	78.95	83.33	1.49	0.01	163.78
	47.74	0.40	9.67	6.20	28.97	0.43	45.27	10.91	34.96	1.82	0.07	47.76
	24.12	0.40	35.61	28.68	164.88	0.92	230.09	145.94	83.07	-	0.01	(229.02)
TP-3												
	3.23	1.20	4.45	1.74	4.44	0.21	10.84	2.16	5.23	2.59	0.07	10.05
	5.25	0.60	5.16	2.31	9.30	0.27	17.04	50.95	10.41	1.81	0.17	63.34
	2.60	0.60	26.77	15.04	51.66	0.61	94.08	20.50	83.16	1.68	0.04	105.38
	38.49	0.60	28.81	16.88	51.23	0.53	97.47	55.58	38.20	1.49	0.04	95.31
	12.25	0.80	25.70	13.47	60.22	0.57	99.96	25.90	73.94	1.62	0.01	101.47
	32.99	0.40	5.05	3.04	16.18	0.24	24.51	7.62	30.69	1.60	0.03	39.94
	66.80	0.10	12.48	6.66	26.57	0.37	46.08	10.91	39.39	1.94	0.04	52.28
	16.01	0.20	16.34	8.84	59.79	0.43	85.40	25.90	57.67	1.74	0.04	85.35
	9.20	0.02	23.42	14.54	104.11	0.55	142.62	75.00	77.50	1.88	0.06	154.44
	6.71	0.10	29.43	33.55	177.79	1.04	241.81	141.44	95.13	2.20	0.06	238.83
	20.39	0.50	39.02	43.13	214 26	1.21	297.62	187.52	93.76	1.60	0.07	282.95
	28.02	0.90	37.53	30.60	161.65	1.32	231.10	119.35	96.91	1.64	0.05	217.95

Test Pit No.	Sampling Depth cm	pH Past	Sat. Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory	Gypsum %	Lime %	Exchange Na meq/100g	Ext. K meq/100g	CEC meq/100g
	305-320	7.20	68.32	21	53	26	SiL		28.5	N.S	0.73	23.39
TP-4	0-15	7.5	5.20	17	56	27	SiCL SiL	1.73	26.7	2.17	2.30	21.8
	15-44	7.8	3.70	6	60	34	SiCL	1.14	27.5	0.84	0.25	18.7
	44-57	7.9	2.70	7	69	24	SiL	0.25	28.0	4.15	0.82	16.0
	57-89	7.8	2.70	35	56	9	SiL	0.11	30.6	2.60	2.10	10.8
	89-110	8.0	2.20	4	49	47	SiC	0.12	26.1	0.49	0.52	25.3
	110-127	7.9	2.60	17	48	35	SiCL	0.026	22.0	4.80	0.52	20.2
	127-138	7.9	2.90	16	60	24	SiL	0.095	27.8	2.50	0.39	24.4
	138-150											
	150-205											
	205-230	Missing										
	230-270											
	270-290											
	290-310											
TP-5	0-10	7.1	138.8	7	64	29	SiCL	0.47	25.1	14.2	0.49	12.9
	10-26	7.4	49.3	9	60	31	SiCL	0.62	26.0	7.7	0.42	18.0
	26-68	7.6	15.8	4	66	30	SiCL	0.40	26.9	7.5	0.25	18.0
	68-84	7.7	23.6	2	69	29	SiCL	0.25	28.3	6.8	0.25	18.0
	84-114	7.7	24.5	4	73	23	SiL	0.70	28.5	7.2	0.32	16.7
	114-120	7.9	2.05	58	35	7	SL	Nill	28.6	5.5	0.13	16.0
	120-138	7.8	30.4	7	64	29	SiCL	0.84	27.2	9.0	0.30	18.0
	138-175	7.8	31.2	20	64	16	SiL	0.34	27.8	5.8	0.18	9.7
	175-195	7.9	29.2	3	64	33	SiCL	0.26	27.4	6.9	0.39	17.4
	195-230	7.9	32.3	12	51	37	SiCL	0.043	27.0	9.6	0.46	11.8
	230-265	7.9	30.1	6	61	33	SiCL	0.37	27.8	9.3	0.36	18.0
	265-300	8.0	29.0	5	54	41	SiC	Nill	28.4	7.8	0.57	20.2

	ESP	O.M.	Cations in Saturation Extract					Anions in Saturation Extract				
	%	%	Calcium meq/l	Magnesium meq/l	Sodium meq/l	Potassium meq/l	Total Cation meq/l	Chloride meq/l	Sulphate meq/l	Bicarbonate meq/l	Nitrate meq/l	Total Anion meq/l
TB-3	N.S	0.4	103.20	17.90	56.37	-	(177.47)	73.52	86.46	-	1.04	(161.02)
TP-4	9.9	4.2	32.0	22.0	21.8		75.8	19.8	50.0	3.2		73.0
	4.5	1.1	36.0	14.0	18.7		68.7	4.4	64.0	1.2		432.6
	25.0	0.5	28.0	14.0	11.3		53.3	3.3	48.0	0.8		52.1
	24.1	0.2	16.0	14.0	14.8		44.8	4.4	38.0	1.2		43.6
	1.9	0.5	16.0	6.0	16.7		38.7	4.4	32.0	1.4		37.8
	23.9	1.7	14.0	2.0	19.5		35.5	4.4	30.0	1.8		36.2
	10.3	0.3	16.0	10.0	21.0		47.0	5.5	40.0	1.2		46.7
TP-5	85.0	1.9	448.0	500.0	1660.0		2608.0	2354.0	60.0	1.8		2415.8
	42.7	0.7	140.0	260.0	405.0		805.0	43.5	122.0	0.8		166.3
	41.5	0.5	48.0	132.0	235.0		415.0	313.5	88.0	0.6		402.1
	38.0	0.2	48.0	84.0	209.0		341.0	264.0	64.0	1.2		329.2
	43.0	0.3	44.0	104.0	239.0		387.0	275.0	92.0	0.8		367.8
	34.0	0.1	40.0	32.0	195.0		267.0	209.0	40.0	1.0		250.0
	50.0	0.4	60.0	120.0	275.0		455.0	319.0	120.0	1.0		440.0
	59.9	0.2	40.0	116.0	336.0		492.0	374.0	88.0	0.8		462.8
	40.0	0.3	36.0	124.0	309.0		469.0	346.5	102.0	1.0		449.5
	81.1	0.3	36.0	132.0	309.0		477.0	357.5	106.0	0.6		464.1
	52.0	0.3	36.0	94.0	283.0		413.0	324.5	102.0	0.8		427.3
	38.7	0.3	32.0	96.0	235.0		363.0	297.0	56.0	1.0		354.0

Test Pit No.	Sampling Depth cm	pH Past	Sat. Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory	Gypsum %	Lime %	Exchange Na meq/100g	Ext. K meq/100g	CEC meq/100g
TP-6	0-12	7.6	59.0	10	68	22	SiL	7.80	23.8	8.4	0.85	19.5
	12-30	7.8	16.0	6	65	29	SiCL	1.20	26.0	13.8	0.62	21.8
	30-37	7.9	9.3	37	50	13	SiL	0.27	28.1	4.16	0.23	14.8
	37-63	7.8	10.5	15	57	28	SiCL	1.90	26.4	5.9	0.28	17.4
	63-93	7.8	11.1	10	64	26	SiL	1.30	26.6	4.9	0.30	12.3
	93-105	7.8	16.7	9	70	21	SiL	1.30	28.5	4.9	0.34	17.4
	105-120	7.8	13.2	3	56	41	SiC	0.086	26.5	4.9	0.44	17.4
	120-127	7.9	13.2	12	75	13	SiL	Nill	30.2	3.5	0.16	16.0
	127-148	7.8	13.3	5	57	38	SiCL	0.086	26.3	3.3	0.54	22.7
	148-195	7.9	16.1	3	47	50	SiC	0.043	26.9	9.6	1.00	12.3
	195-205	7.8	21.7	16	64	20	SiL	Nill	27.7	6.9	0.23	21.8
	205-240	7.8	17.4	6	32	62	C	0.43	27.1	8.3	0.46	24.4
	240-270	7.9	18.0	7	51	42	SiC	0.17	24.4	9.3	0.44	14.2
	270-290	Missing										
	290-330	Missing										

	ESP	O.M.	Cations in Saturation Extract					Anions in Saturation Extract				
			Calcium	Magnesium	Sodium	Potassium	Total Cation	Chloride	Sulphate	Bicarbonate	Nitrate	Total Anion
	%	%	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l	meq/l
TP-6	43.2	1.7	108.0	448.0	584.0		1140.0	946.0	80.0	1.4		1027.4
	63.2	0.4	40.0	61.0	118.0		219.0	137.5	88.0	1.0		226.5
	28.1	0.2	40.0	60.0	74.0		174.0	88.0	66.0	1.0		155.0
	34.4	0.2	30.0	46.0	83.5		159.5	99.0	56.0	1.0		156.0
	40.4	0.5	18.0	48.0	90.8		156.8	93.5	62.0	1.2		156.7
	28.6	0.3	28.0	56.0	135.0		219.0	170.5	52.0	0.8		223.3
	28.5	0.3	20.0	52.0	126.5		198.5	126.5	66.0	1.0		193.5
	21.6	0.2	20.0	58.0	131.0		209.0	137.5	62.0	1.0		200.5
	14.5	0.3	18.0	60.0	131.0		209.0	143.0	60.0	1.0		204.0
	73.1	0.6	32.0	84.0	155.0		271.0	165.0	106.0	1.0		272.0
	32.0	0.3	36.0	100.0	172.0		308.0	247.0	64.0	1.0		312.0
	34.1	0.3	44.0	80.0	166.0		290.0	203.5	90.0	1.0		294.5
	65.5	N.S.	32.0	80.0	166.0		278.0	214.0	60.0	1.0		275.0

Test Pit No.	Sampling Depth cm	pH Paste	Sat. Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory	Gypsum %	Lime %	Exchange Na meq/100g	Ext. K meq/100g	CEC meq/100g
TP-7	0-18	7.30	5.92	8	65	27	SiCL SiL	0.15	27.1	2.24	1.01	40.61
	18-36	8.06	1.03	22	61	17	SiL	Nill	28.9	0.64	0.29	28.72
	36-74	7.38	6.67	3	63	34	SiCL	1.86	26.4	3.74	0.30	49.89
	74-102	7.41	9.88	3	58	39	SiCL	0.79	26.4	8.99	0.55	53.25
	102-111	7.23	8.92	8	75	17	SiL	0.02	27.8	6.67	0.22	30.91
	111-132	7.42	14.69	4	54	42	SiC	0.53	23.6	7.50	0.50	49.59
	132-144	7.49	14.70	6	52	42	SiC	1.50	27.9	7.59	0.59	43.90
	144-150	7.52	15.46	5	50	45	SiC	0.68	24.6	11.89	0.61	44.06
	150-175	7.67	14.14	5	52	43	SiC	0.92	23.9	10.90	0.50	41.75
	175-215	6.88	15.40	2	56	42	SiC	0.07	26.0	10.40	0.65	55.45
	215-240	7.83	13.23	9	64	27	SiCL SiL	0.18	29.4	6.34	0.48	32.01
	240-270	7.56	10.96	10	56	34	SiCL	Nill	29.6	4.43	0.88	37.96
	270-310	missing										
	310-330	7.62	16.58	16	57	37	SiCL SiL	2.26	27.7	7.30	-	30.17
TP-8	0-22	missing										
	22-40	8.01	1.94	6	62	32	SiCL	0.17	26.0	3.35	0.32	35.34
	40-64	8.11	2.58	3	63	34	SiCL	0.10	26.7	4.00	0.31	44.44
	64-90	7.96	6.39	8	60	32	SiCL	1.60	25.0	3.92	0.32	42.14
	90-96	7.87	7.46	11	74	15	SiL	0.04	26.9	2.95	0.20	26.73
	96-112	7.83	8.65	17	60	23	SiL	0.90	26.9	5.24	0.29	34.60
	112-144	7.73	10.19	10	59	31	SiCL	0.30	26.9	12.30	0.46	47.54
	144-185	7.89	11.90	2	68	30	SiCL	Nill	27.9	9.00	0.36	44.06
	185-220	7.76	14.15	5	56	39	SiCL	0.19	26.3	8.79	0.50	42.14
	220-245	7.60	18.34	No Sample								
	245-275	7.67	19.63	4	55	41	SiC	0.14	25.8	13.95	0.88	51.47
	275-300	7.59	21.58	4	53	43	SiC	0.35	23.8	10.60	0.87	47.54
TP-9	0-17	7.64	10.30	6	65	29	SiCL	0.07	26.7	2.59	0.73	35.71
	17-30	8.11	4.61	26	55	19	SiL	Nill	27.1	1.96	0.26	26.55
	30-63	7.98	8.43	6	62	32	SiCL	-	27.3	3.74	0.29	42.52
	63-75	7.79	8.63	9	68	23	SiL	-	27.8	3.82	0.18	40.61

	ESP	O.M.	Cations in Saturation Extract					Anions in Saturation Extract				
	Na		Calcium	Magnesium	Sodium	Potassium	Total Cation	Chloride	Sulphate	Bicarbonate	Nitrate	Total Anion
	%	%	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1
TP-7	5.52	1.8	33.99	15.38	21.10	0.79	71.26	29.11	34.29	3.57	12.60	79.57
	2.23	0.4	2.40	1.35	5.50	0.095	9.345	3.32	4.74	1.45	3.80	13.31
	7.50	0.4	25.70	13.91	42.50	0.15	82.26	20.64	62.70	1.00	1.97	86.31
	15.00	0.5	24.39	16.34	48.97	0.39	90.09	20.07	76.20	1.40	1.77	99.44
	21.58	0.3	11.76	9.92	76.23	0.002	97.912	46.50	51.33	1.08	2.35	101.26
	14.95	0.5	25.79	30.67	113.57	0.96	170.99	73.11	94.81	2.03	0.80	170.75
	17.61	0.7	28.06	22.88	117.12	0.50	168.56	69.34	91.15	1.12	1.75	163.36
	26.90	0.4	31.55	24.60	125.70	0.34	182.19	78.45	91.83	1.14	1.80	173.22
	26.13	0.3	28.16	22.55	111.36	0.31	162.38	69.12	99.95	0.87	2.89	172.83
	18.74	0.3	31.37	24.97	124.00	N.S.	180.34	84.39	87.30	1.32	3.40	176.41
	19.81	0.3	28.80	21.30	101.15	0.45	151.70	66.35	76.68	0.80	2.80	146.63
	11.67	0.2	20.33	16.60	82.91	N.S.	119.84	60.63	49.93	0.97	2.20	113.73
	24.20	0.3	42.30	32.77	119.80	0.80	195.67	121.29	67.36	1.02	3.80	193.47
TP-8	9.34	0.5	2.05	1.28	13.99	N.S.	17.32	9.06	7.42	1.58	4.98	23.04
	9.00	0.4	3.60	1.70	19.10	0.07	24.47	19.04	10.56	1.71	2.50	33.81
	9.30	0.4	25.06	9.88	41.80	0.13	76.87	15.46	55.46	0.96	2.20	74.08
	11.04	0.3	21.50	10.32	53.90	0.15	85.87	19.89	59.63	1.19	1.75	82.46
	15.14	0.4	23.60	14.17	65.96	0.17	103.90	23.30	87.54	1.07	2.60	114.51
	25.96	0.4	22.55	14.51	85.14	0.18	122.38	20.56	111.23	1.19	1.90	134.88
	20.45	0.4	17.66	18.80	99.82	0.23	136.51	48.22	100.08	1.15	4.60	154.05
	20.86	0.4	21.95	25.40	119.78	0.33	167.46	65.94	110.86	1.07	5.50	183.37
			31.55	25.40	162.90	0.44	220.29	114.56	104.39	1.00	4.60	224.55
	25.16	0.5	32.66	25.90	174.80	0.64	234.00	123.35	99.69	1.10	2.78	226.92
	22.30	0.5	34.01	29.30	193.50	0.58	257.39	150.17	107.83	0.88	2.90	261.78
TP-9	7.25	1.7	52.15	31.16	40.80	0.66	124.77	66.58	51.57	1.78	1.40	121.33
	7.38	0.4	19.90	15.83	19.60	0.17	55.50	28.33	19.67	0.99	2.04	51.03
	8.80	0.7	27.44	17.73	42.25	0.10	87.52	49.32	31.93	0.84	2.16	84.25
	9.41	0.4	17.57	13.21	46.73	0.11	77.62	45.06	26.80	1.11	2.70	75.67

Test Pit No.	Sampling Depth cm	pH Paste	Sat. Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory	Gypsum %	Lime %	Exchange Na meq/100g	Ext. K meq/100g	CEC meq/100g
TP-9	75-101	7.62	11.44	3	57	40	SiCL SiC	0.09	25.0	4.52	0.32	51.07
	101-140	7.75	10.91	4	56	40	SiCL SiC	0.01	25.0	5.03	0.54	51.05
	140-175	7.71	12.74	9	42	49	SiC	0.47	23.3	5.52	0.46	52.45
	175-200	7.69	13.05	5	46	49	SiC	0.42	24.9	4.86	0.66	54.85
	200-230	7.62	11.96	6	49	45	SiC	0.21	24.8	5.80	0.66	54.29
	230-265	7.58	14.56	5	49	46	SiC	Nill	24.0	4.28	0.80	55.27
	265-285	7.69	16.00	5	49	46	SiC	0.29	45.5	6.02	0.77	53.05
	285-300	7.61	20.00	19	44	37	SiCL	0.12	24.9	2.11	1.19	37.21
TP-10	0-12	7.74	1.98	7	60	33	SiCL	0.19	28.2	7.91	0.55	50.29
	12-44	8.27	1.00	7	58	35	SiCL	0.07	28.8	0.67	0.38	48.30
	44-80	8.02	1.27	5	53	42	SiC	0.04	26.0	1.71	0.48	49.49
	80-109	8.14	2.84	6	52	42	SiC	Nill	27.0	1.84	0.47	51.27
	109-117	7.99	4.69	9	73	18	SiL	0.12	27.9	1.47	0.29	36.09
	117-134	7.85	3.16	21	64	15	SiL	0.11	28.4	1.88	0.23	26.55
	134-150	7.77	4.05	10	63	27	SiCL SiL	Nill	26.9	1.79	0.37	37.77
	150-185	7.99	4.11	13	65	22	SiL	0.01	28.3	1.50	0.35	39.28
	185-220	7.87	8.83	17	57	26	SiL	0.03	27.5	2.00	0.38	36.84
	220-250	7.70	6.98	4	53	43	SiL	Nill	26.4	1.94	0.84	50.29
	250-275	7.78	8.04	9	54	37	SiCL	10.00	27.2	1.81	0.71	37.77
	275-315	7.69	10.34	12	61	27	SiCL SiL	5.76	24.4	2.35	0.47	30.92
TP-11	0-17	7.45	16.31	7	49	44	SiC	1.64	25.3	7.63	1.03	53.05
	17-53	7.45	11.23	6	51	43	SiC	2.20	25.4	4.24	0.76	41.56
	53-70	7.56	8.40	3	62	35	SiCL	0.99	27.0	3.28	0.60	42.14
	70-76	7.93	7.16	6	63	31	SiCL	0.89	26.9	3.26	0.69	48.32
	76-100	7.83	6.75	4	58	38	SiCL	0.32	27.2	1.67	0.84	41.75
	100-121	7.85	6.10	17	64	19	SiL	0.32	28.7	1.93	0.27	27.63
	121-142	7.83	5.67	11	69	20	SiL	0.36	27.7	1.30	0.27	36.09
	142-180	8.01	4.69	9	57	34	SiCL	0.12	27.4	1.20	0.68	45.99
	180-215	7.50	4.52	5	66	29	SiCL	Nill	27.1	0.96	0.47	36.84
	215-245	7.78	5.22	6	61	33	SiCL	0.12	27.6	1.04	0.52	30.91
	245-270	7.83	5.02	4	52	44	SiC	0.26	24.5	1.34	0.87	51.25
	270-300	7.26	5.50	2	55	43	SiC	0.22	30.1	1.30	0.66	39.47

	ESP Na %	O.M. %	Cations in Saturation Extract: Calcium meq/l	Magnesium meq/l	Sodium meq/l	Potassium meq/l	Total Cation meq/l	Anions in Saturation Extract: Chloride meq/l	Sulphate meq/l	Bicarbonate meq/l	Nitrate meq/l	Total Anion meq/l
TP-9	8.85	0.6	35.48	24.67	64.60	0.14	124.89	68.93	52.82	0.88	1.30	123.93
	9.14	0.2	34.60	24.04	58.37	0.27	117.28	69.01	52.30	0.89	0.50	122.70
	9.78	0.7	38.02	29.05	70.87	0.18	138.12	76.67	62.06	0.80	2.70	142.23
	8.86	0.7	37.99	29.13	75.78	0.33	143.23	78.93	59.27	0.86	1.50	140.56
	8.93	0.5	36.38	26.75	69.50	0.32	132.95	70.55	56.29	0.92	1.30	129.06
	7.74	0.4	42.68	36.09	83.36	N.S	162.13	95.96	54.03	0.84	1.30	152.13
	11.35	0.5	48.81	39.70	96.80	0.44	185.75	123.35	47.39	0.69	4.20	175.63
	5.50	0.5	54.65	51.21	126.50	0.60	232.96	171.83	54.23	N.S	5.10	231.16
TP-10	15.73	2.1	9.15	4.13	6.40	0.47	20.15	9.15	6.52	3.95	0.18	19.80
	1.39	0.9	3.27	1.74	7.50	N.S	12.51	2.98	4.26	1.88	3.90	13.02
	24.00	0.5	3.27	2.43	9.26	0.09	15.05	5.32	6.50	1.50	3.60	16.92
	3.30	0.7	9.96	5.14	15.30	0.12	30.52	18.13	11.79	1.58	3.30	34.80
	4.07	0.4	24.58	11.86	21.30	0.32	58.06	16.19	40.26	1.00	2.50	59.95
	7.08	0.3	10.58	5.50	16.90	0.17	33.15	19.47	11.43	1.08	1.60	33.58
	4.74	0.3	14.92	7.24	20.90	0.15	43.21	28.77	17.37	1.16	2.50	49.80
	3.82	0.4	14.47	7.17	29.95	0.24	51.83	29.77	18.94	1.06	4.00	53.77
	5.29	0.4	23.72	11.50	29.30	0.25	64.77	38.73	26.23	0.81	3.80	69.57
	3.86	0.5	30.12	14.17	35.10	0.32	79.71	39.82	32.94	1.02	3.40	77.18
	4.79	0.4	42.51	18.59	35.70	0.02	96.82	44.10	53.71	1.03	2.46	101.30
	7.60	0.2	47.77	22.99	45.84	0.72	117.32	51.52	76.07	0.70	2.48	130.77
TP-11	14.38	2.2	30.61	54.30	128.00	0.84	213.75	88.75	107.29	N.S	2.50	198.54
	10.20	0.9	26.15	36.89	79.79	0.55	143.38	35.93	102.73	1.39	9.60	149.65
	7.78	0.6	25.36	31.12	48.97	0.55	106.00	23.82	88.89	1.37	6.60	120.68
	6.54	0.8	25.03	28.00	40.50	0.33	93.86	19.52	82.55	1.13	5.70	108.90
	4.00	0.6	24.94	26.40	37.20	0.52	89.06	17.18	78.49	1.33	4.60	101.60
	3.37	0.4	25.42	24.04	30.00	0.30	79.76	15.58	68.01	1.17	3.90	88.66
	3.60	0.4	26.53	23.30	23.90	0.29	74.02	15.70	64.58	1.14	1.10	82.52
	2.61	0.4	21.35	16.47	17.70	0.67	56.19	14.47	44.12	1.30	1.20	61.09
	2.61	0.4	21.13	14.90	17.20	0.47	53.70	15.70	35.56	1.32	1.20	53.78
	3.36	0.6	25.06	21.05	19.90	0.40	66.41	16.69	49.53	1.15	2.11	69.48
	2.51	0.6	26.98	19.90	19.40	0.62	66.90	18.78	41.98	1.33	1.10	63.19
	3.34	0.8	27.04	22.97	21.30	0.63	71.94	17.69	61.83	1.29	1.04	81.85

Test Pit No.	Sampling Depth cm	pH Paste	Sat. Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory	Gypsum %	Lime %	Exchange Na meq/100g	Ext. K meq/100g	CEC meq/100g
TP-12	0-18	7.72	13.70	12	52	36	SiCL	2.60	25.3	3.05	1.14	37.96
	18-54	7.88	6.21	7	53	40	SiCL SiC	0.18	27.1	2.30	0.66	38.72
	54-74	7.60	8.50	10	64	26	SiL	1.70	27.7	2.00	0.28	39.47
	74-89	7.53	10.13	6	63	31	SiCL	3.10	28.1	2.38	0.23	35.11
	89-122	7.77	18.18	11	63	26	SiL	2.98	27.1	6.90	0.25	34.22
	122-133	7.78	13.77	67	23	10	SL	0.06	28.0	1.22	0.12	13.01
	133-150	7.61	18.38	30	48	22	SiL L	1.42	27.6	5.64	0.37	21.20
	150-190	7.60	15.83	11	56	33	SiCL	0.55	27.8	6.99	0.49	41.90
	190-230	7.61	14.48	4	56	40	SiCL SiC	0.76	26.3	0.67	0.71	42.00
	230-255	7.81	14.76	3	50	47	SiC	1.29	21.8	1.93	1.03	44.40
	255-300	7.69	16.19	3	55	42	SiC	1.10	26.1	7.23	0.77	42.56

	ESP	O.M.	Cations in Saturation Extract					Anions in Saturation Extract				
	Na		Calcium	Magnesium	Sodium	Potassium	Total Cation	Chloride	Sulphate	Bicarbonate	Nitrate	Total Anion
	%	%	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1	meq/1
TP-12	8.03	2.9	36.74	20.80	43.20	1.07	101.81	45.54	50.84	6.18	0.13	102.69
	5.90	1.3	30.91	22.60	29.60	0.46	83.57	25.17	53.54	1.78	0.12	80.61
	5.09	0.7	34.35	26.97	42.80	0.31	104.43	50.39	51.53	1.40	0.65	103.97
	6.78	0.7	35.09	42.30	41.36	0.22	118.97	57.92	56.77	1.14	0.18	116.01
	20.16	0.6	47.33	81.12	93.80	0.19	222.44	160.69	54.28	1.60	2.90	219.47
	9.38	0.3	39.03	52.44	69.53	0.28	161.28	90.75	58.92	0.91	0.47	151.05
	26.60	0.6	49.23	64.63	103.50	0.46	217.82	160.69	54.07	1.22	0.09	216.07
	17.00	0.5	35.54	50.93	107.20	0.54	194.21	112.72	70.12	1.06	0.15	184.05
	2.60	0.3	32.52	42.57	116.23	0.77	192.09	99.45	81.89	1.18	0.18	182.70
	4.34	0.4	32.86	43.15	98.50	0.86	175.37	93.48	77.16	1.26	0.13	172.03
	16.98	0.5	38.42	44.80	116.10	0.90	200.22	139.65	68.98	1.12	2.88	212.63

Table 3B-19 Physical and Chemical Properties of Soils (1978)

No.	Depth	Mechanical Analysis				PH	ECe x 10^3	TSS	Cations				Anions				NO_3
		Sand	Silt	Clay	Texture	Paste	Sat.Extr.		Ca	Mg	Na	Total	Cl	SO_4	HCO_3	Total	
	cm	%	%	%	Laboratory		m.mhos/cm	ppm	meq/1	meq/1	meq/1	Cation	meq/1	meq/1	meq/1	Anion	ppm
TP1	0-30	5	65	30	SiCL	7.80	2.12	2,860	12.8	12.8	9.7	35.3	4.4	30.4	1.8	36.4	16.0
	30-50	missing															
	50-130	no sample				7.90	4.90	7.170	36.0	44.0	34.4	174.4	7.7	110.0	1.8	119.5	8.0
	130-165	6	54	40	SiCL SiC	7.95	7.29	10,340	42.0	64.0	65.4	171.4	27.5	138.0	1.8	167.0	8.0
TP2	0-20	missing															
	30-80	85	14	1	SL,LS	7.95	17.54	19,920	30.0	64.0	209.0	303.0	209.5	74.0	1.8	285.0	20.0
	120-200	19	44	37	SiCL	7.65	7.71	9,240	52.0	24.0	55.0	131.0	66.0	60.0	1.4	127.4	10.0
	250-270	3	57	40	SiCL SiC	7.95	2.64	2,340	22.0	18.0	11.3	51.3	6.6	46.0	1.6	54.8	8.0
	270-300	3	71	26	SiL	7.90	35.15	35,700	72.0	122.0	336.0	530.0	357.5	146.0	1.4	505.0	70.0
TP3	0-20	4	56	40	SiCL SiC	7.75	5.78	8,130	38.0	24.0	32.0	94.0	46.2	40.0	2.0	98.2	24.0
	30-80	1	46	53	SiC	8.00	1.54	1,230	6.4	6.0	8.3	20.7	7.7	10.4	2.0	20.1	24.0
	80-115	2	41	57	SiC	7.85	1.57	1,420	6.8	6.4	8.3	21.5	8.8	10.4	1.8	21.0	
	115-150	6	36	58	SiC	7.80	2.43	2,490	14.8	5.2	10.2	30.2	12.1	14.0	2.0	28.1	
	150-250	2	46	52	SiC	7.85	1.90	1,890	8.8	9.6	8.8	27.2	12.1	11.6	1.8	25.5	
	250-300	2	44	54	SiC	7.75	2.38	2,640	14.8	12.0	8.8	35.6	11.0	19.2	2.2	32.4	
AG-1	0-15	4	49	47	SiC	7.50	19.80	28,650	100.0	94.0	142.0	336.0	269.5	54.0	1.0	326.5	130.0
	15-40	4	60	36	SiCL	7.65	13.40	16,580	66.0	42.0	107.0	217.0	154.0	54.0	1.6	209.6	60.0
	40-70	7	66	27	SiCL SiL	7.65	11.15	14,300	54.0	22.0	87.0	163.0	121.0	34.0	1.2	156.2	35.0
	70-190	1	44	55	SiC	7.55	13.20	19,430	52.0	74.0	93.5	219.5	154.0	52.0	1.4	207.4	
	190-230	15	40	45	SiC	7.60	16.43	22,950	72.0	74.0	90.0	236.0	192.5	50.0	1.6	244.1	
	230-270	22	54	24	SiL	7.55	28.06	30,470	92.0	88.0	183.0	363.0	291.5	32.0	1.6	365.1	
	270-300	70	14	16	SL	7.55	28.53	30,680	74.0	106.0	195.0	375.0	302.5	60.0	1.8	364.3	
AG-2	0-20	4	61	35	SiCL	7.75	3.34	3,400	26.0	18.0	20.2	64.2	25.3	32.0	2.6	59.9	28.0
	20-50	2	55	43	SiC	7.85	3.34	2,650	28.0	12.0	25.3	65.3	22.0	38.0	1.6	61.6	8.0
	50-90	3	47	50	SiC	7.80	3.70	2,920	26.0	10.0	31.0	67.0	26.4	36.0	1.8	64.2	8.0
	90-190	12	54	34	SiCL	7.80	5.68	5,910	32.0	16.0	44.4	92.4	41.8	44.0	1.6	87.4	
	190-230	23	60	17	SiL	7.60	51.91	53,790	96.0	206.0	444.0	746.0	588.5	104.0	1.2	693.7	
	230-260	55	19	26	SCL	7.75	7.10	7,770	28.0	40.0	51.6	119.6	66.0	48.0	1.6	115.6	

	Depth	Mechanical Analysis				PH	ECe x 10^3	TSS	Cations				Anions				NO_3		
		Sand	Silt	Clay	Texture	Paste	Sat.Extr.		Ca	Mg	Na	Total	Cl	SO_4	HCO_3	Total			
	cm	%	%	%	Laboratory		m.mhos/cm	ppm		meq/1		Cation		meq/1		Anion	ppm		
	260-300	18	42	40	SiCL SiC	7.75	7.30	7,500	32.0	44.0	55.0	131.0	71.5	56.0	1.6	129.1			
AG-3	0-10	18	48	34	SiCL	7.95	67.81	63,870	76.0	136.0	680.0	892.0	748.0	108.0	1.4	875.4	70.0		
	10-50	18	57	25	SiL	7.95	36.47	30,520	68.0	44.0	340.0	452.0	330.0	104.0	1.4	435.4	90.0		
	50-90	34	53	13	SiL	7.85	10.75	10,420	30.0	32.0	109.0	171.0	99.0	60.0	1.8	160.8	20.0		
	90-130	17	59	24	SiL	8.10	15.30	17,030	40.0	44.0	183.0	267.0	126.5	126.0	1.8	254.3			
	130-160	13	65	22	SiL	8.05	16.43	19,050	40.0	68.0	190.0	298.0	137.5	144.0	1.8	283.3			
	160-180	14	50	36	SiCL	7.90	19.06	22,620	32.0	94.0	235.0	361.0	176.0	162.0	2.0	340.0			
	180-270	6	60	34	SiCL	8.05	16.02	17,910	30.0	84.0	195.0	309.0	132.0	156.0	1.8	289.8			
	270-300	47	33	20	L	7.95	17.24	19,230	36.0	76.0	209.0	321.0	148.5	158.0	1.6	308.1			
AG-4	210-240	11	45	44	SiC	7.65	5.64	6,240	24.0	38.0	43.0	105.0	16.5	90.0	1.6	108.1			
	240-260	16	37	47	C	7.75	5.25	6,660	38.0	30.0	40.5	108.5	17.6	98.0	1.8	117.0			
	260-300	16	55	29	SiCL	7.80	5.25	6,320	38.0	18.0	41.8	97.8	17.6	76.0	1.6	95.2			
AG-5	0-20	8	62	30	SiCL	7.65	49.80	54,780	90.0	204.0	430.0	724.0	577.5	106.0	1.8	685.0	20.0		
	20-90	10	55	35	SiCL	7.80	10.70	12,550	36.0	46.0	118.0	200.0	82.5	110.0	1.6	194.0	20.0		
	90-170	6	63	31	SiCL	7.75	6.14	7,210	32.0	36.0	55.0	123.0	22.0	104.0	1.8	127.8			
	170-200	2	56	42	SiC	7.85	4.26	4,290	20.0	14.0	34.4	68.4	22.0	42.0	1.8	65.8			
AG-6	0-20	5	61	34	SiCL	7.25	57.10	74,670	294.0	216.0	310.0	820.0	726.0	44.0	1.6	771.6	170.0		
	20-90	4	60	36	SiCL	7.60	18.30	26,860	90.0	60.0	150.0	300.0	231.0	56.0	1.0	288.0	50.0		
	90-150	31	49	20	L	7.55	15.34	18,020	56.0	70.0	146.0	266.0	165.0	82.0	1.6	248.6			
	150-190	8	56	36	SiCL	7.55	26.00	26,800	56.0	78.0	222.0	356.0	237.5	92.0	1.6	330.0			
	190-220	11	62	27	SiCL SiL	7.55	31.52	31,760	46.0	118.0	292.0	456.0	319.0	108.0	2.0	429.0			
	220-250	6	67	27	SiCL SiL	7.65	29.00	30,400	44.0	112.0	266.0	422.0	286.0	112.0	1.8	399.8			
	250-300	5	57	38	SiCL	7.85	25.35	24,650	38.0	92.0	251.0	381.0	247.5	108.0	1.8	357.0			
AG-7	0-20	5	61	34	SiCL	7.85	3.17	4,230	34.0	34.0	9.7	77.7	7.7	68.0	1.8	77.5	56.0		
	20-40	7	64	29	SiCL	7.85	3.36	4,060	30.0	36.0	17.4	93.4	11.0	74.0	2.2	87.2	16.0		
	40-100	5	64	31	SiCL	7.85	7.03	8,320	32.0	50.0	58.4	140.4	38.5	98.0	1.8	138.3			
	120-170	4	51	45	SiC	7.80	8.71	11,650	40.0	56.0	64.5	160.5	66.0	92.0	2.0	160.0			

	Depth	Mechanical Analysis				PH	ECe x 10^3	TSS	Cations				Anions				NO_3
		Sand	Silt	Clay	Texture	Paste	Sat.Extr.		Ca	Mg	Na	Total	Cl	SO_4	HCO_3	Total	
	cm	%	%	%	Laboratory		m.mhos/cm	ppm		meq/1		Cation		meq/1		Anion	ppm
	170-200	3	37	60	C	7.85	6.24	8,260	44.0	38.0	44.4	126.4	31.9	86.0	2.4	120.3	
	200-270	no sample				7.75	8.71	10,520	42.0	40.0	77.0	159.0	71.5	78.0	1.6	151.0	
	270-300	62	19	19	SL	7.90	8.46	10,200	36.0	58.0	72.0	166.0	60.5	102.0	1.8	164.3	
AG-8	0-20	10	62	28	SiCL	7.90	45.70	49,970	92.0	108.0	470.0	670.0	506.0	110.0	1.6	617.6	455.0
	20-80	8	64	28	SiCL	7.85	25.81	25,940	52.0	72.0	243.0	367.0	253.0	90.0	1.8	345.0	210.0
	80-120	29	53	18	SiL	7.85	10.90	12,140	48.0	32.0	105.0	185.0	88.0	96.0	1.8	185.8	
	120-140	28	52	20	SiL	7.90	32.40	35,250	72.0	88.0	300.0	460.0	341.0	104.0	1.4	446.0	
	140-220	35	53	12	SiL	7.85	10.90	11,180	30.0	44.0	122.0	196.0	93.5	90.0	1.6	185.0	
	220-280	8	48	44	SiC	7.85	13.70	14,550	28.0	56.0	160.0	244.0	132.0	98.0	1.6	231.6	
AG-9	0-40	3	56	41	SiC	7.30	63.50	81,850	114.0	376.0	458.0	948.0	786.5	78.0	1.6	866.0	190.0
	40-60	2	58	40	SiCL SiC	7.60	28.10	30,050	82.0	74.0	243.0	399.0	286.0	88.0	1.2	375.0	100.0
	60-140	2	56	42	SiCL	7.60	19.40	24,080	60.0	70.0	209.0	339.0	231.0	84.0	1.6	316.6	
	140-200	2	53	45	SiC	7.75	18.50	24,230	78.0	46.0	209.0	333.0	220.0	90.0	1.2	311.0	
	200-215	38	41	21	L	7.80	17.35	20,090	48.0	62.0	190.0	300.0	198.0	84.0	1.8	284.0	
	215-300	4	48	48	SiC	no sample											
AG-10	0-20	7	67	26	SiL	7.25	105.40	183,440	246.0	682.0	870.0	1798.0	1600.5	100.0	1.4	1702.0	100.0
	20-70	8	70	22	SiL	7.45	46.40	51,100	108.0	208.0	345.0	661.0	528.0	92.0	1.0	621.0	70.0
	70-125	5	69	26	SiL	7.65	27.70	31,790	84.0	100.0	202.5	386.5	286.0	80.0	1.4	367.0	
	125-140	9	75	16	SiL	7.60	26.80	31,150	90.0	105.0	195.0	391.0	280.5	92.0	1.2	373.7	
	140-170	4	69	27	SiCL SiL	7.60	25.56	30,860	80.0	130.0	195.0	405.0	275.0	106.0	1.2	382.0	
	170-190	17	74	9	SiL	7.55	39.62	45,720	78.0	178.0	318.0	574.0	473.0	56.0	1.4	530.0	
	200-250	21	71	8	SiL	7.45	42.17	49,570	100.0	214.0	320.0	634.0	500.5	98.0	1.2	600.0	
	250-300	9	66	25	SiL	7.65	29.82	34,470	68.0	138.0	229.0	435.0	324.5	84.0	1.4	410.0	

Table 3B-20 pH, ECe and Texture of Soils Samples from Auger Holes

Location	Sampling Depth cm	pH Paste	Sat.Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory
AH-1	0-20	7.45	30.32	4	55	41	SiC
	20-45	7.40	27.59	3	59	38	SiCL
	45-60	7.45	28.14	3	62	35	SiCL
	60-80	7.55	5.82	6	65	29	SiCL
	80-105	7.55	27.42	8	63	29	SiCL
	105-125	7.35	22.75	3	63	34	SiCL
	125-155	7.40	20.81	4	59	37	SiCL
AH-2	0-20	7.65	6.22	5	64	31	SiCL
	20-40	7.65	4.38	3	71	26	SiL
	40-60	8.10	3.29	7	63	30	SiCL
	60-80	7.40	4.46	6	75	19	SiL
	80-100	7.60	5.52	13	70	17	SiL
	100-120	7.55	5.45	3	66	31	SiCL
	120-150	7.80	6.84	4	55	41	SiC
AH-3	0-25	7.75	2.81	3	57	40	(SiC (SiCL
	25-60	7.50	5.65	3	54	43	SiC
	60-95	7.45	8.55	3	54	43	SiC
	95-120	7.55	10.11	2	53	45	SiC
	120-150	7.60	10.88	7	56	37	SiCL
AH-4	0-40	6.70	108.51	13	68	19	SiL
	40-85	7.20	39.77	21	67	12	SiL
	85-125	7.35	35.26	42	52	6	SiL
	125-195	7.55	18.19	64	31	5	SL
AH-5	0-45	8.10	1.05	2	67	31	SiCL
	45-70	7.90	1.58	3	59	38	SiCL
	70-95	7.70	4.67	5	57	38	SiCL
	95-120	7.75	6.68	6	61	33	SiCL
	120-150	7.50	8.41	1	64	35	SiCL

Location	Sampling Depth cm	pH Paste	Sat.Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory
AH-6	0-10	7.80	29.66	4	65	31	SiCL
	10-35	7.20	11.98	3	61	36	SiCL
	35-65	7.50	10.68	3	82	15	SiL
	65-83	7.70	11.52	5	50	45	SiC
	83-100	7.50	16.85	6	58	36	SiCL
	100-150	missing					
AH-7	0-30	7.1	66.5	7	63	30	SiCL
	30-70	7.8	26.9	5	51	44	SiC
	70-95	7.8	33.3	9	66	25	SiL
	95-120	7.9	24.8	45	44	11	L
	120-150	7.8	21.1	68	25	7	SL
AH-8	0-35	7.6	22.9	8	57	35	SiCL
	35-60	7.6	20.5	7	60	33	SiCL
	60-85	7.6	22.5	8	57	35	SiCL
	85-110	7.7	22.8	4	51	45	SiC
	110-120	7.6	23.9	4	49	47	SiC
	120-135	7.6	26.9	5	18	77	C
	135-150	7.7	22.2	15	54	31	SiCL
AH-9	0-35	7.9	2.03	6	65	29	SiCL
	35-60	7.9	2.9	8	59	33	SiCL
	60-90	7.9	3.5	3	57	40	SiC SiCL
	90-105	7.8	4.2	6	56	38	SiCL
	105-125	7.9	5.6	10	62	28	SiCL
	125-155	7.9	6.9	11	65	24	SiL
AH-10	0-30	7.1	97.6	6	59	35	SiCL
	30-60	7.6	38.8	8	57	35	SiCL
	60-90	7.6	34	7	61	32	SiCL
	90-110	7.7	28.9	29	49	22	SiL

Location	Sampling Depth cm	pH Paste	Sat.Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory
AH-10	110-120	7.8	32.6	13	68	19	SiL
	120-150	8.0	26.9	19	61	20	SiL
AH-11	0-40	7.5	38.2	11	63	26	SiL
	40-70	7.7	24.8	5	63	32	SiCL
	70-125	7.8	22.6	6	65	29	SiCL
	125-160	7.8	25.3	5	63	32	SiCL
AH-12	0-15	7.1	18.2	-	-	-	-
	15-55	7.6	24.8	14	62	24	SiL
	55-80	7.8	127.3	25	55	20	SiL
	80-110	7.7	12.3	30	51	19	SiL
	110-135	7.7	13	48	40	12	L
	135-160	7.5	16.4	50	41	9	L
AH-13	0-15	7.7	6.5	3	54	43	SiC
	15-40	7.9	3.1	6	51	43	SiC
	40-75	8.0	2.5	53	38	9	SL
	75-110	7.9	7.05	7	48	45	SiC
	110-140	8.0	1.8	4	50	46	SiC
	140-160	7.8	2.8	5	37	58	C
AH-14	0-20	7.7	2.5	5	52	43	SiC
	20-45	7.9	2.7	-	-	-	-
	45-90	7.7	4.2	6	56	38	SiCL
	90-125	7.9	4.6	6	22	72	C
	125-140	7.8	5.6	6	22	72	C
	140-160	7.9	6.5	10	36	54	C

Location	Sampling Depth cm	pH Paste	Sat.Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory
AH-15	0-40	8.31	1.51	3	59	38	SiCL
	40-75	7.78	5.81	3	60	37	SiCL
	75-100	7.72	10.25	3	53	44	SiC
	100-120	7.84	13.06	4	50	46	SiC
	120-140	7.76	16.66	3	57	40	(SiCL SiC
	140-155	7.54	19.37	1	62	38	SiCL
	155-165	7.48	25.60	no sample			
AH-16	0-30	7.98	4.35	7	63	30	SiCL
	30-60	7.90	4.26	7	63	30	SiCL
	60-105	8.17	2.60	10	66	24	SiL
	105-125	7.71	5.44	2	55	43	SiC
	125-150	7.64	7.38	3	59	38	SiCL
AH-17	0-20	6.95	121.80	8	65	27	(SiCL SiL
	20-70	7.56	28.88	18	56	25	SiL
	70-95	7.40	27.54	4	58	38	SiCL
	95-120	7.39	27.72	4	56	40	(SiCL SiC
	120-155	7.50	30.35	10	61	29	SiCL
AH-18	0-25	8.07	2.71	8	52	40	(SiCL SiC
	25-50	8.18	1.05	9	56	35	SiCL
	50-85	8.30	1.21	3	61	36	SiCL
	85-100	8.27	2.32	8	68	24	SiL
	100-110	8.04	1.67	38	48	14	L
	110-130	8.14	1.69	21	59	20	SiL
	130-150	8.08	1.75	4	55	41	SiC

Location	Sampling Depth cm	pH Paste	Sat.Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory
AH-19	0-25	7.64	12.97	6	67	27	(SiCL (SiL
	25-60	8.39	1.14	4	60	36	SiCL
	60-95	8.06	2.18	4	56	40	(SiCL (SiC
	95-120	7.83	5.22	14	69	17	SiL
	120-150	7.96	8.72	no sample			
AH-20	0-25	7.94	5.37	2	57	41	SiC
	25-45	7.92	5.42	3	56	41	SiC
	45-70	7.88	5.88	2	56	42	SiC
	70-95	7.85	8.17	6	63	31	SiCL
	95-115	7.85	9.28	4	57	39	SiCL
	115-140	7.97	9.88	4	49	47	SiC
	140-155	7.88	11.04	9	67	24	SiL
AH-21	0-35	8.05	2.95	7	63	30	SiCL
	35-60	7.85	7.35	7	53	40	(SiCL (SiC
	60-85	8.08	5.00	2	52	46	SiC
	85-115	7.83	10.26	6	50	44	SiC
	115-135	7.32	1.41	24	56	20	SiL
	135-155	7.62	17.27	28	53	19	SiL
AH-22	0-25	7.89	5.14	5	49	46	SiC
	25-55	8.04	2.11	6	45	49	SiC
	55-80	8.10	2.73	3	49	48	SiC
	80-110	8.08	3.45	4	57	39	SiCL
	110-135	7.84	4.08	2	63	35	SiCL
	135-160	7.74	7.46	3	69	28	SiCL

Location	Sampling Depth cm	pH Paste	Sat.Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory
AH-23	0-5	6.59	206.10	8	60	32	SiCL
	5-20	6.94	93.00	7	63	30	SiCL
	20-50	7.21	53.44	no sample			
	50-90	7.52	30.29	3	60	37	SiCL
	90-130	7.47	24.83	7	56	37	SiCL
	130-160	7.93	23.92	9	55	36	SiCL
AH-24	0-15	7.82	4.88	12	59	29	SiCL
	15-45	7.40	23.34	4	46	30	SiCL
	45-70	7.57	23.00	no sample			
	70-105	7.44	23.74	4	56	40	SiCL SiC
	105-130	7.56	25.52	10	55	35	SiL
	130-155	7.47	23.83	4	58	38	SiCL
AH-25	0-10	6.39	161.30	10	72	18	SiL
	10-20	6.73	109.00	13	64	23	SiL
	20-50	7.06	23.20	7	67	26	SiL
	50-80	7.57	22.86	6	68	26	SiL
	80-100	7.60	20.35	2	60	38	SiCL
AH-26	0-35	8.09	3.21	7	56	37	SiCL
	35-65	missing					
	65-100	7.55	5.07	17	58	25	SiL
	100-130	7.59	5.93	13	72	15	SiL
	130-155	7.62	3.49	41	48	11	L
AH-27	0-25	7.85	10.62	8	57	35	SiCL
	25-65	7.73	8.38	3	60	37	SiCL
	65-95	7.47	10.14	6	54	40	SiCL SiL

Location	Sampling Depth cm	pH Paste	Sat.Ext. ECe m.mhos/cm	Mechanical Analysis Sand %	Silt %	Clay %	Texture Laboratory
	95-130	7.58	10.47	16	53	31	SiCL
	130-150	7.53	8.07	42	42	17	L
AH-28	0-20	7.42	26.91	8	55	37	SiCL
	20-60	7.42	25.82	9	57	34	SiCL
	60-80	7.45	26.60	15	50	35	SiCL
	80-100	7.28	35.12	11	59	30	SiCL
	100-150	missing					
AH-29	0-20	7.60	10.56	9	56	35	SiCL
	20-50	7.88	7.84	6	60	34	SiCL
	50-85	7.78	8.48	6	55	39	SiCL
	85-120	7.60	9.06	5	59	36	SiCL
	120-150	7.55	10.87	6	69	25	SiL
AH-30	0-35	7.30	21.96	5	62	33	SiCL
	35-80	7.52	19.90	7	56	37	SiCL
	80-120	7.55	22.30	6	58	36	SiCL
	120-150	7.55	21.76	2	42	46	SiC
AH-31	0-20	6.74	134.00	17	60	23	SiL
	20-60	7.28	51.20	18	62	20	SiL
	60-110	7.43	47.19	5	61	34	SiCL
	110-130	7.23	57.59	9	67	24	SiL
	130-150	7.34	47.91	6	53	41	SiC
AH-32	0-30	7.27	46.17	5	62	33	SiCL
	30-75	7.49	37.48	3	66	31	SiCL
	75-95	7.36	36.67	no sample			
	95-105	7.35	53.50	18	62	29	SiL
	105-135	7.41	49.63	5	65	30	SiCL
	135-145	7.22	58.04	no sample			
	145-155	7.34	59.14	57	33	10	SL

Table 3B-21 Profile Description of Auger Holes (1)

No.	Location Soil Series Salinity Type	Land Use Vegetation	Depth cm	Colour	Texture	Structure	ECe m.mhos/cm	pH	Mottling	Concretions	Remarks
AH-1	near the head of Jahannam canal	waste land no vegetation	0-20	yellowish brown 10YR5/4 (very)	SiCL	moderate fine granular	30.32	7.45		few salt and gypsum	crust formation (5mm thick)
			20-60	brown 7.5YR5/4 (dry)	SiC	weak medium sub-angular blocky	27.87	7.45		few salt and gypsum	
	Adla series, L11		60-80	dark brown 7.5YR4/3 (moist)	SiCL	weak medium angular blocky	5.82	7.55		common gypsum	
	External Solonchak		80-105	reddish brown 5YR4/4 (moist)	SCL	weak medium angular blocky	27.42	7.55	common yellowish brown cloudy	many gypsum few salt	
			105-155	dark yellowish brown 10YR4/4 (wet)	SCL	weak medium angular blocky	21.78	7.40	common reddish brown cloudy	common gypsum many salt	GWT 150cm
AH-2	near the school; near the Kahlaa river	test field Shok	0-20	brown 7.5YR5/4 (dry)	SiCL	weak fine granular	6.22	7.65			cracks up to 60 cm. deep
			20-40	yellowish brown 10YR5/4 (dry)	SiCL	weak fine granular	4.38	7.65			
	Adla series, L11		40-60	reddish brown 5YR4/4 (dry)	SiC	weak medium sub-angular blocky	3.29	8.10			
	Internal Solonchak		60-80	dark brown 7.5YR4/4 (dry)	SCL	weak medium sub-angular blocky	4.46	7.40	few faint reddish brown cloudy	very few salt	
			80-100	yellowish brown 10YR5/4 (moist)	SL	weak coarse sub-angular blocky	5.52	7.60	few faint reddish brown cloudy		
			100-120	brown 7.5YR5/4 (moist)	SiCL	weak coarse sub-angular blocky	5.45	7.55		very few salt	
			120-150	dark brown 7.5YR4/4 (moist)	SiCL	moderate coarse subangular blocky	6.84	7.80			
AH-3	BM3512/712, EL.6.58m, near Tel-Al-Ahaimar	barley broad beans field, Shok (predom.) Aqul	0-25	brown 10YR5/3 (very dry)	SiCL	weak fine granular	2.81	7.75			cracks up to 50 cm. deep
	Adla series, L11		25-60	yellowish brown 10YR5/4 (dry)	SiC	strong medium granular	5.65	7.50			
				Munsell's soil color names	Field texture						

Table 3B-21 Profile Description of Auger Holes (2)

No.	Location Soil Series Salinity Type	Land Use Vegetation	Depth cm	Colour	Texture	Structure	ECe m.mhos/cm	pH	Mottling	Concretions	Remarks
AH-3	Internal Solonchak		60-95	brown 10YR4/3 (dry)	SiCL	moderate medium granular	8.55	7.45	few faint reddish brown cloudy	few salt few black	-
			95-150	brown 10YR4/3 (moist)	SiC	moderate medium angular blocky	10.50	7.60	common faint reddish brown cloudy	many gypsum and salt	
AH-4	BM3512/716, EL.6.39m, near Bahasa canal	waste land Tahamah, Tartia, Zour	0-40	dark yellowish brown 10YR3/4 (moist)	SiCL	weak fine granular	108.51	6.70		common gypsum and salt	Sabakh soil characterized by
			40-85	olive 5Y5/3 (moist)	SL	massive	39.77	7.20		few salt	the dark colour of the surface
	Al-Gheriba series, B2(2) Sabakh soils		85-195	olive brown 2.5Y4/4 (moist)	SL	massive	26.73	7.45			
AH-5	about 700m south of Abed-Asui settlement	barley field under fallow, Shok	0-45	light yellowish brown 10YR6/4 (dry)	SiCL	moderate fine granular	1.05	8.10	few faint reddish brown cloudy	few gypsum	cracking up to 30cm deep
			45-70	brown 10YR5/3 (dry)	SiCL	moderate fine sub angular blocky	1.58	7.90			
	Amarah series, B3(1)		70-120	brown 10YR5/3 (dry)	SiC	moderate fine angular blocky	5.68	7.75	few distinct reddish brown cloudy	few gypsum and salt	
	Internal Solonchak		120-150	brown 10YR4/3 (moist)	SiC	strong medium angular blocky	8.41	7.50	common distinct reddish brown cloudy	common salt	bivalve shells
AH-6	near the marsh, near the Gasma river,	paddy field, Shorek, Seed	0-10	light gray 2.5Y 7/2 (dry)	SiC	moderate fine granular	29.66	7.80	common yellowish brown cloudy		many salt crust
			10-65	dark yellowish brown 10YR4/4 (moist)	SiC	weak medium sub-angular blocky	11.33	7.35	common reddish brown cloudy	common gypsum and salt	
	Muminah series H83		65-100	dark grayish brown 10YR4/2 (moist)	SiCL	weak medium sub-angular blocky	14.19	7.60		common salt	spiral shells GWT 95cm
	External Solonchak		100-150	dark brown 7.5YR4/4 (wet)	SiC	massive	-	-	common faint brown cloudy		17.2 m.mhos/cm at 27°C
AH-7	BM3514/718, EL.5.09m, near Malayieh village	waste land no vegetation	0-30	dark yellowish brown 10YR4/4 (moist)	SiCL	weak fine granular	66.5	7.1	few reddish brown tubular	few salt	salt crust no crack
			30-70	dark brown 7.5YR4/3 (moist)	SiC	weak medium sub-angular blocky	26.9	7.8	many reddish brown tubular	few black few salt	many spiral and few bivalve shells
	Amarah series, B33		70-95	dark yellowish brown 10YR4/4 (moist)	SCL	weak medium sub-angular blocky	33.3	7.8	many reddish brown cloudy/tubular		

Table 3B-21 Profile Description of Auger Holes (3)

No.	Location Soil Series Salinity Type	Land Use Vegetation	Depth cm	Colour	Texture	Structure	ECe m.mhos/cm	pH	Mottling	Concretions	Remarks
AH-7	External Solonchak		95-120	yellowish brown 10YR5/4 (moist)	SL	massive	24.8	7.9			
			120-150	yellowish brown 10YR5/4 (moist)	SL	massive	21.1	7.8			
AH-8	about 1.5km south east of Malayieh village Amarah series B3(1) External Solonchak	waste land Tahamah	0-35	light yellowish brown 10YR6/4 (dry)	SiCL	moderate fine granular	22.9	7.6			hard crust
			35-85	yellowish brown 10YR5/4 (dry)	SiCL	weak fine granular	21.5	7.6			
			85-120	dark brown 7.5YR4/4 (moist)	SiC	moderate medium angular blocky	23.4	7.7		common gypsum and salt	
			120-135	dark brown 7.5YR4/4 (moist)	SiC	strong medium angular blocky	26.9	7.6		many salt	
			135-150	dark yellowish brown 10YR4/4 (moist)	SCL	weak medium sub- angular blocky	22.2	7.7		few salt	
AH-9	BM3512/720 EL.5.52m, near the oil pipe-line Al-Gheriba series B2(2) Internal Solonchak	upland field Tahamah	0-35	very pale brown 10YR7/3 (dry)	SiCL	moderate fine granular	2.0	7.9			
			35-60	brown 7.5YR5/4 (dry)	SiCL	weak fine granular	2.9	7.9			
			60-105	yellowish brown 10YR5/4 (dry)	SiCL	moderate fine granular	3.9	7.9		few salt	
			105-125	grayish brown 10YR5/2 (moist)	SiCL	moderate fine granular	5.6	7.9		many gypsum and salt	
			125-155	dark yellowish brown 10YR4/4 (moist)	SiCL	weak medium sub- angular blocky	6.9	7.9		few gypsum and salt	
AH-10	about 1.8km south east of Hammed Jabar village Al-Khasit series B4(4) External Solonchak	waste land Tahamah (scarce)	0-30	dark yellowish brown 10YR4/4 (dry)	SiCL	moderate fine granular	97.6	7.1			crust
			30-90	dark yellowish brown 10YR4/4 (dry)	SiCL	moderate fine granular	36.4	7.6		few gypsum and salt	
			90-110	yellowish brown 10YR5/4 (moist)	SL (SiC)	massive	28.9	7.7	common faint yellowish brown tubular	few salt	
			110-150	yellowish brown 10YR5/4 (moist)	SCL	weak medium angular blocky	29.8	7.9	few faint yellow- ish brown tubular	common gypsum and salt	

Table 3B-21 Profile Description of Auger Holes (4)

No.	Location Soil Series Salinity Type	Land Use Vegetation	Depth cm	Colour	Texture	Structure	ECe m.mhos/cm	pH	Mottling	Concretions	Remarks
AH-11	near the oil pipe-line; between 2 disused cannals	waste land Tahamah, Shok	0-40	light yellowish brown 10YR6/4 (dry)	SiCL	single grain puffed	38.2	7.5	few yellowish brown spotty	few salt	crust
			40-70	yellowish brown 10YR5/4 (dry)	SiCL	moderate fine granular	24.8	7.7		few salt	
	Al-Gheriba series B2(2)		70-125	yellowish brown 10YR5/4 (dry)	SiCL	moderate fine granular	22.6	7.8		common salt	
	External Solonchak		125-160	yellowish brown 10YR5/4 (dry)	SiC	moderate medium angular blocky	25.3	7.8	common reddish brown cloudy tubular	many salt	
AH-12	about 1.5km north of Al-Bahasa	waste land Shok (scarce)	0-15	brown 10YR5/3 (dry)	SiCL	weak fine granular	18.2	7.1		very many gypsum and salt	
	village; near the Malayieh canal		15-55	dark yellowish brown 10YR4/4 (moist)	SiCL	weak fine granular	24.8	7.6			
	Al-Gheriba series B2(2)		55-80	dark yellowish brown 10YR4/4 (moist)	SCL	very weak medium subangular blocky	127.3	7.8	common faint reddish brown tubular		
	External Solonchak		80-110	dark yellowish brown 10YR4/4 (moist)	SCL	weak medium subangular blocky	12.3	7.7	common reddish brown tubular		
			110-160	brown 10YR4/3 (wet)	SL	massive	14.7	7.6	common yellowish brown spotty		
AH-13	near Kamiluodeh village,	barley field Shurraib	0-15	pale brown 10YR6/3 (dry)	SiCL	strong coarse prismatic	6.5	7.7		many salt on the surface	cracks up to 15 cm
	Al-Khasif series		15-40	dark yellowish brown 10YR3/4 (moist)	SiCL	moderate fine granular	3.1	7.9	common yellowish brown cloudy		
	B4(4)		40-75	dark yellowish brown 10YR4/4 (moist)	SiCL	weak medium granular	2.5	8.0	few faint yellowish brown cloudy		
	Internal Solonchak		75-110	dark brown 7.5YR4/4 (moist)	SiC	weak coarse angular blocky	7.1	7.9	common reddish brown cloudy		
			110-140	dark yellowish brown 10YR4/4 (moist)	SiCL	weak medium sub-angular blocky	1.8	8.0	many yellowish brown cloudy		
			140-160	light olive brown 2.5Y5/3 (moist)	SiC	massive	2.8	7.8	many bright brown cloudy		many spiral she-lls

Table 3B-21 Profile Description of Auger Holes (5)

No.	Location Soil Series Salinity Type	Land Use Vegetation	Depth cm	Colour	Texture	Structure	ECe m.mhos/cm	pH	mottling	Concretions	Remarks
AH-14	about 400m south of the Gasma river;	wheat field Aqul, Choran	0-20	light gray 10YR7/2 (dry)	SiCL	strong medium prismatic	2.5	7.7	few faint reddish brown cloudy		fine cracks up to 20cm deep
	east of small depression		20-45	yellowish brown 10YR5/4 (dry)	SiCL	moderate medium granular	2.7	7.9		few gypsum	
	Al-Gheriba series		45-90	dark brown 7.5YR4/4 (dry)	SiCL	moderate fine granular	4.2	7.7	common reddish brown cloudy	few salt	
	B2(2)		90-140	dark brown 7.5YR4/4 (moist)	SiC	weak medium granular	5.1	7.9	common reddish brown cloudy		
	Internal Solonchak		140-160	yellowish brown 10YR5/4 (moist)	SCL	massive	6.5	7.9		few salt	

Table3B-22 Water Quality

		Kahlaa River	Al-Chikke Marsh
pH		8.66	8.50
$ECx10^6$ (μ mhos/cm)		846	1,041
TSS (ppm)		524	622
Chemical Composition (meq/ℓ)	Ca^{++}	3.44	3.21
	Mg^{++}	1.81	2.74
	Na^{+}	3.13	4.30
	$Cℓ^{-}$	2.90	4.02
	$SO4^{--}$	2.81	3.53
	$HCO3^{-}$	2.02	1.85
	$NO3^{-}$	0.01	0.01
SAR		1.93	2.49
Classification		C3-S1	C3-S1

Table 3B-23 Groundwater Quality

Test Pit No.	G.W. Table cm	pH	$EC \times 10^6$ micro.mhos/cm at 25°C	Cation					Anion					SAR	Class
				Ca meq/l	Mg meq/l	Na meq/l	K meq/l	Total meq/l	Cl meq/l	SO_4 meq/l	HCO_3 meq/l	CO_3 meq/l	Total meq/l		
TP-4	165	8.3	11,175	16	34	88	0.7	138.7	38	90	4.4	0	132.4	17.6	C4-S4
TP-9	230	7.9	24,585	66	86	180	0.4	332.4	275	42	4.0	0	321.0	20.6	C4-S4
TP-10	275	8.0	11,547	52	30	64	0.8	146.8	90	52	2.6	0	144.6	10.0	C4-S3
TP-11	130	8.0	6,109	26	27	32	0.3	85.3	25	51	7.0	0	83.0	6.2	C4-S2
TP-12	275	8.0	20,115	44	58	160	0.9	262.9	190	70	5.6	0	265.6	22.4	C4-S4

$$SAR = \frac{Na^+}{\sqrt{(Ca+Mg)/2}}$$

Table 3C-1 Present Land Use (1977/78)

(Unit: ha)

Item	Area
1. Cultivated Area	
a. Summer crops	
Paddy	38
Sorghum	225
Vegetables	21
Sub-total (1)	284
b. Winter crops	
Wheat	750
Barley	1,000
Broad beans	125
Vegetables	3
Sub-total (2)	1,878
c. Arable land (fallow land) 1/ (3)	1,298
Total (1) + (2) + (3)	3,460
2. Non Cultivated Area	
High salinity area 2/	4,040
Marsh	500
Roads and canals	122
Villages and others 3/	38
Total	4,700
Grand Total	8,160

Source: Data of the Department of Land Survey, Missan Agriculture Office

Note:

1/: The land was practically cultivated with no crops in 1977, however, its soil and water utilization conditions are deemed suitable to crop cultivation with an EC value of less than 25 mmho/cm.

2/: The EC value of soils is more than 25 mmho/cm at 25°C. Mostly located on the eastern part of the Project Area.

3/: Villages and oil pipeline sites.

Table 3C-2 Extension Centers and Extension Workers in Missan

(Unit: person)

Place	Extension Centers	Female Ext. Workers	Ext. Workers for Youth	Total Workers
Ali-Al-Graby	1	1	1	2
Ali-Al-Sharky	1	1	1	2
Quamit	1	2	2	4
Al-Amara	1	5	1	6
Al-Maymouna	1	2	1	3
Al-Salam	-	1	1	2
Al-Majar Al-Qaber	1	1	2	3
Al-Adel	-	-	1	1
Qulat Salm	1	1	1	2
Al-Azeir	1	2	2	4
Al-Kahlaa	1	1	2	3
Al-Rafey	-	1	1	2
Al-Mesharak	1	1	1	2
Total	10	19	16	35

Source: Data prepared by Missan Agriculture Office

4C-1. Selection of Crops to be Introduced

a. Paddy Rice

(i) The Government has planned to expand the paddy cropping area by 4.7 times and to increase the gross paddy rice production by 7.9 times within the fourth Five-year National Economic Development Plan period of 1976 to 1980.

(ii) Missan province is the third biggest paddy producing province in Iraq. The gross production is about 51,000 tons.

(iii) The paddy cropping area in the Project Area was only 38 ha in 1978, but it was remarkably expanded to 175 ha in 1979, that is, 4.6 times of the above-mentioned production.

(iv) Natural conditions in the Project Area are favorable for paddy cultivation. Saline soils will be improved by leaching.

(v) The systematization of mechanized farm practices for paddy cultivation is on the way in Iraq.

(vi) Paddy rice of Amber varieties has been purchased by the Government. Therefore, there is no problem in its marketability. The annual consumption of rice has been increasing year by year, which results in an increased import of paddy. The per capita consumption of paddy in 1980 is estimated to increase to 1.14 times of that in 1975 under the Five-year National Economic Development Plan.

b. Barley

(i) Barley is the most important feeder crop in Iraq. The Government has planned to increase its production by 1.6 times under the Five-year Plan.

(ii) Barley occupies a larger cropping area among the other agricultural crops in Missan province.

(iii) The irrigated cultivation of barley is easy. The mechanized farm practices for barley cultivation have been already systematized in Iraq.

(iv) The barley consumption has been increasing year by year. The Government has planned to increase the meat production by 1.5 times and the milk production by 1.4 times under the Five-year Plan, 1976 to 1980.

(v) Both the sowing and harvesting seasons of barley come by two weeks earlier than these of wheat. Therefore, the busiest seasons of farm machines does not completely overlap each other if these two crops are cultivated.

c. Wheat

(i) Wheat is the staple food of Iraqi people. The Government has planned to increase its production by 2.3 times under the Five-year Plan.

(ii) Iraq is an importer of wheat recently. Self-sufficiency of this crop is one of the national targets.

(iii) Wheat is one of the major crops raised in Missan province. The cropping area is 19,575 ha with the gross production of 15,660 tons.

(iv) The irrigated cultivation of wheat is easy. The mechanized farm practices have been already systematized in Iraq to a considerable extent.

4C-2. Study on Cropping Patterns

In determination of the cropping pattern, six alternative rotational cropping patterns shown in Table 4C-1 were studied.

<u>Cropping Pattern No. 1.</u>: Five-year rotation (incl. sugarcane)

This cropping pattern is advantageous in paddy weed control and in maintenance of land productivity, but has been canceled in the study taking into consideration the following:

(i) The paddy cropping area will decrease to 1,242 ha, that is, 20 % of the total cultivated area in the Project Area, which will result in a marked decrease of paddy production. (Sugar harvested area in this cropping pattern is 3,726 ha.)

(ii) Transportation of harvested sugarcane to existing sugarcane factories is difficult since the distance from the Project Area to the nearest factory is more than 40 km. On the assumption that sugarcane of 60 ton/ha is harvested in 120 days, the necessary number of six-ton tracks for transportation will be 373 units per day.

(iii) The sugarcane farm has already had a plan to expand its cropping area, and its factory will have no more surplus capacity to accept sugarcane from outside.

(iv) The machinery cost for this cropping pattern is higher than that for the cropping pattern No. 6. (see Tables 4C-2/4). Farm mechanization system for the cropping pattern is not economical in comparison with that for the cropping pattern No. 6.

Cropping Pattern No. 2.: Five-year rotation

This cropping pattern has similar advantages to these of the cropping pattern No. 1, but has been canceled in this study due to a small acreage of paddy cropping area and a low economy.

Cropping Pattern No. 3.: Four-year rotation

This cropping pattern is similar to the above-mentioned cropping pattern No. 1 in various aspects. The paddy cropping area will be 1,552 ha, that is, 25 % of the total cultivated area in the Project. Sugarcane harvested area will be 3,105 ha.

Cropping Pattern No. 4.: Three-year rotation

This cropping pattern has similar advantages to these of the cropping pattern No. 1, but involves the following;

(i) The paddy production is small. The paddy cropping area is 2,070.

(ii) The sowing and harvesting seasons of summer crops partially overlap each other. Big labor force and machinery capacity are required, accordingly.

(iii) Market prices of millet and sorghum are low. The cropping pattern is not economic, accordingly.

Cropping Pattern No. 5.: Two-year rotation

This cropping pattern is similar to the above-mentioned cropping pattern No. 4. The paddy cropping area is 3,105 ha. Both sugarcane and millet are grown in 1,555.2 ha. The cropping pattern is not economic.

Cropping Pattern No. 6.: Continuous Cropping

This cropping pattern aims at an alternating cropping of the summer crop of paddy and the winter crops of barley and wheat. The cropping area of paddy, barley and wheat is 6,210 ha, 1,000 ha and 1,000 ha, respectively.

Due to a larger paddy cropping area than these in the other cropping patterns, the cropping pattern is the most economic. However, a decrease of soil fertility due to continuous paddy cropping, a decrease of yield caused by spreading paddy weeds, adverse effect upon the ecological system brought about by herbicide to be applied and big labor force and machinery capacity required for timely sowing of a single crop, etc., are the major problems involved in the cropping pattern No. 6.

Based on alternative studies on these six types of cropping pattern, the cropping pattern No. 6 has been selected taking into account the following;

(i) The state rice farm aims to establish a technical system for paddy cultivation and paddy farm operation and management with a high efficiency.

(ii) Paddy is more profitable among the other crops. (see Table 4C-4 of Appendix 4C-2).

(iii) It is considered that the following countermeasures will be effective to solve the problems pointed out above;

- Soil fertility: Application of paddy straw compost
- Weed Control: Application of pylazorate type herbicide with a low toxicity plus two times' puddlings one time's weeder operation
- Peak demand of labor force and machinery: Introduction of the early, medium and late maturing lines of paddy to elongate the paddy growing season.

Table 4C-1 Alternative Cropping Pattern

Description	Type No.	Rotation Period				
		1st	2nd	3rd	4th	5th
Five-year	1	Paddy	Sugarcane	Sugarcane	Sugarcane	Sugarcane
	2	Paddy (Wheat) (Barley)	Sorghum	Berseem	Berseem	Berseem
Four-year	3	Paddy	Sugarcane	Sugarcane	Sugarcane	-
Three-year	4	Paddy (Barley) (Wheat)	Sorghum (Berseem)	Millet	-	-
Two-year	5	Paddy (Berseem) (Wheat etc.)	Sorghum & Millet	-	-	-
Continuous Cropping	6	Paddy (Barley) Wheat)	Paddy (Barley) Wheat)	-	-	-

Note: ( ) Winter crops

Table 4C-2 Machinery Cost in Cropping System No.1
(Sugarcane and Paddy)

Equipment	Total No. (unit)	Unit Cost (I.D.)	Total Cost (I.D.)
Motor Car	4	2,700	10,800
Survey Car	14	2,700	37,800
Pick-up	10	1,100	11,000
Wheel Tractor	26	7,600	197,600
Crawler Tractor	3	11,700	35,100
Bottom Plow	7	590	4,130
Disk Harrow	4	530	2,120
Tooth Harrow			
Puddling Rotor	6	560	3,360
Broadcaster	3	1,400	4,200
Culti-packer			
Combine	7	15,000	105,000
Trailer	26	1,300	33,800
Motorcycle	50	100	50,000
Grain Pump	2	6,000	12,000
Tank Lorry	1	5,500	5,500
Water Pump	10	380	3,800
Ridger			
Seeder & Weeder	8	2,700	21,600
Manure Spreader	3	1,400	4,200
Hay Baler	2	5,280	10,560
Front Loader	2	900	1,800
Truck	111	4,600	510,600
Cane Harvester	19	38,800	737,200
Planter	9	1,035	9,315
Sub-total	327	-	1,811,485
Workshop	1	22,870	22,870
Sub-total	1	-	22,870
Total	-	-	1,834,355

Table 4C-3 Machinery Cost in Cropping System No.6
(Paddy & Winter Crops)

Equipment	Total No.	Unit Cost (I.D.)	Total Cost (I.D.)
Motor Car	4	2,700	10,800
Survey Car	14	2,700	37,800
Pick-up	10	1,100	11,000
Wheel Tractor	85	7,600	646,000
Crawler Tractor	8	11,700	93,600
Bottom Plow	26	590	15,340
Disk Harrow	16	530	8,480
Tooth Harrow	10	280	2,800
Puddling Rotor	31	560	17,360
Broadcaster	4	1,400	5,600
Culti-packer	8	100	800
Combine	37	15,000	555,000
Trailer	56	1,300	72,800
Motorcycle	50	100	5,000
Grain Pump	2	6,000	12,000
Tank Lorry	2	5,500	11,000
Water Pump	30	380	11,400
Ridger	8	250	2,000
Seeder & Weeder	40	2,700	108,000
Manure Spreader 3t	8	1,400	11,200
Hay Baler	9	5,280	47,520
Front Loader	4	900	3,600
Sub-total	462	-	1,689,100
Seed Center[1/]	1 unit	40,000	40,000
Workshop	1	22,870	22,870
Sub-total	2	-	62,870
Total	-	-	1,751,970

1/ Seed Center

Facilities and Equipment of Seed Center

Unloading	Unloading hopper	Capacity:	2 tons
Cleaning	Seed cleaner		2 ton/hr
Grain separating	Grain separator with scalperator		2 to 3 ton/hr
Seed grading	Seed grader		2 to 3 ton/hr
Weighting	Weighting machine		1 to 50 kg
Others			
Building	300 sq.m		

Table 4C-4 Gross Output in Each Crop Rotation

		Paddy	Sugarcane	Berseem	Sorghum	Millet	Barley	Wheat	Total
No.1	Area (ha)	1.242	3.726 1/						4.968
	Output (I.D.)	475,065	1,341,360						1,816,425
No.2	Area (ha)	1.242		3.726	1.242		1.000	1.000	8.210
	Output (I.D.)	475,065		745,200	111,780		98,900	153,000	1,583,945
No.3	Area (ha)	1.553	3.105 1/						4.658
	Output (I.D.)	594,023	1,117,800						1,711,823
No.4	Area (ha)	2.070		2.070	2.070	2.070	1.000	1.070	10.350
	Output (I.D.)	791,775		165,600	186,300	161,460	98,900	153,000	1,557,035
No.5	Area (ha)	3.105		1.035	1.553	1.552	1.035	1.035	9.315
	Output (I.D.)	1,187,663		82,800	139,770	121,056	102,362	158,355	1,792,006
No.6	Area (ha)	6.210					1.000	1.000	8.210
	Output (I.D.)	2,375,325					98,900	153,000	2,627,225

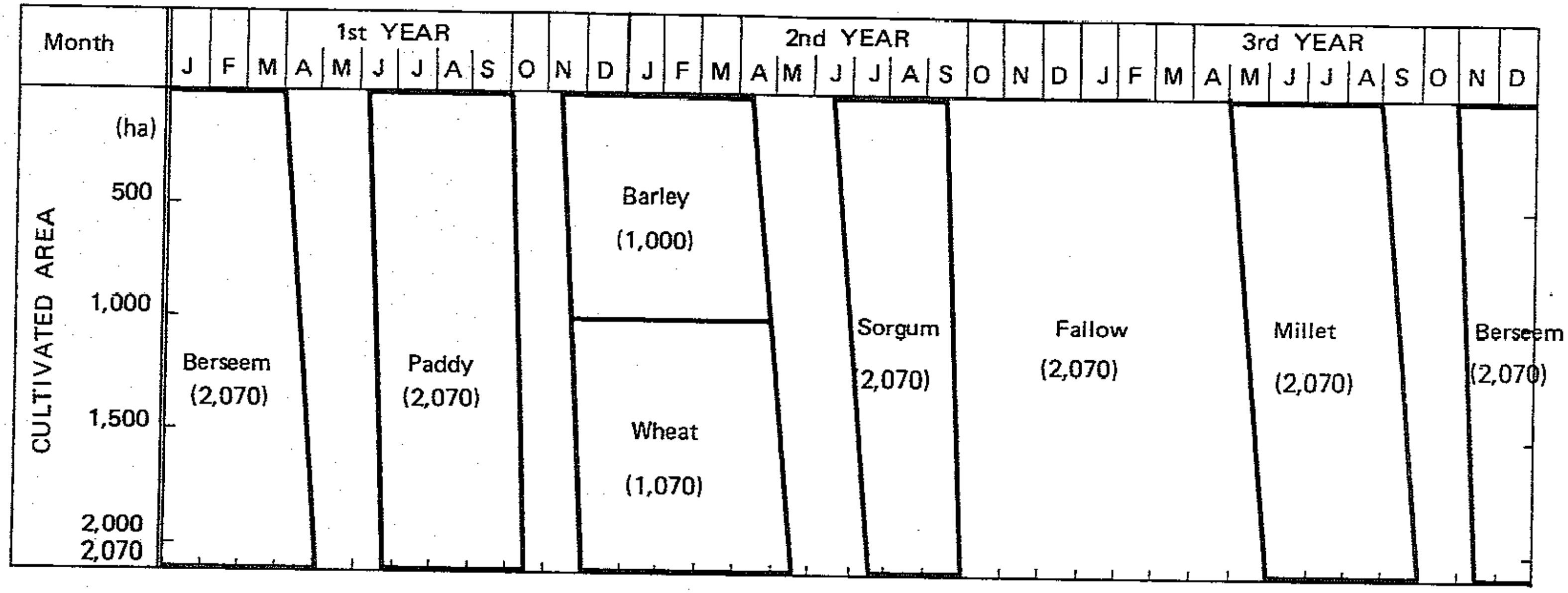
1/ Harvested area

Table 4C-5 Unit Price and Production in Each Crop

Crops	Unit Price (I.D/t)	Production (t/ha)	Output (I.D/ha)	Remarks
Paddy	70 1/ (85) 2/	4.5	382.5	85 I.D/ton x 4.5 ton/ha
Millet	39	2.0	78	
Sorghum	45	2.0	90	
Sugarcane	6	60	360	
Berseem	4 3/	20 - 50	80 - 200	20 t - Winter crop 50 t - Annual
Corn	40	2.0	80	
Wheat	70 1/ (51) 2/	3.0	153	51 I.D/ton x 3.0 ton/ha
Barley	55 1/ (43) 2/	2.3	98.9	43 I.D/ton x 2.3 ton/ha

Note: 1/ financial farm gate price at present
2/ financial farm gate price in future
3/ estimated unit price based on production cost

FIGURE 4C-1 CROPPING CALENDAR FOR THREE-YEAR ROTATION
(PADDY - BARLEY & WHEAT - SORGUM - MILLET - BERSEEM - PADDY)



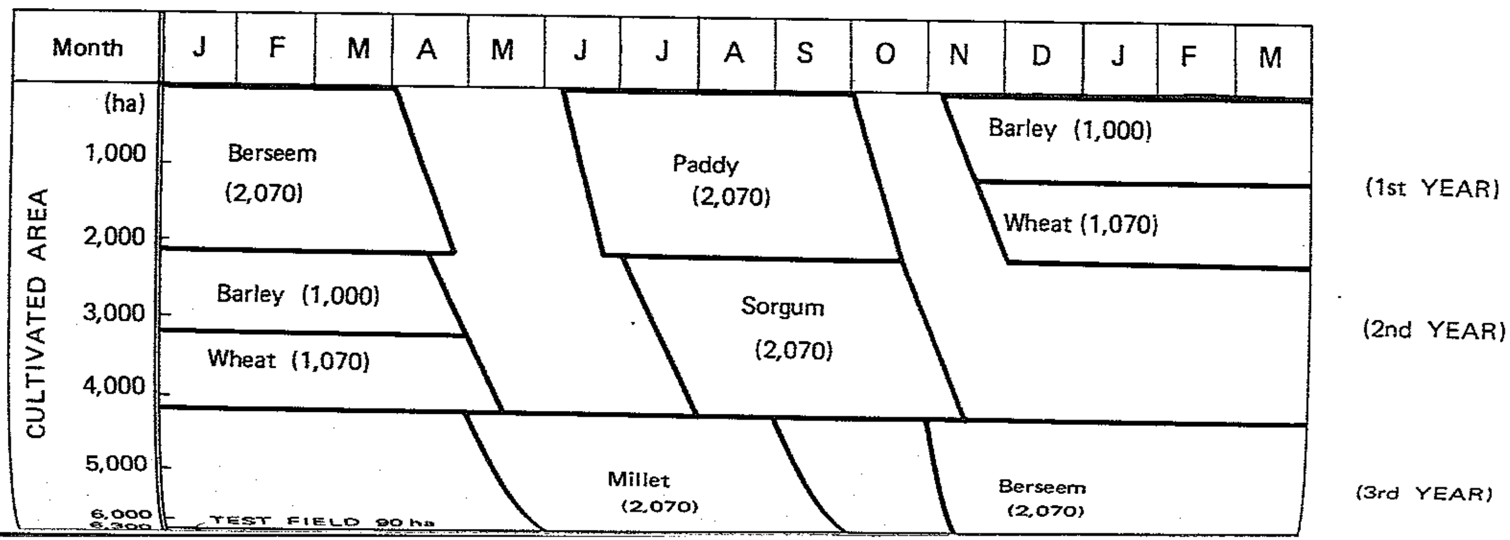
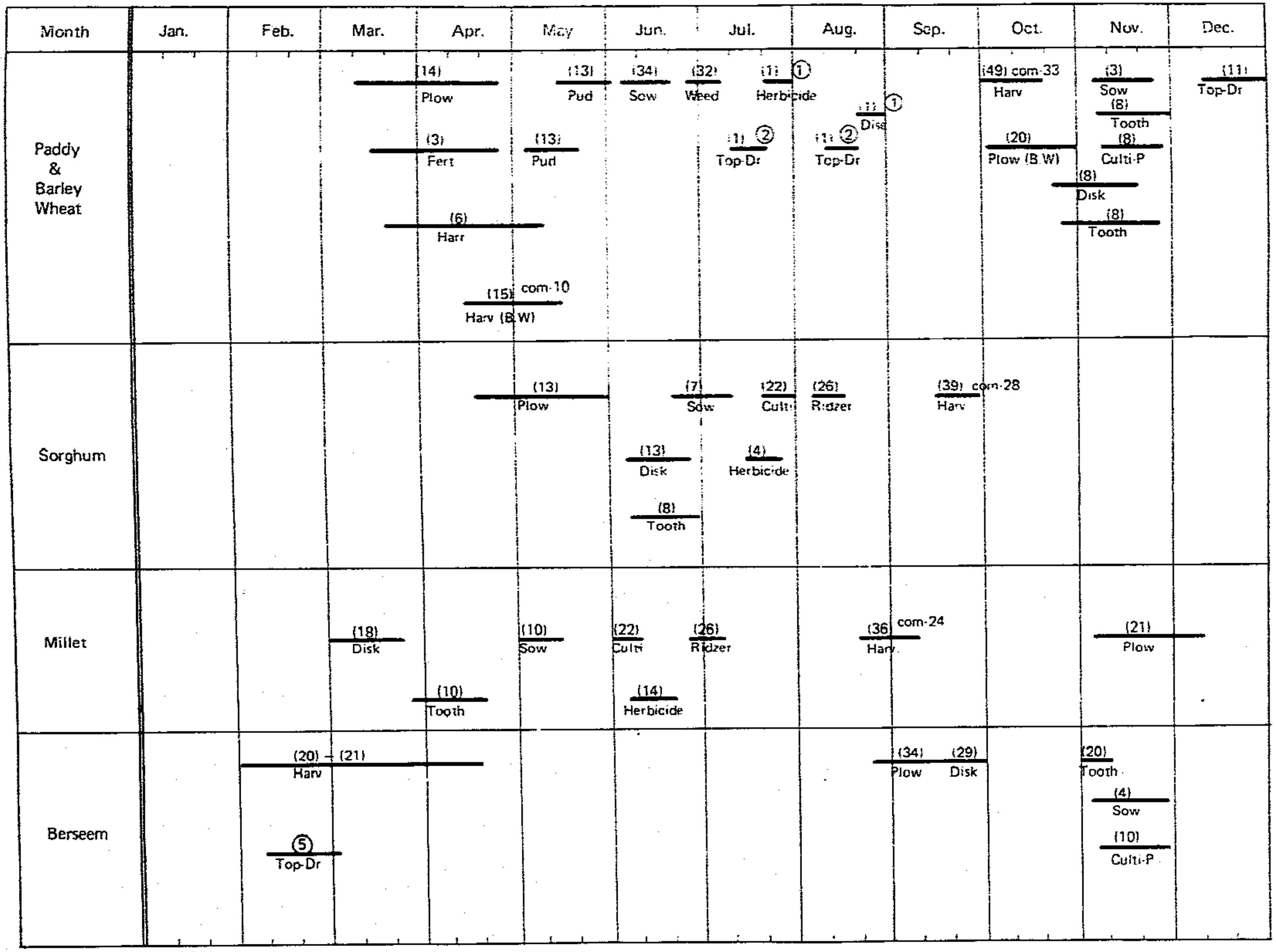


FIGURE 4C-2 FARM MECHANIZATION SYSTEM FOR THREE-YEAR ROTATION



Abbreviation

Plow: Plowing
Pud. Puddling
Sow: Sowing
Weed; Weeding
Harv; Harvesting
Tooth; Tooth Harrow
Disk; Disk Harrow
Top-Dr; Top-Dressing
Culti-P; Culti-packer
Fert; Fertilizing
Harr; Harrowing
Culti; Cultivating

( ); Number of Tractor
○ ; Number of Aircraft

4C-3. Comparison of Paddy Sowing Methods

The direct sowing to dry fields, direct sowing to submerged fields and transplanting are considered. The direct sowing to submerged fields is divided into drill seeder sowing and broadcasting by aircraft. Comparison of such paddy sowing methods is made herein. (see Table 4C-6 of Appendix 4C-3)

a) Direct sowing to dry fields

Sowing is made to dry fields, therefore, mechanized sowing is comparatively easy. However, development of plowsole cannot be expected in this method of sowing without puddling and leveling, which results in an increase in water requirement and also a low percentage in seed germination.

b) Direct sowing to submerged fields

Puddling is a premise in this sowing method, therefore, the shortcomings of the direct sowing to dry fields mentioned above can be fulfilled. On the contrary, seeders for submerged fields are inferior to these for dry fields in trafficability. Furthermore, farm machines of bigger capacity is required in this method.

c) Aircraft broadcasting to submberged fields

Sowing to a vast area can be finished in a short time in this method, however, the following demerits should be taken into account;

- Stabilized paddy sowing cannot be expected since aircraft operation is not available when the weather is not good.
- Farm practices following to the aircraft sowing are difficult. Specially, no method except herbicide application is available for weed control.
- A high leveled technique is required for aircraft operation for sowing. (Mobilization and training of pilots will be indispenaable.)

d) Transplanting

Much labor is required for sowing, but a higher yield can be expected. The problems in introducing the transplanting to paddy sowing in this rice farm are as follows;

- o Seedling breeding techniques are not yet well developed in the Project Area; and,
- o Paddy is not tolerant to salts during its rooting period.

As a result of comparative studies on these methods, the introduction of riding-type multi-drilling seeders has been proposed, taking into account the following;

- o Leveling and percolation control are easy in this method of sowing because it premises puddling works; and,
- o Farm practices following to the sowing are easy. Furthermore, a stabilized yield can be expected.

In order to stabilize a paddy yield, sowing should be finished within the optimum season. The aircraft broadcasing is advantageous in this aspect.

Experimental aircraft broadcasting of paddy seed and transplanting will be conducted in the proposed experimental farm.

Table 4C-6 Comparison of Sowing Method

Description	Direct Sowing to Dry Fields	Direct Sowing to Submerged Fields by Seeder	Broadcasting by Aircraft	Transplanting
1. Inicial Water Supply	much	a little	a little	a little
2. Wind damage at sowing stage	almost nil	a little transported by wind	a little transported by wind and operation to be stopped under wind velocity more than 10 m	nil
3. Labor forth	moderate	much	a little	much
4. Germination	poor	good	good	uncertain for plant rooting
5. Weed thickly grow	many	moderate	moderate	small
6. Weeding	weeder, chemical	weeder, chemical	chemical	weeder, chemical
7. Cultivation	easy	easy	hard	easy
8. Lodging of paddy	moderate	many	many	small
9. Yield	a little	moderate	a little	much
10. Machinery price for sowing or transplanting	25,800 I.D.1/	108,000 I.D.2/	67,900 I.D.3/	108,000 I.D.4/

Note: 1/: Grain drill width 6.0 m, 12 rows, 9 units
2/: Seed drill 10 rows, 40 units
3/: Aircraft, 3 units
4/: Transplanter 10 rows, 40 units

Table 4C-7 Agricultural Inputs Materials

Crops	Item	Period	Inputs (kg/ha)
Paddy	Seed	May 20 - Jun.30	100
	Compost	Mar. 1 - May 24	5,400
	Fertilizer		
	Basal dressing	Mar. 1 - May 28	Urea 90 T.S.P. 174
	Top dressing	Jun.20 - Jul.11	Urea 90
		Jul.28 - Aug.18	Urea 80
	Compost	Mar. 1 - Apr.15	6,000
	Herbicide	Jul.12 - 27	Pyrazolate 15
	Disease control	Aug.20 - 31	Kitazin P 30
Barley	Seed	Nov.10 - 13	120
	Fertilizer		
	Basal dressing	Nov.10 - 13	Urea 124 T.S.P. 87
	Top dressing	Dec.20 - 23	Urea 50
Wheat	Seed	Nov.10 - 17	120
	Fertilizer		
	Basal dressing	Nov.13 - 17	Urea 170 T.S.P. 87
	Top dressing	Dec.23 - 27	Urea 90

Table 4C-8 Labor Population

(Unit: '000 persons)

Year	Population: Total	Population: Rural	Population: Urban	Employable Labor	Ratio of Labor (%)
1960	6,885	3,884	3,001	1,631.1	23.6
1965	8,047	3,936	4,111	2,148.0	26.6
1970	9,440	3,988	5,452	2,664.9	28.2
1971	9,750	3,998	5,752	2,959.1	28.3
1972	10,074	4,009	6,065	2,858.0	28.3
1973	10,413	4,019	6,394	2,962.3	28.4
1974	10,765	4,030	6,735	3,070.3	28.5
1975	11,124	4,040	7,084	3,181.5	28.6

Source: Annual Abstract of Statistics, 1975

Table 4C-9 Rural and Urban Populations, 1974

(Unit: '000 persons)

Governorate	Rural	Urban	Total
D'hok	90 (54.2)	76 (45.8)	166 (100.0)
Nineveh	365 (40.9)	527 (59.1)	892 (100.0)
al-Sulaimaniya	312 (58.0)	226 (42.0)	538 (100.0)
Arbil	247 (51.9)	229 (48.1)	476 (100.0)
Kirkuk	238 (40.6)	348 (59.4)	586 (100.0)
Diala	272 (35.9)	214 (64.1)	758 (100.0)
al-Anbar	187 (39.5)	191 (60.5)	378 (100.0)
Baghdad	525 (15.7)	2,817 (84.3)	3,342 (100.0)
Wasit	227 (59.7)	153 (40.3)	380 (100.0)
Babylon	307 (53.1)	271 (46.9)	578 (100.0)
Kerbela	106 (19.0)	452 (81.0)	558 (100.0)
l-Qodisiya	238 (57.3)	177 (42.7)	415 (100.0)
l-Muthanna	82 (54.3)	69 (45.7)	151 (100.0)
Mayasan	217 (60.1)	144 (39.9)	361 (100.0)
Thi-Qar	351 (64.5)	193 (35.5)	544 (100.0)
Basrah	263 (28.8)	651 (71.2)	914 (100.0)
Total	4,027 (37.4)	6,738 (62.6)	10,765 (100.0)

Source: Statistic Pocket Book, 1974, Central Statistic Organization

Note : Parenthesized figures show percentage

Table 4C-10 Employable Labor Population by Sectors

(Unit: '000 persons)

Year	Population				Percent			
	Labor Population	Agri. Labor	Non-Agri. Labor	The un-employed	Labor Population	Agri. Labor	Non-agri. Labor	The un-employed
1960	1,631.1	733.9	865.8	31.4	100.0	45.0	53.1	1.9
1965	2,148.0	1,009.6	986.7	151.7	100.0	47.0	45.9	7.1
1970	2,664.9	1,385.7	1,122.0	157.2	100.0	52.0	42.1	6.2
1971	2,759.1	1,434.7	1,157.9	166.5	100.0	52.0	42.0	6.0
1972	2,858.0	1,486.2	1,190.4	181.4	100.0	52.0	41.7	6.3
1973	2,962.3	1,540.4	1,221.8	200.1	100.0	52.0	41.2	6.8
1974	3,070.3	1,596.6	1,254.8	218.9	100.0	52.0	40.9	7.1
1975	3,181.5	1,654.4	1,287.0	240.1	100.0	52.0	40.5	7.5

Source: Abdul Wahab M.A.I.-Dahiri, Economics of Agricultural Section in Iraq. P 43

Table 4C-11 Machinery and Labor Requirements (for Paddy)

Description	Period	Required Quantity (kg/ha)	Machinery	1/ Efficiency	Labour: Operator	Labour: Un-skilled Labor (hr/ha)	Remarks
Seed Preparation	Feb.	Seed 100	Seed Center			0.9	1/ see Appendix, Table 4C-12
Land Preparation							
Manure Spreading	Mar. 1-May 24		Manure Spreader 3t	0.6 hr/ha	0.6		
			Front Loader	0.3	0.3		
Plowing	Mar. 2-May 26		Bottom Plow 14-16"x3	2.2	2.2		
Harrowing	Mar. 5-Jun.10		Disk Harrow 20"x24	1.0	1.0		
Puddling	May 4-Jun.25		Puddling Rotor W.3.6m	0.8	1.6		Twice
Fertilizing	Mar. 3-May 28		Broadcast 2,000 ℓ	0.2	0.2	0.2	
Sowing	May 20-Jun.30	100kg/ha	Seed Spacing Drill 10 rows	2.0	2.0	0.2	
Top Dressing	Jun.11-Jul.20		Aircraft			0.2	
	Jul. 6-Aug.15		-do-			0.2	
Weeding	Jul. 1-Aug.15		Weeder 10 rows	1.4	1.4		
						40.0	
Herbicide	Jul.12-22		Aircraft			0.05	
Disease control	Sep.10-Oct. 5		-do-			0.05	
Water management	May 10-Nov.10				0.8	22.0	Pump station Water way On-farm
Harvesting	Oct. 1-Nov.30		Combine W. 4.25m	2.6	2.6		
			Trailer 3t	1.3	1.3		
			Hay Baler	0.6	0.6		
			Trailer		2.1	6.4	
Others						3.0	

Table 4C-12 Farm Operation Efficiency

Machinery	Operation (Width) (m) (1)	Operation Seed (Km/hr) (2)	Theoretic Operattion Capacity (ha/hr) (3)=(1)x(2)/10	Efficiency in Field (%) (4)	Operation Capacity in Field (ha/hr) (5)=(3)x(4)	Hours per Ha (hr/ha) (6)	Operation Hours per Day 6 hr (ha/day) (7)	Operation Hours per Day 9 hr (ha/day) (8)
Bottom Plow 14-16"x3	1.05	5.0	0.53	85	0.45	2.2	2.7	4.1
Disk Harrow 20" x 24	2.10	5.5	1.16	85	0.99	1.0	5.9	8.9
Tooth Harrow 30 x 3	3.00	6.5	1.95	85	1.66	0.6	10.0	14.9
Puddling Rotor	3.60	4.5	1.62	80	1.30	0.8	7.8	11.7
Broadcaster 2,000 ℓ	15.00	5.0	7.50	65	4.88	0.2	29.3	43.9
Cultipacker	4.00	5.0	2.00	85	1.70	0.6	10.2	15.3
Seed Drill 10 rows	3.00	2.5	0.75	65	0.49	2.0	2.9	4.4
Weeder 10 rows	3.00	3.0	0.90	80	0.72	1.4	4.3	6.5
Hay Baler	4.25	4.0	1.70	70	1.19	0.6	7.1	10.7
Combine Paddy	4.25	1.5	0.64	60	0.38	2.6	2.3	3.4
Wheat		3.2	1.36	60	0.82	1.2	4.9	7.3
Manure Spreader 3 t	6.00	7.5	4.50	40	1.80	0.6	10.8	16.2

Table 4C-13 Machinery and Labor Requirements (for Barley & Wheat)

Description	Period	Required Quantity (kg/ha)	Machinery	Efficiency (hr/ha)	Labour (hr/ha) Opera-tor	Labour (hr/ha) Unskilled Labor	Remarks
Seed Selection	Sep.		Seed Center			0.5	
Plowing	Oct. 3- 24		Bottom Plow 14-16"x3	2.2 hr/ha	2.2		
Harrowing	Oct.25-Nov. 9		Disk Harrow 20" x 24	1.0	1.0		
	Oct.27-Nov.15		Tooth Harrow 30toothx3	0.6	0.6		
Sowing	Nov.10 - 25	Seed 120	Broadcaster 2,000 ℓ	0.2	0.2	0.2	Fertilizer
	Nov.11 - 28	Fert.257-211	Tooth Harrow 30 x 3	0.6	0.6		Wheat 257 kg/ha
	Nov. 16 - 30		Cultipacker W.4.0m	0.6	0.6		Barley 211
Top Dressing	Dec. 20 - 30	90 - 50	Broadcaster	0.2	0.2	0.2	Wheat 90
							Barley 50
Water Management	Nov.10-Apr.10				2.2	16.8	
Harvesting	Apr.15-May 15		Combine W. 4.25m	1.2	1.2		
			Trailer 3 t	1.8	1.8		
	Apr.17-May 16		Baler	0.6	0.6		

Table 4C-14 Farm Labor Balance with the Project, In Future (A)

Items	Area (ha)	Jan. F	Jan. M	Jan. L	Feb. F	Feb. M	Feb. L	Mar. F	Mar. M	Mar. L	Apr. F	Apr. M	Apr. L	May F	May M	May L	Jun. F	Jun. M	Jun. L
1. Labor Requirement																			
Paddy	6,300																		
Unskilled Laborer		-	-	-	117	117	117	20	220	220	20	829	822	822	822	860	890	928	927
Skilled Laborer		-	-	-	-	-	-	100	400	399	497	456	310	378	463	833	708	594	460
Sub-total		-	-	-	117	117	117	120	620	619	517	1,285	1,132	1,200	1,285	1,693	1,598	1,522	1,387
Barley & Wheat	2,000																		
Unskilled Laborer		270	270	270	270	270	210	270	270	270	270	270	270	-	-	-	-	-	-
Skilled Laborer		36	36	36	36	36	28	36	36	36	36	99	195	198	100	-	-	-	-
Sub-total		306	306	306	306	306	238	306	306	306	306	369	465	198	100	-	-	-	-
Experimental Farm	90																		
Unskilled Laborer		20	20	20	20	20	20	30	30	30	60	60	60	90	90	90	40	40	40
Skilled Laborer		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-total		20	20	20	20	30	20	30	30	30	60	60	60	90	90	90	40	40	40
Compost																			
Unskilled Laborer		-	-	114	114	114	-	-	-	-	-	-	-	-	-	-	-	-	-
Skilled Laborer		-	-	60	60	60	25	25	-	-	-	-	-	-	-	-	-	-	-
Sub-total		-	-	174	174	174	25	25	-	-	-	-	-	-	-	-	-	-	-
Total Unskilled Laborer		290	290	404	521	521	347	320	520	520	350	1,159	1,152	912	912	950	930	968	967
Skilled Laborer		36	36	96	96	96	53	161	436	435	533	555	505	576	563	833	708	594	460
Total		326	326	500	617	617	400	481	956	955	883	1,714	1,657	1,488	1,475	1,783	1,638	1,562	1,427
2. Regular Employee																			
Unskilled Laborer		916	917	917	917	917	916	916	917	917	916	917	917	916	917	917	916	917	917
Skilled Laborer		500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500
Total		1,416	1,417	1,417	1,417	1,417	1,416	1,416	1,417	1,417	1,416	1,417	1,417	1,416	1,417	1,417	1,416	1,417	1,417
3. Temporary Employee																			
Unskilled Laborer		-	-	-	-	-	-	-	-	-	-	242	235	-	-	33	14	51	50
Skilled Laborer		-	-	-	-	-	-	-	-	-	33	55	5	76	63	333	208	94	-
Total		-	-	-	-	-	-	-	-	-	33	297	240	76	63	366	222	145	50

Table 4C-14 Farm Labor Balance with the Project, In Future (B)

Items	Area (ha)	Jul. F	Jul. M	Jul. L	Aug. F	Aug. M	Aug. L	Sep. F	Sep. M	Sep. L	Oct. F	Oct. M	Oct. L	Nov. F	Nov. M	Nov. L	Dec. F	Dec. M	Dec. L	Total
1. Labor Requirement																				
Paddy	6,300																			
Unskilled Laborer		810	972	852	888	865	810	810	990	810	810	810	810	810	-	-	1,167	1,167	1,170	22,282
Skilled Laborer		198	359	359	197	36	36	36	36	36	499	539	580	580	543	543	423	383	384	11,365
Sub-total		1,008	1,331	1,211	1,085	901	846	846	1,026	846	1,309	1,349	1,390	1,390	543	543	1,590	1,550	1,554	33,647
Barley & Wheat	2,000																			
Unskilled Laborer		-	-	-	-	-	-	-	-	-	-	-	270	270	270	339	270	270	270	5,139
Skilled Laborer		-	-	-	-	-	-	42	42	41	200	244	200	260	229	264	36	36	36	2,574
Sub-total		-	-	-	-	-	-	42	42	41	200	244	470	530	499	603	306	306	306	7,713
Test Field	90																			
Unskilled Laborer		50	50	50	50	50	50	70	70	60	100	100	100	100	100	100	50	50	50	2,030
Skilled Laborer		-	-	-	-	-	-						-	-	-	-	-	-	-	-
Sub-total		50	50	50	50	50	50	70	70	60	100	100	100	100	100	100	50	50	50	2,030
Compost																				
Unskilled Laborer		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	342
Skilled Laborer		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	60	60	410
Sub-total		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	60	60	752
Total Unskilled Laborer		810	1,022	902	938	915	860	880	1,060	870	910	910	1,180	1,180	370	439	1,487	1,487	1,490	29,793
Skilled Laborer		248	359	359	197	36	36	78	78	77	699	783	780	840	772	807	519	479	480	14,349
Total		1,058	1,381	1,261	1,135	951	896	958	1,138	947	1,609	1,693	1,960	2,020	1,142	1,246	2,006	1,966	1,970	44,142
2. Regular Employee																				
Unskilled Laborer		916	917	917	916	917	917	916	917	917	916	917	917	916	917	917	916	917	917	33,000
Skilled Laborer		500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	18,000
Total		1,416	1,417	1,417	1,416	1,417	1,417	1,416	1,417	1,417	1,416	1,417	1,417	1,416	1,417	1,417	1,416	1,417	1,417	51,000
3. Temporary Employee																				
Unskilled Laborer		-	105	-	22	-	-	-	143	-	-	-	263	264	-	-	571	570	573	3,136
Skilled Laborer		-	-	-	-	-	-	-	-	-	199	283	280	340	222	307	19	-	-	2,517
Total		-	105	-	22	-	-	-	143	-	199	283	543	604	222	307	590	570	573	5,653

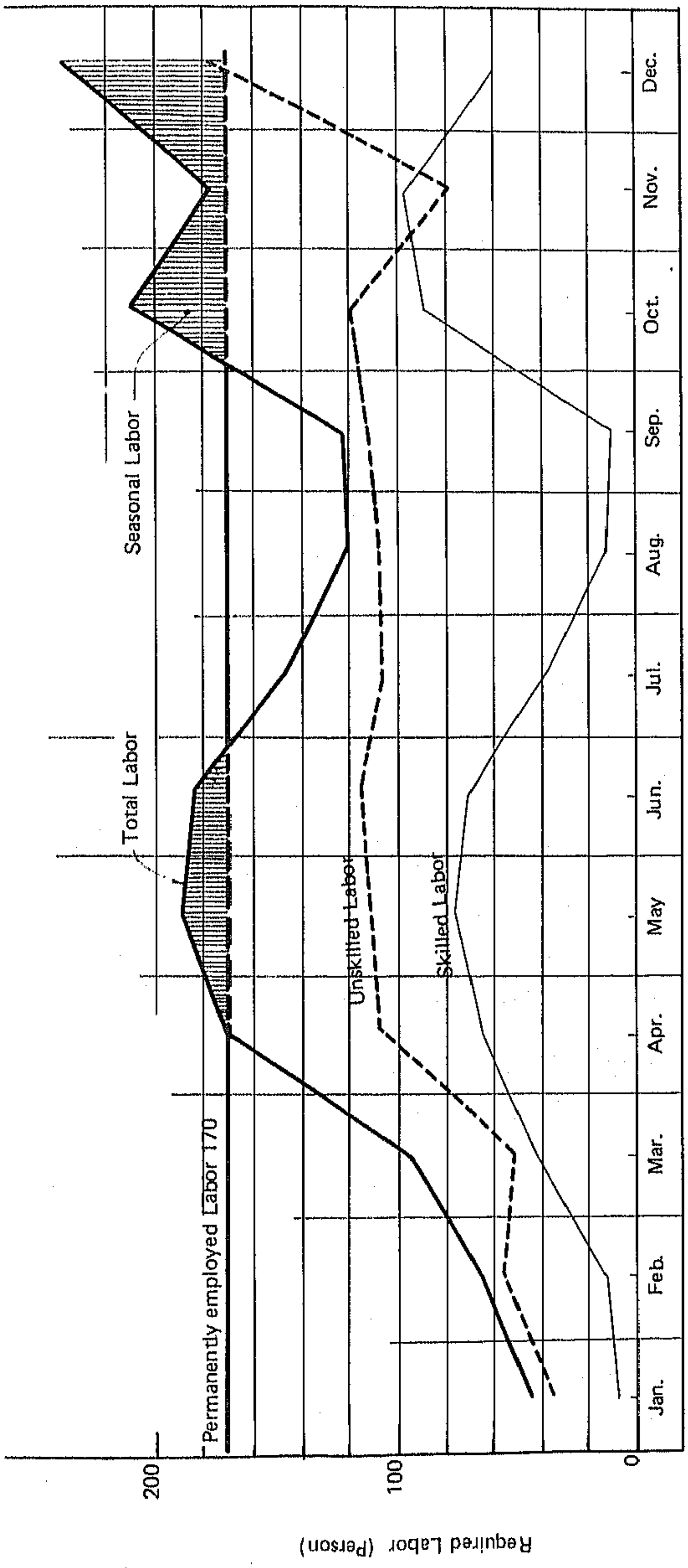


FIGURE 4C-3 MONTHLY LABOR REQUIREMENT

4C-6. Bearing Capacity and Farm Machines to be Introduced

A bearing capacity of the present submerged fields was measured by corn-penetrometer in the field survey as follows;

- Surface soil layers (depth: 0 to 15 cm)
  0.5 to 3.5 kg/sq.cm
- Sub-surface soil layers (depth: 15 to 30 cm)
  1.0 to 7.0 kg/sq.cm

In general, dry soils are plowed and harrowed, so it is not necessary to pay any attentions to a bearing capacity for such farm machines. However, tractors and seeders will be operated for puddling and sowing in the submerged fields with water. Therefore, careful attentions should be paid to the bearing capacity in selecting farm machines.

The sub-surface soil layers in the Project Area except the marshy area have bigger bearing capacity than 2.0 kg/sq/cm, that is, the minimum capacity required for travel of tractor and seeder to be introduced. Crawler-type farm machines will be required for puddling and sowing in the marshy area if such area is left as it is, however, it is considered that the sub-surface layers will be improved, by removal of both surface and subsurface waters, to have a sufficient bearing capacity for operation of farm machines without crawlers.

Bearing Capacity Required:

A bearing capacity required for operation of a farm machine is widely different by machine type, its wheel type, attachments and farm practices for which the machine is operated, however, it is shown in corn-penetrometer indicis as follows;

(i) Bearing capacity of surface soil layers (for plowing and harvesting)

An averaged corn-penetrometer index of soil layers from the soil surface to 15 cm deep should range in the following values;

Travel	Tractor with rubber wheel	Tractor with rubber wheel and shoe	Combine Semi-crawler
Easy	more than 4	more than 3	more than 3
A little difficult	3 to 4	2 to 3	2 to 3
Difficult	2 to 3	1 to 2	1 to 2
Impossible	less than 2	less than 1	less than 1

(ii) Bearing capacity of sub-surface soil layers (for puddling)

An averaged corn-penetrometer index of soil layers at 15 cm deep from ground surface should be more than 2 kg/sq.cm.

Bearing Capacity Measurement

The bearing capacity measurement was conducted totally at 50 points in the field survey, that is, 35 points in seven places of the Project Area and at five points in the test field No. 6, one time before submerging it with water and two times after submerging (one time immediately after water supply and the other at 24 hours later). The measurement points are shown in Appendix 3B-2.

Table 4C-15 Penetration Testing Result

(Unit: kg/cm^2)

Depth \ Observed Point	No.1	No.2	No.3	No.4	No.5	No.6	No.7	Test Field (No.1) a	b	c
0 - 15(cm)	1.5 - 2.5	1 - 2	1.5 - 2.5	1	1	1 - 1.5	0.5	2.5 - 3.5	2	1
15 - 30(cm)	4 - 6	3 - 4.5	4 - 6	3 - 3.5	3.5 - 5	2.5 - 7	1.0	>5	>5	3 - 4

a. Before flooding water

b. Just after flooding water

c. After flooding water (24 hour)

FIGURE 4C-4 RESULT OF CONE PENETRATION TESTS

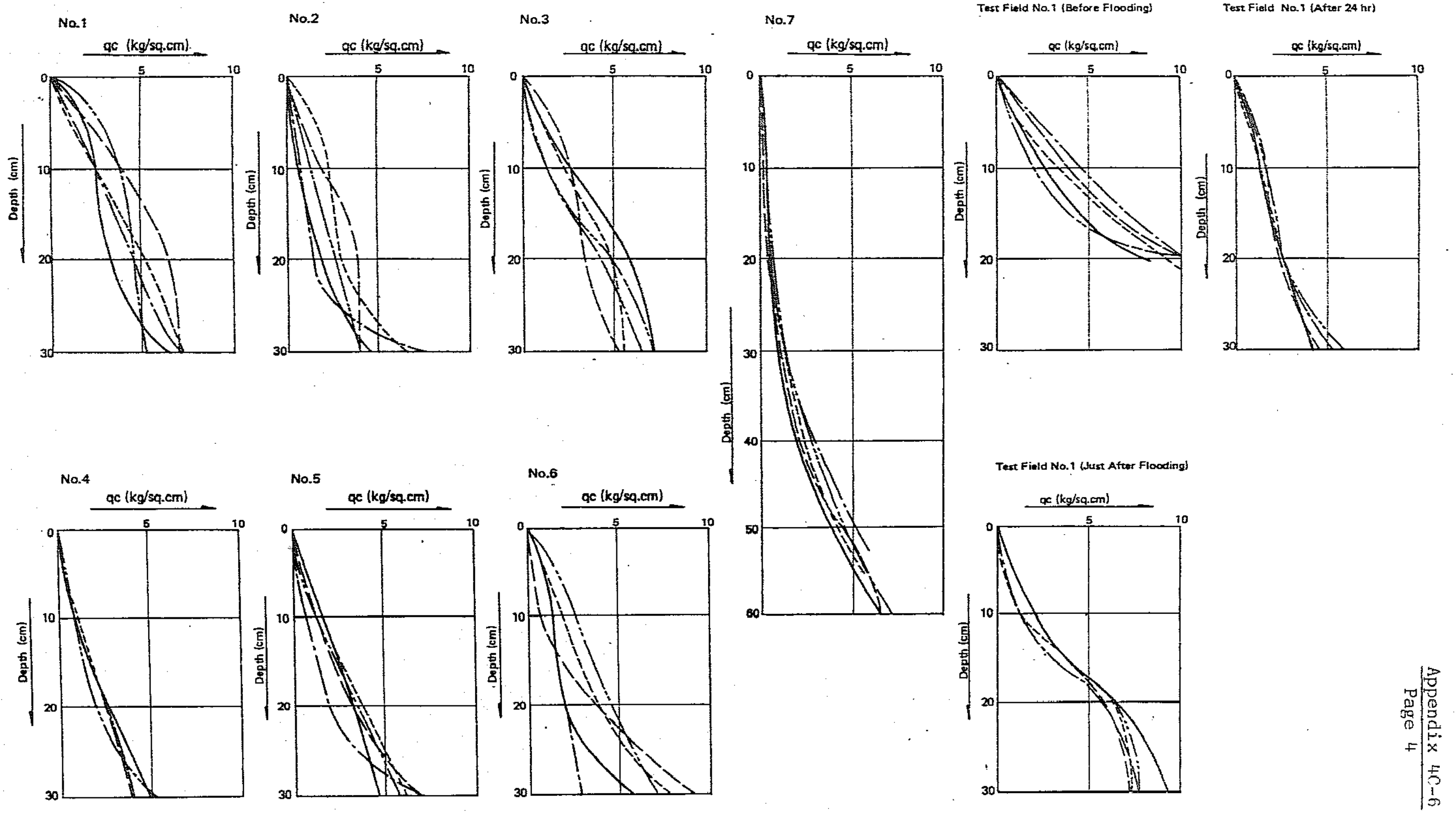


Table 4C-16 Target Yield of Paddy and Fertilizer Application

Year		1st	2nd	3rd	4th
Target Yield (ton/ha)		2.5 1/	3.5 2/	4.0 3/	4.5 4/
Fertilizer (Kg/ha)					
N	(N)	67	94	106	120
	(Urea)	145	204	230	260
P_2O_5	(P_2O_5)	45	62	71	80
	(T.S.P.)	98	135	154	174

Fertilizer	Basal fertilizer	1st top dressing after sowing 30 days	2nd top dressing after sowing 60 days
N	1/3 of total N	1/3 of total N	1/3 of total N
P_2O_5	all of P_2O_5	-	-

1/: The target yield of 2.5 ton/ha is equivalent to 140% of 1.79 ton/ha, yield in non-fertilizer areas. (see Table eC-17)

2/: Yield in case of nitrogen fertilizer application of 94 kg/ha is estimated at 4.2 ton/ha (see Table 4C-17)
The yield of 3.5 ton/ha is determined at a discount of 15% on the above-mentioned yield.

3/: Yield in case of nitrogen fertilizer application of 106 kg/ha is computed at a discount of about 10% on the estimated yield of 4.3 ton/ha.

4/: Experimental result (see No. 10 in Table 4C-17)

Table 4C-17 Fertilizer Response of Rice in Al-Majar 2/
Amber-33, Variety, 1976

(Unti: Kg/ha)

No.	Fertilizer Application	Yield 1/
1.	Without fertilizer	1,790
2.	N 60 Kg + P_2O_5 40 Kg	3,461
3.	N 80 Kg + P_2O_5 40 Kg	4,036
4.	N 100 Kg + P_2O_5 40 Kg	4,408
5.	N 120 Kg + P_2O_5 40 Kg	4,460
6.	N 60 Kg + P_2O_5 60 Kg	4,249
7.	N 80 Kg + P_2O_5 60 Kg	4,155
9.	N 100 Kg + P_2O_5 60 Kg	4,243
10.	N 120 Kg + P_2O_5 60 Kg	4,526

Source: Data of Experiment Station, State Organization for Soil and Land Reclamation, Amara

1/: Pump-irrigation area in Al-Majar
2/: Soil conditions in Al-Majar experimental station are as follows.

No.	Item	Analytical Results
1.	Soil tex, lab,	Silty loam clay
2.	pH	7.45
3.	ECe (mmho/cm)	7.60
4.	C, E.C. (Meq/100g soil)	24.2
5.	O.M. (%)	2.095
6.	No^3 (ppm)	39.5
7.	E.P. (ppm)	11.6
8.	E.K. Meq/100g soil	0.42

Source: Data of State organization for Soil and Land Reclamation, Amara

Table 4C-18 Target Yield of Wheat and Fertilizer Application

Year	1st	2nd	3rd
Target Yield (ton/ha)	2.4	2.7	3.0
Fertilizer N and P_2O_5 (Kg/ha)	N 96 (Urea 209)	N 108 (Urea 235)	N 120 (Urea 260)
	P_2O_5 32 (T.S.P.70)	P_2O_5 36 (T.S.P.78)	P_2O_5 40 (T.S.P.87)

Total Fertilizer	Basic Fertilizer	Top dressing after sowing 70 days
N	50%	50%
P_2O_5	100%	

Note: The averaged yield in the three years is 4,630 ton/ha in case of fertilizer application of 120 Kg N and 40 Kg P_2O_5. The target yield of 3 ton/ha is determined at a discount of 35% on the above-mentioned averaged yield.

Table 4C-19 Yield of Wheat, Mexibak Variety

(Unit: Kg/ha)

No.	Fertilizer Application	Yield (1970/71)	Yield (1971/72)	Yield (1973/74)	Mean
1.	Control	3,156	2,964	3,740	3,287
2.	N 40 Kg	3,372	3,404	4,200	3,659
3.	N 80 Kg	4,204	3,652	4,592	4,149
4.	N 120 Kg	3,924	3,816	4,408	4,049
5.	P_2O_5 40 Kg	3,568	3,484	3,760	3,604
6.	N 40 Kg + P_2O_5 40 Kg	3,312	3,924	4,416	3,884
7.	N 80 Kg + P_2O_5 40 Kg	4,300	4,196	4,024	4,173
8.	N120 Kg + P_2O_5 40 Kg	4,928	4,532	4,432	4,631
9.	P_2O_5 80 Kg	3,304	3,036	4,024	3,455
10.	N 40 Kg + P_2O_5 80 Kg	3,660	3,284	4,080	3,675
11.	N 80 Kg + P_2O_5 80 Kg	3,960	3,724	4,628	4,104
12.	N120 Kg + P_2O_5 80 Kg	4,780	4,348	3,900	4,343

Source: Data of Abu-Ghraib Experimental Station

Table 4C-20 Target Yield of Barley and Fertilizer Application

Year	1st	2nd	3rd
Target yield (ton/ha)	1.8	2.1	2.3
Fertilizer N and P_2O_5	N 64 (Urea 139)	N 72 (Urea 157)	N 80 (Urea 174)
	P_2O_5 32	P_2O_5 36	P_2O_5 40
(Kg/ha)	(T.S.P.70)	(T.S.P.78)	(T.S.P.87)

Total Fertilizer	Basic Fertilzier	Top dressing after sowing 70 days
N	50%	50%
P_2O_5	100%	

Note: An averaged yield of Assirat and Numar varieties in case of fertilizers application of 80 Kg N and 40 Kg P_2O_5. (see Table 4C-21). The target yield of 2.3 ton/ha is determined at a discount of 30% on the averaged yield.

Table 4C-21 Averaged Yield of Barley (1973/74 to 1975/76)

(Unit: Kg/ha)

No.	Treatment	Arrirat	Numar
1.	Control	3,196	3,368
2.	N 40 Kg	3,360	3,280
3.	N 80 Kg	2,708	3,252
4.	P_2O_5 40 Kg	3,500	3,196
5.	N 40 Kg + P_2O_5 40 Kg	2,968	3,324
6.	N 80 Kg + P_2O_5 40 Kg	3,256	3,236

Source: Data of Abu-Ghraib Experimental Station

Table 4C-22 Annual Cropping Area

(Unit: ha)

On-farm Construction Block	Season	Crop	1986	1987	1988	1989	1990	1991	Remarks
A	Summer	Paddy	2,780 (135) 2/	2,780 (234)	2,780 (300)	2,780 (300)	2,780 (300)	2,780 (300)	
2,780 ha	Winter	Wheat	460	460	460	460	460	460	
	"	Barley	460	460	460	460	460	460	
B	Summer	Paddy	-	2,060	2,060	2,060	2,060	2,060	
2,060 ha	Winter	Wheat	-	320	320	320	320	320	
	"	Barley	-	320	320	320	320	320	
C	Summer	Paddy	-	-	1,370	1,370	1,370	1,370	
1,370 ha	Winter	Wheat	-	-	220	220	220	220	
	"	Barley	-	-	220	220	220	220	
Total 1/	Summer	Paddy	2,780	4,840	6,210	6,210	6,210	6,210	
6,210 ha	Winter	Wheat	460	780	1,000	1,000	1,000	1,000	
	"	Barley	460	780	1,000	1,000	1,000	1,000	
G. Total			3.700	6.400	8.210	8.210	8.210	8.310	

Note: 1/: The total area of 6,210 ha excludes the experimental farm of 90 ha. The total cultivated area will be 6,300 ha, accordingly.

2/: The pareuthesized figures show acreages of the seed farm

4C-8. Management of the Experimental Farm

The experimental farm and propagation farm will be managed as follows;

Seed Requirement and Production

The experimental farm of totally 90 ha will consist of the experimental farm of 72 ha and seed farm of 18 ha. The basic seed farm will be located in the seed farm in future. The experimental farm will be an independent block surrounded by the service roads. The seed farm of 18 ha has been planned to meet the seed requirement in the propagation farm of 300 ha.

Seed Requirement and Production

Item	Seed farm	Experi. farm	Propaga. farm	Main farm
Area (ha)	18	72	300	6,210
Seed per ha (kg/ha)	100	100	100	100
Seed requirement (ton)	1.8	7.2	30.0	621.0
Yield per ha (ton/ha)	2.5	2.5	4.5	4.5
Seed production (ton)	45.0	180.0	1,350.0	27,945.0

Note: The seed requirement for the main farm will be 621 tons whereas the seed production after propagation will be 1,350 tons. Therefore, sufficient volume of seed can be secured even if a considerable volume is lost in seed screaning.

Imput Materials

The necessary imput materials in the experimental farm management will be as follows;

Item	Materials per ha. (kg/ha)	Quantity of materials (ton)	Necessary 1/ materials (ton)	Unit price (I.D.)	Price (I.D.)
Seed	100	9.0	11.7	137.42	1,607
Urea 2/	260	23.4	30.4	41.00	1,246
T.S.P. 2/	174	15.7	20.4	35.70	728
Herbicide 3/	15	1.4	1.8	1,364.00	2,455
Kitajin, powder	30	2.7	3.5	120.00	420
Sumithion emulsion	1 (lit/ha)	9.0	117	2.19	256
Machinery cost 4/ (I.D.)	26.4	2,376	3,088	-	3,088
Total					9,800

Note:

1/ Experimentations are apt to require a bigger volume of input materials than estimated. Therefore, the cost is estimated to secure 130 % of the estimated volume of materials.

2/ Urea and T.S.P. necessary to attain the target yield have been adopted.

3/ Pylazorate type granular herbicide

4/ Quoted from the Machinery Cost by Crops (see Main Report Table 4-4)

Farm Machinery and Laboratory Equipment

a) Farm Machinery

Machinery	Total No.	Unit Cost (I.D.)	Total Cost (I.D.)
Rotary harrow, 2.6m	2	1,230	2,460
Seed drill, 21 rows	2	1,710	3,420
Power sprayer	5	260	1,300
Mist duster, 20 kg	5	10	50
Transplanter, 8 rows	3	1,810	5,430
Ridzer	2	250	500
Lime sower, 400 ℓ	3	300	900
Motercycle	5	100	500
Pick up	3	1,100	5,500
Others			1,940
Total			22,000

Farm machineries other than mentioned above will be diverted from the main farm.

b) Laboratory Equipment

Item	Total No.	Unit Cost (I.D.)	Total Cost (I.D.)
Thermostatic germinators	1	336	336
Testing rice husker, for one sheaf	1	46	46
Testing rice pearling mill	1	155	155
Stalk balances (200 g)	1	23	23
Specific gravity balance	1	112	112
Granometers	2	9	18
Rice & Barley moisture meter	1	93	93
Rice shattering habit tester	1	139	139
Fertility counter (seed sortor & counter)	1	464	464
Indoor seedling farm set	1	85	85
Quadrate sampling thresher	1	58	58
Seed collecting thresher	1	186	186

Item	Total No.	Unit Cost (I.D.)	Total Cost (I.D.)
Quadrate sampling huller	1	155	155
Quadrate sampling winnower	1	97	97
Quadrate sampling rice separator	1	23	23
Rice polisher (18 ℓ)	1	62	62
Quadrate sampling grain dryer	1	232	232
Soil sampler for 100 ml cylinder	1	32	32
Soil sampler cylinders (100 ml)	10	5	50
Soil tensiometers 3 type	30	10.8	325
Paddy field receded depth tester	10	23.2	232
Electric conductivity meters	1	23	23
Oxidation-reduction potential meter	1	31	31
Glass electrode pH meter	1	32	32
Incubators (97x53x67)	1	274	274
Large-scaled hot air dryer	1	528	528
Stirrer	1	93	93
Ion-exchange desalinized water equipment	1	186	186
Automatic balance	2	355.5	711
Refrigerator	1	232	232
Others			967
Total			6,000

Balance

(Income)

Item	Production (ton)	Unit Price (I.D.)	Amount (I.D.)	Remarks
Seed farm	45	137.42	6,184	(18 ha)
Experimental farm	180	85.00	15,300	(72 ha)
Total	225		21,484	(90 ha)

(Expense)

Production Materials 9,730 I.D.

(Benefit)

(Income) - (Expense) 11,754 I.D.

Propagation farm

Propagation farm has been planned as follows;

Basic Seed Farm (18 ha) → Commercial Seed Farm (Propagation farm) (300 ha) → Rice Production Farm (6,210 ha)

Annual areas of propagation farm are shown as below;

Year	Area (ha)	Percent of Area (%)	Propagation Farm (ha)
1986	2,780	45	135
1987	4,840	78	234
1988	6,210	100	300
1989	6,210	100	300
1990	6,210	100	300
1991	6,210	100	300

4C-9. Labor Requirement and Settlement Program

(1) Rice Farm Staff

The settlement program will play an important role in securing necessary personnel and laborers for smooth operation and management of the rice farm. Housing and living environmental improvement for 130 personnel, 170 laborers and 30 farm households presently living in the Project Area will be implemented as a related project to Kahlaa Rice Farm Project. In principle, farmers now living in the Project Area would be employed, with priority, by the rice farm.

Rice Farm Laborers

The peak demand of about 100 skilled laborers such as machine operators and drivers will be created in paddy sowing and harvesting seasons. On the other hand, unskilled laborers of about 110 persons will be constantly required for seven months from April to October. In addition, the peak demand of 120 to 180 seasonal laborers comes periodically in June, October and December.

In order to secure such labor force, 170 laborers whose force is constantly required from the plowing to harvesting seasons will be permanently employed, and the remaining laborers will be seasonally mobilized. Seasonal laborers required will be about 20 persons for sowing and about 70 persons for harvesting.

The necessary laborers except special skilled laborers will be secured in the Project Area. Out of 270 farm households now living in the Project Area, farmers of 170 households will move to the other areas, or engage in the other jobs such as fishery. For such farmers to be employed by the rice farm, education and training will be conducted to let them work in the rice farm in the capacity of skilled laborers.

The present housing areas except that in the middle of the western boundary facing the Kahlaa river will be afforested to be ornamental forest or windbreaker zones. Therefore, the removal of present houses will not be necessarily needed. Farmers who will move from the Project Area would be provided with a conpensational farm land to continue agriculture.

Rice Farm Personnel

The necessary rice farm personnel such as paddy experts and irrigation engineers will be 130 persons. (see 4-C-9)

(2) Village Plan

The village plan for the rice farm aims to materialize a village where living and production environments have a harmony. The integrated farm facilities including the farm management office will be installed adjacent to the village though the total cultivated area of 6,300 ha in the Project is divided into four farm management units.

The state farm system will be adopted for the farm management. Farmers will not have their individual farm but take part in the farm management as state farm laborers.

Present villages are mostly located in the Kahlaa levee. One of the reasons might be a short distance to Kahlaa town and Amara city, cores of the rural life environment, but it is considered that the river has played important social and economic roles in farmers' mode of life.

Taking it into consideration, three village plans were studied as follows;

- To scatter villages in farm management units;
- To locate a village in the heart of the Project Area; and,
- To place a village in the middle of the western Project Area boundary.

As a result, the middle of the western boundary has been proposed as village site due to the following reasons;

(i) The above-mentioned mode of living centering around the river seems to continue in future, too.

(ii) The proposed village site is convenient in transportation to and from Kahlaa town and Amara city. Bus service will be made available after construction of Kahlaa bridge because a provincial road runs along the opposite bank of the Kahlaa river to the Project Area.

(iii) The Kahlaa levee is relatively high in elevation.

(iv) The proposed village site lies somewhat to the south of the heart of the Project Area. However, it being located nearly in the central part of the Project Area, operation and maintenance of facilities will be easy.

(v) The proposed road system with tracks and bus services for rice farm staff will make the transportation and traffic within the Project area smooth, so rice farm staff will not have to spend much time to go to and come back from farm fields. As for farm machinery and imput materials, the farm operation base with a temporary storehouse will be installed in each farm operation unit. As a conclusion, it is not necessary to locate a village in each farm operation unit.

(vi) A collective housing area system has been proposed aiming at a high utilization efficiency of public facilities such as mosque, clinic, drinking water system, sewerage and recreation facilities.

(vii) The major water source facilities such as intake gates, irrigation pump station, etc., will be located in the middle of the Kahlaa levee. Therefore, the proposed village site is advantageous in their management.

FIGURE 4C-5
VILLAGE PLAN MAP

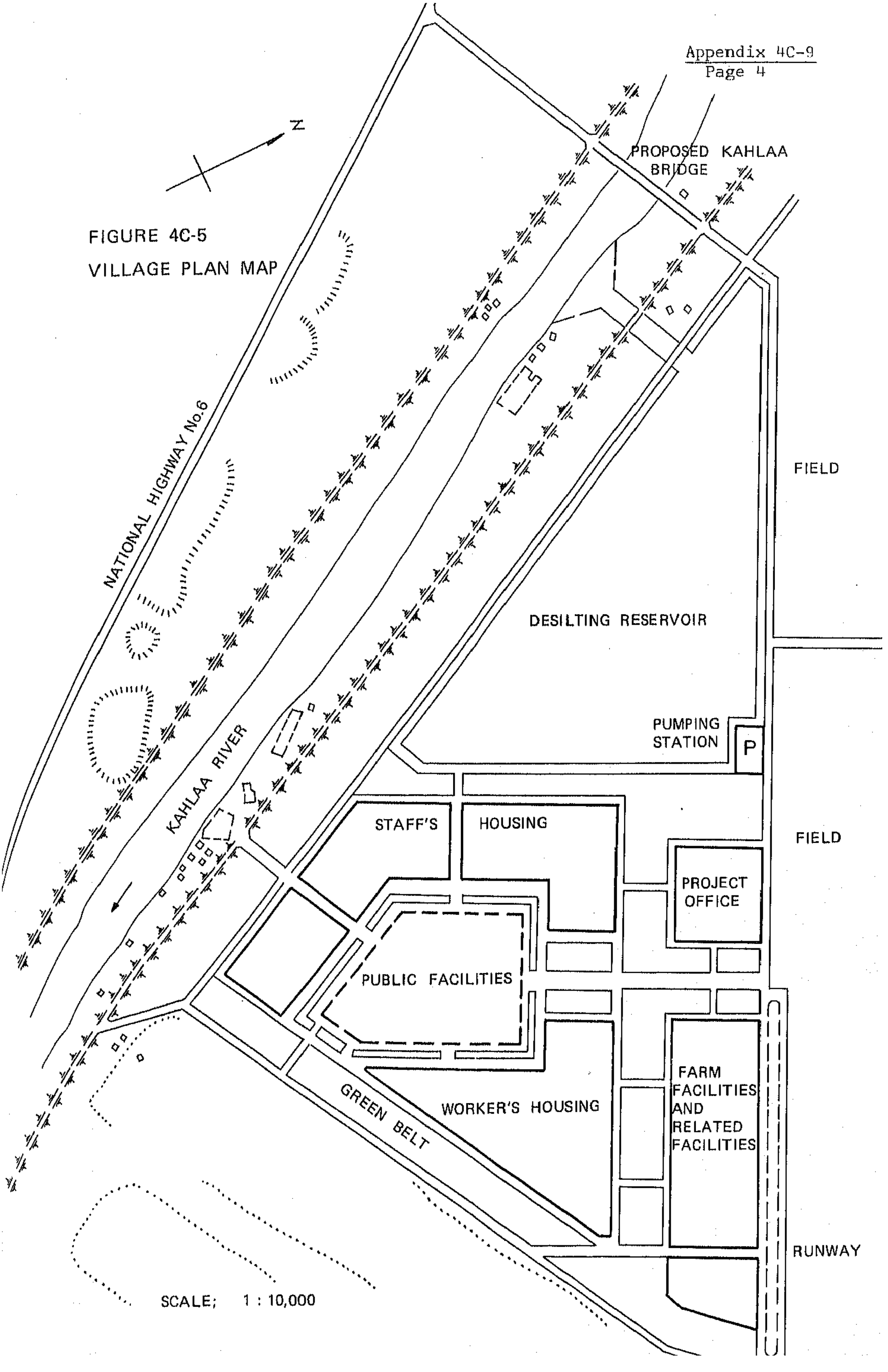


Table 4D-1 Reference Crop Evapotranspiration (ETo)

(Unit: mm/day)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1966	2.5	3.3	4.6	5.9	8.8	11.5	11.1	10.7	9.5	5.1	4.2	2.3	6.6
1967	2.0	2.5	4.2	5.8	8.5	10.6	11.0	10.0	9.0	5.3	6.5	2.0	6.5
1968	1.9	3.2	4.5	5.8	8.8	11.1	11.3	10.2	9.0	5.2	4.1	2.2	6.4
1969	1.9	3.2	4.9	5.8	8.7	11.0	10.5	10.0	9.0	5.4	3.9	2.5	6.4
1970	2.0	3.2	4.6	6.2	8.8	11.3	11.0	10.0	8.6	5.1	4.2	2.0	6.4
1971	2.0	3.2	4.6	5.8	8.9	10.8	11.1	10.0	8.6	4.9	3.9	2.0	6.3
1972	1.8	2.4	3.3	4.8	8.3	11.0	10.8	10.5	8.8	5.3	4.4	1.7	6.1
1973	2.0	3.7	3.9	5.2	9.5	10.8	11.2	10.8	9.6	5.7	4.0	2.2	6.6
1974	2.0	2.3	3.7	4.9	8.7	11.2	11.0	10.4	9.5	5.2	4.1	1.9	6.2
1975	1.9	2.5	3.5	4.9	8.9	11.3	11.2	10.6	9.5	5.0	3.9	1.9	6.3
1976	2.0	2.5	3.3	5.0	8.3	10.0	11.1	10.3	9.5	5.3	4.1	2.4	6.2
1977	1.8	2.8	3.7	4.8	8.9	11.2	11.3	10.8	9.5	5.1	4.9	2.4	6.4
1978	2.1	2.6	3.6	5.0	8.5	11.1	11.3	10.3	9.3	5.4	3.6	2.4	6.3
Mean	2.0	2.9	4.0	5.4	8.7	11.0	11.1	10.4	9.2	5.2	4.3	2.1	6.4

Table 4D-2 Crop Evapotranspiration (ET crop)
(Paddy)

(Unit: mm/day)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1966	-	-	-	-	9.2	12.1	12.2	14.4	12.8	5.1	4.2	-	10.1
1967	-	-	-	-	8.9	11.1	12.1	13.5	12.2	5.3	6.5	-	10.1
1968	-	-	-	-	9.2	11.7	12.4	13.8	12.2	5.2	4.1	-	9.9
1969	-	-	-	-	9.1	11.6	11.6	13.5	12.2	5.4	3.9	-	9.7
1970	-	-	-	-	9.2	11.9	12.1	13.5	11.6	5.1	4.2	-	9.7
1971	-	-	-	-	9.3	11.3	12.2	13.5	11.6	4.9	3.9	-	9.6
1972	-	-	-	-	8.7	11.6	11.9	14.2	11.9	5.3	4.4	-	9.9
1973	-	-	-	-	10.0	11.3	12.3	14.6	13.0	5.7	4.0	-	10.2
1974	-	-	-	-	9.1	11.8	12.1	14.0	12.8	5.2	4.1	-	10.0
1975	-	-	-	-	9.3	11.9	12.3	14.3	12.8	5.0	3.9	-	10.0
1976	-	-	-	-	8.7	10.5	12.2	13.9	12.8	5.3	4.1	-	9.8
1977	-	-	-	-	9.3	11.8	12.4	14.6	12.8	5.1	4.9	-	10.3
1978	-	-	-	-	8.9	11.7	12.4	13.9	12.6	5.4	3.6	-	9.9
Mean	-	-	-	-	9.1	11.6	12.2	14.0	12.4	5.2	4.3	-	10.0

Table 4D-3 Crop Evapotranspiration (ET crop)
(Wheat)

(Unit: mm/day)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1966	2.8	3.6	5.1	6.5	1.8	-	-	-	-	-	2.1	2.5	3.3
1967	2.2	2.8	4.6	6.4	1.7	-	-	-	-	-	3.3	2.2	3.4
1968	2.1	3.5	5.0	6.4	1.8	-	-	-	-	-	2.1	2.4	3.1
1969	2.1	3.5	5.4	6.4	1.7	-	-	-	-	-	2.0	2.8	3.2
1970	2.2	3.5	5.1	6.8	1.8	-	-	-	-	-	2.1	2.2	3.1
1971	2.2	3.5	5.1	6.4	1.8	-	-	-	-	-	2.0	2.2	3.1
1972	2.0	2.6	3.6	5.3	1.7	-	-	-	-	-	2.2	1.9	2.7
1973	2.2	4.1	4.3	5.7	1.9	-	-	-	-	-	2.0	2.4	3.1
1974	2.2	2.5	4.1	5.4	1.7	-	-	-	-	-	2.1	2.1	2.7
1975	2.1	2.8	3.9	5.4	1.8	-	-	-	-	-	2.0	2.1	2.7
1976	2.2	2.8	3.6	5.5	1.7	-	-	-	-	-	2.1	2.6	2.8
1977	2.0	3.1	4.1	5.3	1.8	-	-	-	-	-	2.5	2.6	3.0
1978	2.3	2.9	4.0	5.5	1.7	-	-	-	-	-	1.8	2.6	2.8
Mean	2.2	3.2	4.4	5.9	1.8	-	-	-	-	-	2.2	2.3	3.0

Table 4D-4 Crop Evapotranspiration (ET crop)
(Barley)

(Unit: mm/day)

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
1966	2.8	3.6	5.1	1.2	-	-	-	-	-	2.6	4.6	2.5	3.0
1967	2.2	2.8	4.6	1.2	-	-	-	-	-	2.7	7.2	2.2	3.1
1968	2.1	3.5	5.0	1.2	-	-	-	-	-	2.6	4.5	2.4	2.9
1969	2.1	3.5	5.4	1.2	-	-	-	-	-	2.7	4.3	2.8	3.0
1970	2.2	3.5	5.1	1.2	-	-	-	-	-	2.6	4.6	2.2	2.9
1971	2.2	3.5	5.1	1.2	-	-	-	-	-	2.5	4.3	2.2	2.9
1972	2.0	2.6	3.6	1.0	-	-	-	-	-	2.7	4.8	1.9	2.5
1973	2.2	4.1	4.3	1.0	-	-	-	-	-	2.9	4.4	2.4	2.9
1974	2.2	2.5	4.1	1.0	-	-	-	-	-	2.6	4.5	2.1	2.6
1975	2.1	2.8	3.9	1.0	-	-	-	-	-	2.5	4.3	2.1	2.5
1976	2.2	2.8	3.6	1.0	-	-	-	-	-	2.7	4.5	2.6	2.6
1977	2.0	3.1	4.1	1.0	-	-	-	-	-	2.6	5.4	2.6	2.8
1978	2.3	2.9	4.0	1.0	-	-	-	-	-	2.7	4.0	2.6	2.6
Mean	2.2	3.2	4.4	1.0	-	-	-	-	-	2.6	4.7	2.3	2.8

Table 4D-5 Selected KC Values for Each Crop

Month	Paddy	Wheat	Barley	Trees
Jan.	-	1.1	1.1	0.9
Feb.	-	1.1	1.1	0.9
Mar.	-	1.1	1.1	0.9
Apr.	-	1.1	0.2	0.9
May	1.05	0.2	-	0.9
Jun.	1.05	-	-	0.9
Jul.	1.1	-	-	0.9
Aug.	1.35	-	-	0.9
Sep.	1.35	-	-	0.9
Oct.	1.0	-	0.5	0.9
Nov.	1.0	0.5	1.1	0.9
Dec.	-	1.1	1.1	0.9

Table 4D-6 Crop Salt Tolerance Level 1/

(Unit: mmho/cm)

Yield Potential	100%		90%		75%		50%		
Crop	ECe 2/	ECw 3/	ECe	ECw	ECe	ECw	ECe	ECw	Max.ECe 4/
Paddy	3.0	2.0	3.8	2.6	5.1	3.4	7.2	4.8	12
Wheat	6.0	4.0	7.4	4.9	9.5	6.4	13.0	8.7	20
Barley	8.0	5.3	10.0	6.7	13.0	8.7	18.0	12.0	28
Trees 5/	4.0	2.7	6.8	4.5	10.9	7.3	17.9	12.0	32

Note: 1/ Source: Ayers R.S. and Westcot, D.W. Water quality for agriculture

2/ ECe: Electric conductivity of the soil saturation extract

3/ ECw: Electric conductivity of the irrigation water

4/ Max. ECe: Maximum tolerable electric conductivity of the soil saturation extract

5/ Data on palm are applied.

Table 4D-7 Irrigation Water Requirements for Each Crop (1)

(Unit: MCM)

Year	Crop	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1966	Paddy	-	-	-	-	13.55	53.41	66.39	70.80	61.20	23.29	2.74	-	291.38
	Wheat	0.97	1.15	2.47	3.32	0.24	-	-	-	-	0.03	0.97	1.27	10.42
	Barley	0.96	1.13	2.44	0.40	-	-	-	-	-	0.26	2.37	1.25	8.81
	Trees	0.12	0.14	0.32	0.46	0.71	0.90	0.90	0.87	0.76	0.35	0.34	0.18	6.05
	Total	2.05	2.42	5.23	4.18	14.50	54.31	67.29	71.67	61.96	23.93	6.42	2.70	316.70
	Mean Dis. 1/	0.77	1.00	1.95	1.61	5.41	20.95	25.12	26.76	23.90	8.93	2.48	1.01	-
1967	Paddy	-	-	-	-	13.20	51.89	66.15	69.61	59.88	24.38	2.58	-	287.69
	Wheat	0.87	0.85	2.48	3.33	0.09	-	-	-	-	0.02	0.21	1.67	9.52
	Barley	0.86	0.84	2.46	0.45	-	-	-	-	-	0.46	2.82	1.01	8.90
	Trees	0.11	0.11	0.34	0.46	0.66	0.83	0.90	0.82	0.71	0.44	0.37	0.14	5.89
	Total	1.84	1.80	5.28	4.24	13.95	52.72	67.05	70.43	60.59	25.30	5.98	2.82	312.00
	Mean Dis.	0.69	0.74	1.97	1.64	5.21	20.34	25.03	26.30	23.38	9.45	2.31	1.05	-
1968	Paddy	-	-	-	-	13.55	52.80	66.86	70.33	59.88	24.26	2.67	-	290.35
	Wheat	1.13	1.70	2.69	2.57	0.24	-	-	-	-	0.00	1.02	1.55	10.90
	Barley	1.12	1.68	2.66	0.00	-	-	-	-	-	0.45	2.22	1.15	9.28
	Trees	0.16	0.23	0.37	0.32	0.71	0.89	0.92	0.83	0.71	0.43	0.30	0.16	6.03
	Total	2.41	3.61	5.72	2.89	14.50	53.69	67.78	71.16	60.59	25.14	6.21	2.86	316.56
	Mean Dis.	0.90	1.49	2.14	1.11	5.41	20.71	25.31	26.57	23.38	9.39	2.40	1.07	-

Note: 1/ mean discharge Unit: cu.m/sec

Table 4D-8 Irrigation Water Requirements for Each Crop (2)

(Unit: MCM)

Year	Crop	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1969	Paddy	-	-	-	-	13.14	52.65	64.89	69.61	59.88	24.49	2.70	-	287.45
	Wheat	0.00	1.63	2.53	2.22	0.00	-	-	-	-	0.00	0.92	1.42	8.72
	Barley	0.00	1.62	2.51	0.00	-	-	-	-	-	0.46	2.22	1.41	8.22
	Trees	0.00	0.23	0.34	0.27	0.64	0.87	0.87	0.82	0.71	0.44	0.30	0.20	5.69
	Total	0.00	3.48	5.38	2.49	13.78	53.52	65.85	70.43	60.59	25.39	6.14	3.03	310.08
	Mean Dis. 1/	0.00	1.44	66.69	0.96	5.14	20.65	24.59	26.30	23.38	9.48	2.37	1.13	-
1970	Paddy	-	-	-	-	13.55	53.10	66.15	69.61	58.55	24.14	2.74	-	287.84
	Wheat	0.33	1.61	2.74	3.54	0.24	-	-	-	-	0.00	0.97	1.18	10.61
	Barley	0.33	1.60	2.71	0.45	-	-	-	-	-	0.45	2.37	1.17	9.08
	Trees	0.02	0.23	0.37	0.50	0.71	0.89	0.90	0.82	0.67	0.43	0.34	0.16	6.04
	Total	0.68	3.44	5.82	4.49	14.50	53.99	67.05	70.43	59.22	25.02	6.42	2.51	313.75
	Mean Dis.	0.25	1.42	2.17	1.73	5.41	20.83	25.03	26.30	22.85	9.34	2.48	0.94	-
1971	Paddy	-	-	-	-	13.59	52.19	66.39	69.61	51.18	23.90	2.49	-	279.35
	Wheat	0.95	1.48	2.52	2.52	0.24	-	-	-	-	0.00	0.59	0.95	9.25
	Barley	0.95	1.46	2.49	0.00	-	-	-	-	-	0.43	1.84	0.95	8.12
	Trees	0.12	0.20	0.34	0.32	0.73	0.85	0.90	0.82	0.67	0.39	0.25	0.12	5.71
	Total	2.02	3.14	5.35	2.84	14.56	53.04	67.29	70.43	51.85	24.72	5.17	2.02	302.43
	Mean Dis.	0.75	1.30	2.00	1.10	5.44	20.46	25.12	26.30	20.00	9.22	1.99	0.75	-

Note: 1/ mean discharge Unit: cu.m/sec

Table 4D-9 Irrigation Water Requirements for Each Crop (3)

(Unit: MCM)

Year	Crop	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1972	Paddy	-	-	-	-	13.43	52.65	65.68	70.80	59.21	24.39	2.76	-	288.91
	Wheat	0.28	1.18	1.35	2.50	0.23	-	-	-	-	0.00	1.02	0.12	6.68
	Barley	0.27	1.17	1.34	0.19	-	-	-	-	-	0.46	2.47	0.12	6.02
	Trees	0.02	0.16	0.18	0.34	0.67	0.87	0.89	0.87	0.69	0.44	0.35	0.00	5.48
	Total	0.57	2.51	2.87	3.03	14.33	53.52	66.57	71.67	59.90	25.28	6.60	0.24	307.09
	Mean Dis. 1/	0.21	1.00	1.07	1.17	5.35	20.65	24.85	26.76	23.11	9.44	2.55	0.09	-
1973	Paddy	-	-	-	-	13.78	52.19	66.63	70.80	61.64	24.88	2.71	-	292.63
	Wheat	1.18	1.35	2.31	2.97	0.26	-	-	-	-	0.00	0.92	0.28	9.27
	Barley	1.17	1.34	2.29	0.38	-	-	-	-	-	0.50	2.26	0.27	8.21
	Trees	0.16	0.16	0.32	0.41	0.78	0.85	0.92	0.89	0.76	0.46	0.32	0.02	6.05
	Total	2.51	2.85	4.92	3.76	14.82	53.04	67.55	71.69	62.40	25.84	6.21	0.57	316.16
	Mean Dis.	0.94	1.18	1.84	1.45	5.53	20.46	25.22	26.77	24.07	9.65	2.40	0.21	-
1974	Paddy	-	-	-	-	13.54	52.95	66.15	70.80	61.20	24.26	2.69	-	291.59
	Wheat	0.19	0.10	1.86	2.73	0.23	-	-	-	-	0.00	0.89	0.00	6.00
	Barley	0.19	0.10	1.84	0.31	-	-	-	-	-	0.45	2.32	1.05	6.26
	Trees	0.00	0.00	0.25	0.37	0.71	0.89	0.90	0.85	0.76	0.43	0.32	0.00	5.48
	Total	0.38	0.20	3.95	3.41	14.48	53.84	67.05	71.65	61.96	25.14	6.22	1.05	309.33
	Mean Dis.	0.14	0.08	1.47	1.32	5.41	20.77	25.03	26.75	23.90	9.39	2.40	0.39	-

Note: 1/ mean discharge Unit: cu.m/sec

Table 4D-10 Irrigation Water Requirements for Each Crop (4)

(Unit: MCM)

Year	Crop	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1975	Paddy	-	-	-	-	13.36	53.10	66.63	70.80	61.20	24.03	2.70	-	291.82
	Wheat	0.47	0.95	2.10	2.67	1.13	-	-	-	-	0.00	0.92	1.41	9.65
	Barley	0.46	0.95	2.08	0.27	-	-	-	-	-	0.43	2.22	0.00	6.41
	Trees	0.04	0.12	0.28	0.35	0.69	0.89	0.92	0.87	0.76	0.41	0.30	0.00	5.63
	Total	0.97	2.02	4.46	3.29	15.18	53.99	67.55	71.67	61.96	24.87	6.14	1.41	313.51
	Mean Dis.1/	0.36	0.83	1.67	1.27	5.67	20.33	25.22	26.76	23.90	9.29	2.37	0.53	-
1976	Paddy	-	-	-	-	13.25	50.98	66.39	70.56	61.20	24.38	2.73	-	289.49
	Wheat	0.35	0.80	1.72	2.20	0.14	-	-	-	-	0.00	0.97	0.89	7.07
	Barley	0.34	0.79	1.27	0.24	-	-	-	-	-	0.46	2.32	0.88	6.30
	Trees	0.02	0.09	0.23	0.28	0.66	0.80	0.90	0.85	0.76	0.44	0.32	0.11	5.46
	Total	0.71	1.68	3.22	2.72	14.05	51.78	67.29	71.41	61.96	25.28	6.34	1.88	308.32
	Mean Dis.	0.27	0.67	1.20	1.05	5.25	19.98	25.12	26.66	23.90	9.44	2.45	0.70	-
1977	Paddy	-	-	-	-	13.53	52.95	66.86	70.80	61.20	24.14	2.84	-	292.32
	Wheat	0.75	1.32	1.35	2.66	0.21	-	-	-	-	0.02	0.83	0.57	7.71
	Barley	0.74	1.31	1.34	0.31	-	-	-	-	-	0.05	2.42	0.57	6.74
	Trees	0.09	0.18	0.16	0.35	0.71	0.89	0.92	0.89	0.76	0.43	0.32	0.05	5.75
	Total	1.58	2.81	2.85	3.32	14.45	53.84	67.78	71.69	61.96	24.64	6.41	1.19	312.52
	Mean Dis.	0.59	1.16	1.06	1.28	5.40	20.77	25.31	26.77	23.90	9.20	2.47	0.44	-

Note: 1/ mean discharge Unit: cu.m/sec

Table 4D-11 Irrigation Water Requirements for Each Crop (5)

(Unit: MCM)

Year	Crop	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1978	Paddy	-	-	-	-	13.48	52.80	66.86	70.55	60.75	24.49	2.55	-	291.48
	Wheat	0.59	1.06	2.05	2.86	0.23	-	-	-	-	0.00	0.68	1.18	8.65
	Barley	0.58	1.05	2.03	0.38	-	-	-	-	-	0.46	1.89	1.17	7.56
	Trees	0.07	0.12	0.27	0.39	0.69	0.89	0.92	0.85	0.74	0.44	0.25	0.16	5.79
	Total	1.24	2.23	4.35	3.63	14.40	53.69	67.78	71.40	61.49	25.39	5.37	2.51	313.48
	Mean Dis. 1/	0.46	0.92	1.62	1.40	5.38	20.71	25.31	26.66	23.72	9.48	2.07	0.94	-
Mean (1966-1978)	Paddy	-	-	-	-	13.46	52.59	66.32	70.36	59.77	24.23	2.68	-	289.41
	Wheat	0.59	1.20	2.14	2.78	0.17	-	-	-	-	0.00	0.89	0.68	8.45
	Barley	0.58	1.19	2.11	0.21	-	-	-	-	-	0.41	2.27	0.67	7.44
	Trees	0.07	0.16	0.28	0.37	0.69	0.87	0.90	0.85	0.73	0.41	0.32	0.07	5.72
	Total	1.24	2.55	4.53	3.36	14.32	53.46	67.22	71.21	60.50	25.05	6.16	1.42	311.02
	Mean Dis.	0.46	1.05	1.69	1.30	5.35	20.63	25.10	26.59	23.34	9.35	2.38	0.53	-

Note: 1/ mean discharge Unit: cu.m/sec

Table 4D-12 Measurements of Water Requirements in Paddy Field (1)
(Summer Season)

Item	Test Field No.4			Test Field No.5		
1. Location	Paddy field near marsh			Western part of the Project Area		
2. Testing Data	1979 July 9 to 11			1979 July 19 to 22		
3. Field Condition						
Irrigation	Plot to plot irrigation by gravity flow from the Gasma canal, W = 1.0m, D = 0.5m			Plot to plot irrigation by pumping canal size W = 1.5m, D = 0.3m		
Drainage	no facilities, 50cm difference between paddy field and marsh			no facilities		
Farm plot (Area)	irregular shape, ranging from 1 to 5 are			irregular shape, ranging from 2 to 5 are		
Soil texture	Silty clay loam			Silty clay loam		
Water table	Equal to field surface			Equal to field surface		
Paddy cultivation	Three weeks after sowing			Three weeks after sowing		
4. Measurement	Test (A)	Test (B)	Mean	Test (A)	Test (B)	Note
4-1. by N-type Instrument						
Water requirement in depth(mm)	21	25	23	24	12*	*Due to irrigation water flowing into the test field, values are not reliable
Evaporation (mm)	12.8	19.4	16.1	19.7	16.1	
Percolation (mm)	8.2	15.6	6.9	4.3	-	
4-2. by Direct Reading						
Water requirement in depth(mm)	15	30	22.5	24	4*	
Evaporation (mm)	12.8	19.4	16.1	19.7	16.1	
Percolation (mm)	2.2	10.6	6.4	4.3	-	

Table 4D-13 Measurements of Water Requirements in Paddy Field (2)
(Summer Season)

Item	Test Field No.6			Test Field No.1		
1. Location	Western part of the Project Area			Vicinity of Aman School		
2. Testing Date	1979 July 22 to 27			1979 July 28 to 29		
3. Field Condition						
Irrigation	Plot to plot irrigation by pumping			Newly prepared field for testing		
Drainage	No facilities			Provided canal with 1m depth		
Farm plot (Area)	Irregular shape, 5 are			Square, 1 acre, crack well-developed		
Soil texture	Silty clay loam			Silty clay		
Water table	Equal to field surface			More than 2.0m below the ground surface		
Paddy cultivation	Immediately after sowing			No cultivation		
4. Measurement	Test (A)	Test (B)	Mean	Test (A) (Before puddling)	Test (B) (After puddling)*	Note
4-1. by N-type Instrument						*Ridges were covered by Vinyl sheets
Water requirement in depth (mm)	28	25	26.5	Due to high percolation, measurements were impossible	42	
Evaporation (mm)	20.7	20.1	20.4		30.6	
Percolation (mm)	7.3	4.9	6.1		11.4	
4-2. by Direct Reading						
Water requirement in depth (mm)	27	23	25.0		55	
Evaporation (mm)	20.7	20.1	20.4		30.6	
Percolation (mm)	6.3	2.9	4.6		24.4	

Table 4D-14 Measurements of Water Requirements in Paddy Field (3)
(Winter Season)

Item	Test Field No.1	Test Field No.2
1. Location	Vicinity of Aman School	Central part of the Project
2. Testing Date	1979 January 13 to 15	1979 January 29 to 31
3. Field Condition		
Irrigation	No irrigation, newly prepared field for testing	No irrigation, newly prepared field for testing
Drainage	A canal with 1m depth was provided	No facilities
Farm plot	Square, 1 acre, crack well-developed	Square 1 acre
Soil texture	Silty clay	Silty clay loam
Water table	1.4m below field surface	0.7m below field surface
Field condition	Keeping drainage water at 60cm below surface	Wet due to previous rainfall, a fallow land

4. Measurement	Test Field No.1 Test (A)	Test Field No.1 Test (B)	Test Field No.1 Mean	Test Field No.2 Test (A)	Test Field No.2 Test (B)	Note
4-1. by N-type Instrument						
Water requirement in depth (mm)	354	184	268	Due to the rapid percolation, Measurements were impossible	86	Standing water of about 60mm deep was completely percolated within six to ten hours in both cases.
Evaporation (mm)	3.5	3.5	3.5		1.6	
Percolation (mm)	350.5	180.5	264.5		84.4	
4-2. by Direct Reading						
Water requirement in depth (mm)	210	116	163		101	
Evaporation (mm)	3.5	3.5	3.5		1.6	
Percolation (mm)	206.5	112.5	159.5		99.4	