(5)-7 Summary of Pit Excavation Survey, P-7

PROFILE DESCRIPTION

Site No. : P-7 Survey Date : 31 JAN. '89

A. Information of the Site

Soil Mapping Unit : Yc-mdl

FAO Classification : Calcic Yermosols, moderate deep

USDA Classification : Typic Calciothids

Land Suitability Classification : S2kd

Location : About 20km west south west of the pilot farm site. Hailat Al-Rakah

Landform : Wadi bank

Elevation : 270m Slope : <1%

Micro Relief : Even

Land use : Cultivation (Rhoase grass)

B. Information of the Soil

Parent Material : Recent alluvium over subrecent and old alluvium

Drainage : Imperfect

Flood Hazard : None

Surface Feature : Loose sand

Evidence of Erosion : None

Wind blown Sand Hazard : Slight

C. Brief Description of the Profile

Moderate deep profile developed on alluvium. The soil texture is sand. There are gravel layer at 15-70cm in depth in the profile.

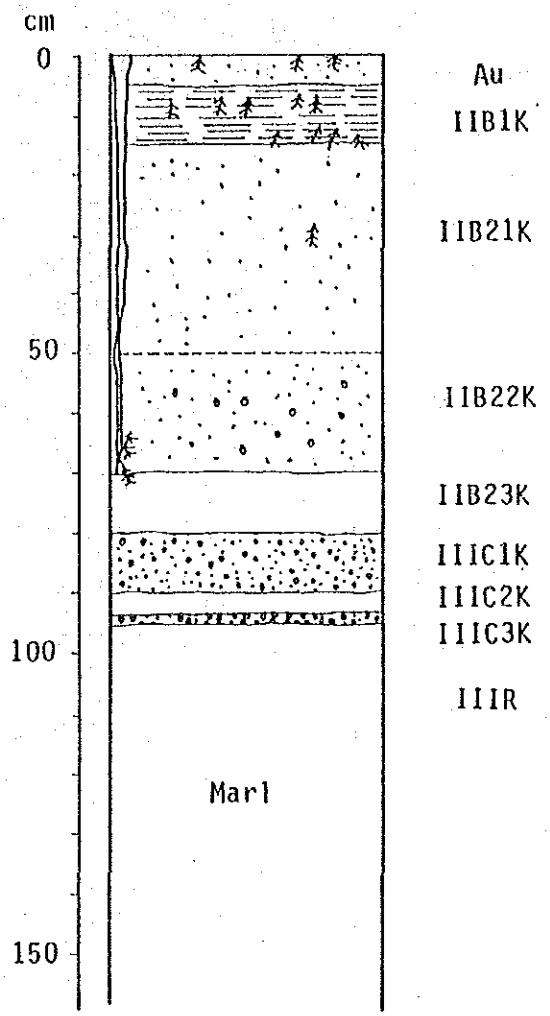
C Horizon occurs from 80cm in depth. There is gypsum content throughout the profile. This soil has moderate suitability for irrigated agriculture development.

D. Profile Description (P-7)

Horizon	Depth (cm)	Description
Au	0 - 5	Dull yellow orange (10YR 7/4) dry, dull yellowish brown (10YR 5/4) moist; sand, 20% gravel (1-10mm in diameter); dry loose, moist loose; single grain; crack (3cm in width); few fine roots; many fine pores; strong reaction to HCl; clear smooth to:

IIB1K	5 - 15	Dull orange (7.5YR 7/4) dry, orange (7.5YR 6/6) moist; fine sand; 10% gravel (1-2mm in diameter); dry soft, moist very friable; weak platy; crack; common fine roots; many fine pores; violent reaction to HCl; clear smooth to:
IIB21K	15 - 50	Orange (7.5YR 7/6) dry, orange (7.5YR 6/6) moist; gravelly sandy loam, 40% gravel (2-5mm in diameter); dry very hard, moist friable; subangular blocky; crack; few fine roots; many fine pores; gypsum; violent reaction to HCl; many $CaCO_3$ concretions; abrupt smooth to:
IIB22K	50 - 70	Dull orange (7.5YR 7/4) dry, orange (7.5YR 6/6) moist; gravelly sand, 60% gravel (2-10mm in diameter); dry extremely hard, moist very farm; weak subangular blocky; crack; few fine roots; common fine pores; gypsum; violent reaction to HCl; clear smooth to:
IIB23K	70 - 80	Light yellow orange (10YR 8/4) dry, dull yellow orange (10YR 6/4) moist; fine sand, 10% gravel (2mm in diameter); dry extremely hard, moist very farm; subangular blocky; no roots; few fine pores; gypsum; violent reaction to HCl; clear smooth to:
IIC1K	80 - 90	Dull yellow orange (10YR 7/3) dry, dull yellow orange (10YR 7/4) moist; 90% gravel (2-5mm in diameter); dry extremely hard, moist very firm; massive; gypsum; violent reaction to HCl; clear smooth to:
IIC2K	90 - 93	Light yellow orange (10YR 8/3) dry, dull yellow orange (10YR 6/4) moist; fine sand, 5% gravel (2-3mm in diameter); dry extremely hard, moist very firm; massive; gypsum; violent reaction to HCl; clear smooth to:
IIIC3K	93 - 95	Dull yellow orange (10YR 7/3) dry, dull yellow orange (10YR 7/4) moist; 90% gravel (2-5mm in diameter); dry extremely hard, moist very firm; massive; gypsum; violent reaction to HCl; clear smooth to:

R 95 + Light gray (2.5Y 8/2) dry, light gray (5Y 8/2) moist; marls



P-7 (Hailat Al-Rakah)

Sampl'g Depth (cm)	Bulk density (g/cm³)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
10	1.96	63.9	0.6	35.5	13.4	45.2	50.8	2.0	2.0	Sand	21	37	0.7	0.5	6.76	10.88
40	1.71	64.3	2.9	32.8	35.1	62.1	29.9	4.0	4.0	Sand	23	31	0.5	0.6	6.78	6.85
75	1.6	60.3	3.1	36.6	35.3	63.6	26.4	8.0	2.0	Sand	25	22	0.4	0.5	7.12	1.685

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
3.48	32.0	30.0	4.6	0.26	15.0	30.7	15.8	8.1	82.3	2.6	28.8	96.2	11.1	1.5		0.040
2.19	34.0	76.0	4.4	0.58	17.4	25.3	11.0	5.80	50.0	1.70	17.3	61.5	6.0	1.0		0.030
0.54	35.0	66.0	3.7	0.34	14.6	23.3	1.60	0.75	14.0	0.50	12.9	14.6	1.7	0.5		0.010

Organic matter (%)
0.8
0.6
0.2
0.2

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(5)-8 Summary of Pit Excavation Survey, P-8

PROFILE DESCRIPTION

Site No. : P-8 Survey Date : 1 FEB. '89

A. Information of the Site

Soil Mapping Unit : Yc-dl

FAO Classification : Calcic Yermosols, deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S2k

Location : About 40km west of the pilot farm site. Shasr.

Landform : Flat plain

Elevation : 290m Slope : <1%

Micro Relief : Even

Land use : Cultivation (Date palm), since 1988

B. Information of the Soil

Parent Material : Recent alluvium over subrecent and old alluvium

Drainage : Imperfect

Flood Hazard : None

Surface Feature : Loose sand

Wind blown Sand Hazard : Slight

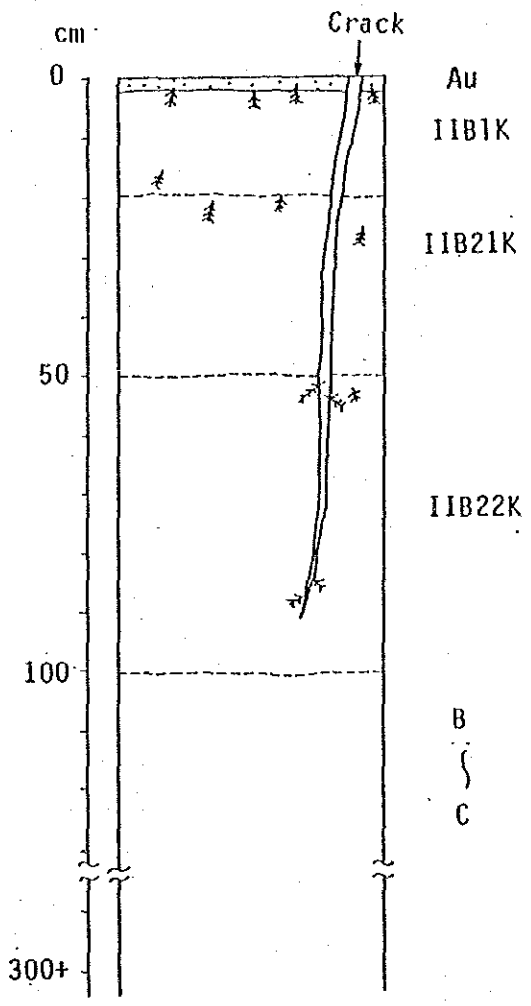
C. Brief Description of the Profile

Deep profile developed on alluvium. Surface soil is loose fine sand. Subsoil is sandy loam to loam and has subangular blocky to massive structure. Consistency of subsoil is hard in dry, very friable in moist. Cracks are developed on the profile. Roots are distributed up to 95cm in depth. This soil has moderate suitability for irrigated agriculture development.

D. Profile Description (P-8)

Horizon	Depth (cm)	Description
Au	0 - 2	Dull yellow orange (10YR 7/4) dry, dull yellowish brown (10YR 5/4) moist; gravelly fine sand, 30% gravel (2-5mm in diameter); dry loose, moist loose; single grain; crack (3cm in width); few fine roots; few fine pores; violent reaction to HCl; clear smooth to:

IIB1K	2 - 20	Dull orange (7.5YR 7/4) dry, bright brown (7.5YR 5/6) moist; sandy loam, 10% gravel (1-3mm in diameter); dry hard, moist very friable; subangular blocky; crack; few fine roots; many fine pores; gypsum crystal; violent reaction to HCl; abrupt smooth to:
IIB21K	20 - 50	Orange (7.5YR 7/6) dry, bright brown (7.5YR 5/6) moist; loam, 5% gravel (1-3mm in diameter); dry hard, moist very friable; subangular blocky; crack; few fine roots; many fine pores; gypsum crystal; violent reaction to HCl; abrupt smooth to:
IIB22K	50 - 100	Dull orange (7.5YR 7/4) dry, bright brown (7.5YR 5/8) moist; loam; dry hard, moist friable; subangular blocky; crack; few fine roots; many fine pores; gypsum crystal; violent reaction to HCl; abrupt smooth to:
B - C	100 - 300 +	Dull orange (7.5YR 7/4) dry, bright brown (7.5YR 5/8) moist; loam; dry hard, moist friable; massive; violent reaction to HCl:



P-8 (Shasr)

Sampl'g Depth (cm)	Bulk density (g/cm^3)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
10	1.54	58.1	1.1	40.8	19.9	44.8	51.2	2.0	2.0	Sand	19	18	0.4	0.4	6.91	5.39
30	1.72	65.2	1.9	32.9	13.8	32.9	63.1	2.0	2.0	Sand	21	16	0.2	0.5	7.21	0.375
80	1.63	61.4	1.3	37.3	8.3	15.5	74.5	8.0	2.0	Sand	24	12	0.5	0.5	6.76	11.04

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
1.75	30.0	85	3.0	0.30	20.5	14.6	4.40	2.50	46.0	1.0	24.7	47.3	4.6	2.0		0.025
0.12	35.0	75.0	3.9	0.28	24.8	15.7	1.50	0.55	2.0	0.14	2.2	2.4	1.2	0.10		0.025
3.53	62.0	38.0	2.6	0.20	15.0	17.3	9.40	5.10	95.0	0.90	35.3	98.6	10.2	1.6		0.010

Organic matter (%)
0.5
0.5
0.2

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(5)-9 Summary of Pit Excavation Survey, P-9

PROFILE DESCRIPTION

Site No. : P-9 Survey Date : 2 FEB. '89

A. Information of the Site

Soil Mapping Unit : Yc-md2

FAO Classification : Calcic Yermosols, moderate deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S3dk

Location : About 50km north of the pilot farm site. Dauka.

Landform : Flat plain

Elevation : 200m Slope : <1%

Micro Relief : Even

Land use : Cultivation (Rhodes grass - Center pivot irrigation)

B. Information of the Soil

Parent Material : Alluvium on limestone

Drainage : Poor

Flood Hazard : None

Surface Feature : Covered by Rhodes grass

Wind blown Sand Hazard : None

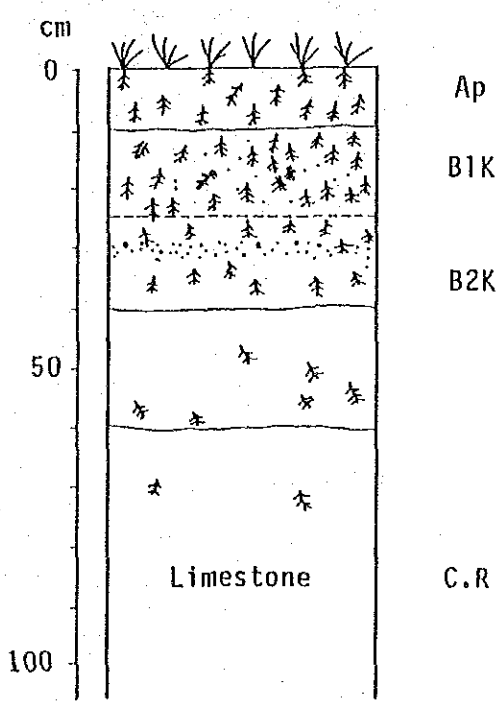
C. Brief Description of the Profile

Shallow profile developed on the limestone. Hard and platy limestone occurs at 60cm in depth. This layer is impermeable one. Drainage is poor. Salinization same as P-10 may occur in the future. Roots are distributed up to 70cm in depth. This soil is not suitable for irrigated agriculture.

D. Profile Description (P-9)

Horizon	Depth (cm)	Description
Ap	0 - 10	Dull yellow orange (10YR 6/4) moist; fine sand, 10% gravel (2-3mm in diameter); moist loose; single grain; many medium roots; common fine pores; strong reaction to HCl; clear smooth to:

B1K	10 - 25	Bright yellowish brown (10YR 6/6) moist; gravelly sandy loam, 30% gravel (2-5mm in diameter); moist very friable; subangular blocky; many medium roots; common fine pores; violent reaction to HCl; abrupt smooth to:
B2K	25 - 40	Bright yellowish brown (10YR 6/6) moist; gravelly sandy loam, 30% gravel (2-3mm in diameter); moist very friable; subangular blocky; many fine roots; common fine pores; violent reaction to HCl; clear smooth to:
C	40 - 60	Light gray (7.5YR 8/1) moist, bright brown (2.5YR 5/6) mottled 30%; moist hard; common fine roots; violent reaction to HCl; clear smooth to:
R	60 +	Limestone; gypsum mesh



P-9 (Dauka centre pivot)

Sampl'g Depth (cm)	Bulk density (g/cm³)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) mS/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
5	1.74	65.5	4.6	29.9	22.7	38.3	57.7	2.0	2.0	Sand	17	22	0.4	0.7	7.25	0.952
30	1.48	55.9	18.0	31.1	17.2	35.8	58.2	2.0	4.0	Sand	21	17	0.5	0.6	7.00	1.995
50	1.72	68.9	9.2	21.9	23.3	20.1	73.9	2.0	4.0	Sand	22	16	2.1	0.6	7.21	5.18

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
0.30	10	60	2.6	0.20	20.5		3.20	1.80	4.0	0.51	2.5	5.3	3.1	1.1		0.025
0.64	31.0	63.0	4.0	0.18	20.5		9.20	4.90	5.0	0.85	1.9	8.7	9.9	1.3		0.020
1.66	30.0	35.0	2.5	0.12	22.9		26.75	13.90	11.0	0.15	2.4	17.6	32.9	1.3		0.020

Organic matter (%)
0.5
0.4
0.4

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(5)-10 Summary of Pit Excavation Survey, P-10

PROFILE DESCRIPTION

Site No. : P-10 Survey Date : 2 FEB. '89

A. Information of the Site

Soil Mapping Unit : Yc-md2

FAO Classification : Calcic Yermosols, moderate deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S3dk

Location : About 50km north of the Pilot farm site. Dauka.

Landform : Fan undulating

Elevation : 200m Slope : <1%

Micro Relief : Undulating

Land use : Cultivation, Growth condition is bad (Rhodes grass, Date plam)

B. Information of the Soil

Parent Material : Alluvium on limestone

Drainage : Poor

Flood hazard : None

Surface feature : Salinization

Wind blown sand hazard : None

C. Brief Description of the Profile

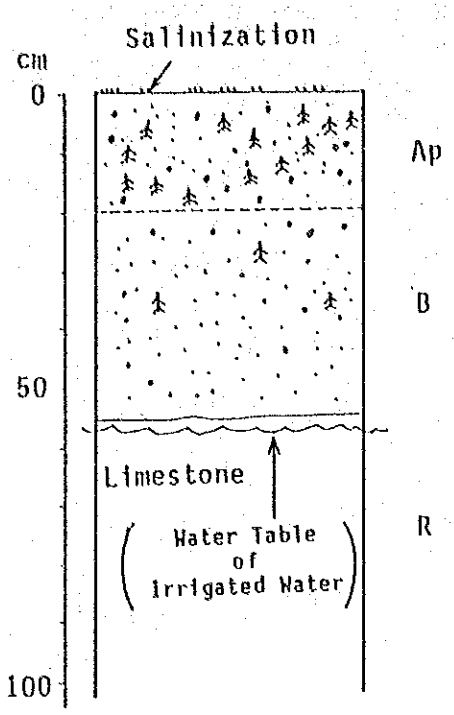
Shallow profile developed on the limestone. Hard and platy limestone occurs at 50cm depth. This layer is impermeable one. Drainage is poor. The profile is wet and the water table of irrigated water occurs at 50cm in depth. Strong salinization is observed on the surface.

This soil is not suitable for irrigated agriculture.

D. Profile Description (P-10)

Horizon	Depth (cm)	Description
Ap	0 - 20	Dull yellow orange (10YR 6/4) moist; gravelly sand; moist very friable; massive; common fine roots; common fine pores; violent reaction to HCl; abrupt smooth to:

B	20 - 55	Light yellow orange (10YR 8/3) moist; gravelly sand; moist loose; single grain; few fine roots; violent reaction to HCl; clear smooth to:
R	55 -	White; limestone; water table at 55cm depth



P-10 (Dauka local farm)

Sampl'g Depth (cm)	Bulk density (g/cm^3)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
5	1.79	71.6	15.0	13.4	24.4	41.8	58.2	—	—	Sand	16	29	0.5	0.8	7.14	2.99
40	1.78	67.9	12.9	19.2	34.7	80.3	15.7	2.0	2.0	Sand	19	22	0.7	0.7	7.21	1.334

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
0.96	14	16	4.3	0.26	34.7		7.40	4.20	18.0	0.30	7.5	20.1	9.0	0.8		0.040
0.43	3.0	3.0	3.6	0.12	30.4		2.50	1.50	9.0	0.34	6.4	11.3	1.3	0.7		0.045

Organic matter (%)
0.9
0.8

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(5)-11 Summary of Pit Excavation Survey, P-11

PROFILE DESCRIPTION

Site No. : P-11 Survey Date : 4 FEB. '89

A. Information of the Site

Soil Mapping Unit : Yc-dl

FAO Classification : Calcic Yermosols, deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S2k

Location : About 2km west of the pilot farm site

Landform : Wadi

Elevation : 270m Slope : <1%

Micro Relief : Even

Land Use : None

B. Information of the Soil

Parent Material : Recent alluvium over subrecent and old alluvium

Drainage : Imperfect

Flood Hazard : None

Surface Feature : Loose sand

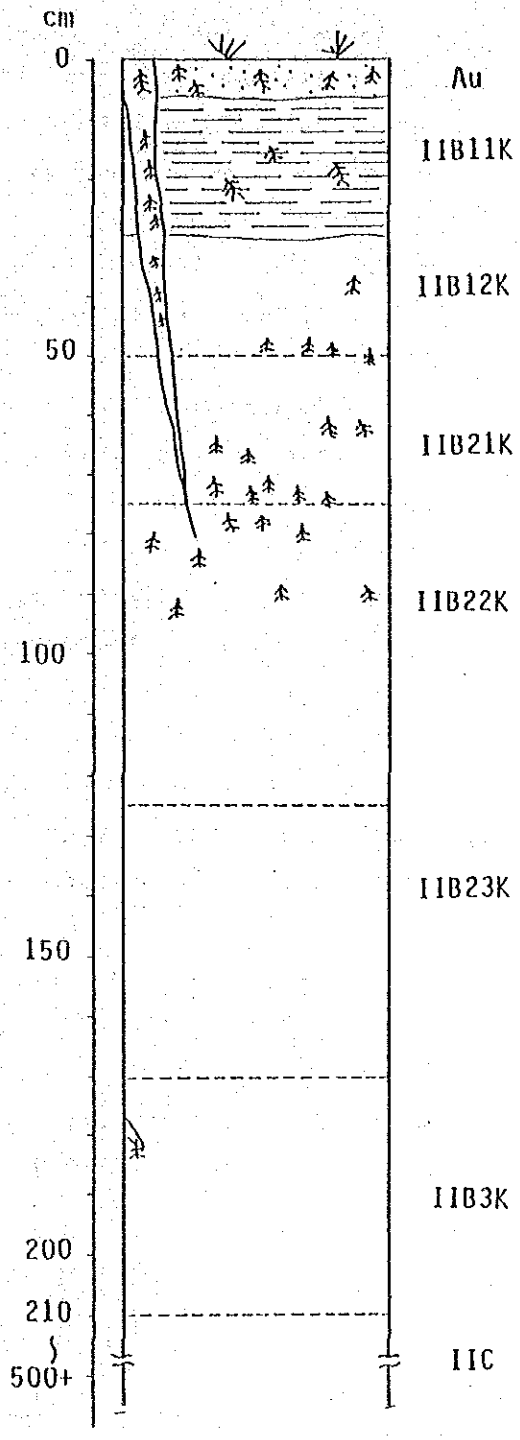
Wind blown Sand Hazard : Slight

C. Brief Description of the Profile

Deep profile developed on the alluvium. Surface soil is loose sand. Subsurface soil is sandy loam and has platy structure. Subsoil is sandy loam and subangular blocky structure. Silt content increase with depth. Consistency of subsoil is very hard in dry, friable in moist. Roots are distributed up to 180cm depth. Cracks were developed on the profile. This soil has moderate suitability for irrigated agriculture development.

D. Profile Description (P-11)

Horizon	Depth (cm)	Description
Au	0 - 6	Dull yellow orange (10YR 7/4) dry, dull yellowish brown (10YR 5/4) moist; gravelly sand, 30% gravel (2-3mm in diameter); dry loose, moist loose; single grain; crack (10cm in width); few fine roots; strong reaction to HCl; clear smooth to:


cm
0
50
100
150
200
210
500+
Au
IIB11K
IIB12K
IIB21K
IIB22K
IIB23K
IIB3K
IIC

IIB11K	6 - 30	Orange (7.5YR 7/6) dry, yellowish brown (10YR 5/6) moist; sandy loam; dry soft, moist very friable; platy; crack; few fine roots; common fine pores; violent reaction to HCl; common $CaCO_3$ concretions, clear smooth to:
IIB12K	30 - 50	Orange (7.5YR 7/6) dry, yellowish brown (10YR 5/6) moist; sandy loam; dry hard, moist friable; subangular blocky; crack; few fine roots, common fine pores; violent reaction to HCl; many $CaCO_3$ concretions; abrupt smooth to:
IIB21K	50 - 75	Dull orange (7.5YR 7/4) dry, bright yellowish brown (10YR 6/6) moist; sandy loam; dry hard, moist friable; subangular blocky; crack; common fine roots; common fine pores; violent reaction to HCl; many $CaCO_3$ concretions; abrupt smooth to:
IIB22K	75 - 125	Dull yellow orange (10YR 7/4) dry, bright yellowish brown (10YR 6/6) moist; sandy loam; dry very hard, moist friable; subangular blocky; few fine roots; common fine pores; violent reaction to HCl; many $CaCO_3$ concretions, abrupt smooth to:
IIB23K / IIB3K	125 - 210	Light gray (5Y 7/2) dry, light yellow (5Y 7/3) moist; bright yellowish brown (2.5Y 7/6) mottled 5%; silty loam; dry very hard, moist friable; massive; no roots; common fine pores; violent reaction to HCl; few $CaCO_3$ concretions; abrupt smooth to:
IIC	210 - 500 +	Dull brown (7.5YR 6/3) dry, dull brown (7.5YR 5/4) moist, orange (7.5YR 6/6) mottled 20%; silty loam; dry very hard, moist friable; massive; a root along the crack; few fine pores; violent reaction to HCl; few $CaCO_3$ concretions

P-11 (Near the pilot farm site)

Sampl'g Depth (cm)	Bulk density (g/cm³)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
10	1.52	57.2	1.4	41.4	8.8	44.6	55.3	—	—	Sand	18	34	0.4	0.9	7.23	0.296
40	1.61	60.5	1.8	37.7	15.8	13.8	86.2	—	—	Sand	20	26	0.4	0.8	7.32	0.460
90	1.67	62.8	2.2	35.0	11.3	21.5	78.4	—	—	Sand	19	19	0.5	0.5	9.22	2.54

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
0.09	3.0	4.0	3.7	0.18	36.7	—	0.85	0.60	1.0	0.51	1.2	1.6	1.2	0.10		0.025
0.17	3.0	3.0	3.9	0.34	45.5	—	1.10	0.65	2.0	0.82	2.2	3.2	1.2	0.15		0.020
0.81	3.0	4.0	3.9	0.28	33.6	—	3.45	1.85	19.0	1.10	11.9	20.1	4.7	0.60		0.020

Organic matter (%)
0.5
0.4
0.4

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(5)-12 Summary of Pit Excavation Survey, A-12-18

Proposed Pilot Farm, Site-3 (based on Harza-1985-)

Mapping Unit Tol

Site Location A-12-8

Soil Classification :

FAO - Calcic Yermosols, deep

US -Typic Calciorthids, deep

Land Classification :

FAO - S2 USBR - 2S

Geomorphic Unit :	Recent Alluvial Terraces, Outwash Fans and Deep Eolian Deposits
Parent Material :	alluvium
Topography :	level with slopes of less than 1%
Vegetation :	short grasses and small forbs.
Drainage :	well drained
Remarks :	This soil is a deep sand to sandy loam that has moderate potential for irrigated agriculture.

Horizon	Depth (cm)	Profile Description
	0 - 3	This is a layer of single grained sand on surface.
A11	3 - 9	Moist color is strong brown (10YR 5/8); coarse sand with less than 2% fine gravels; massive to single grain structure; soft when dry, very friable when moist and nonsticky, nonplastic when wet.
A12 ca	9 - 33	Moist color is strong brown (10YR 5/6); loamy coarse sand with no gravels; massive to single grain structure, slightly hard when dry, very friable when moist and nonsticky, nonplastic when wet.
B21 ca	33 - 65	Brown color (10YR 5/4) when moist; very fine sandy loam texture; massive structures, hard when dry, very friable when moist and nonsticky, nonplastic when wet.

B22 ca	65 - 93	Strong brown (10YR 5/6) moist color; sandy loam texture, medium angular blocky structure; hard when dry, friable when moist and nonsticky, nonplastic when wet.
IIB2 t	93 - 155	Strong brown (10YR 5/6) moist color; very fine sandy loam stratified with loam; medium angular blocky structure; slightly hard when dry, friable when moist and slightly sticky, nonplastic when wet. Hand augered from 135cm to 260cm.
	155 - 200	Strong brown, very fine sand.
	200 - 250	Brown to dark brown, very fine sandy loam.
	250 - 260	Red (5R 4/8) moist loam to clay loam.
	260 +	Too hard to auger.

Proposed Pilot Farm. Site-3 (A-12-8)

Sampl'g Depth (cm)	Bulk density (g/cm³)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH paste	EC S.E (mmhos/cm)
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
0～ 9	–	–	–	–	–	–	–	–	–	–	19.4	63.3	<0.1	–	7.9	1.90
9～33	–	–	–	–	–	–	–	–	–	–	18.7	63.2	<0.1	–	8.7	1.87
33～65	–	–	–	–	–	–	–	–	–	–	18.7	78.5	<0.1	–	8.0	7.00
65～93	–	–	–	–	–	–	–	–	–	–	24.5	54.0	<0.1	–	7.6	35.60
93～155	–	–	–	–	–	–	–	–	–	–	34.2	41.6	<0.26	–	7.4	59.40

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Extractable cations (me/100g)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
–	–	–	–	–	2.85	6	3.73	0.49	0.18	0.31	–	–	–	–	>100	–
–	–	–	–	–	2.19	28	3.02	0.36	0.62	0.28	–	–	–	–	>100	–
–	–	–	–	–	1.53	73	3.02	0.33	1.11	0.18	–	–	–	–	>100	–
–	–	–	–	–	3.54	>100	4.06	1.07	7.02	0.32	–	–	–	–	>100	–
–	–	–	–	–	4.62	>100	4.24	1.01	21.3	0.41	–	–	–	–	>100	–

Organic matter (%)
–
–
–
–
–

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

※ Based on Harza (1985)

(6) Summary of Pit Excavation Survey in the Pilot Farm Site

3.2.3-6 (1)	Summary of Pit Exavation Survey	(PP-1) in the Pilot Farm Site
3.2.3-6 (2)	"	(PP-2) "
3.2.3-6 (3)	"	(PP-3) "
3.2.3-6 (4)	"	(PP-4) "
3.2.3-6 (5)	"	(PP-5) "
3.2.3-6 (6)	"	(PP-6) "

(6)-1 Summary of Pit Excavation Survey, PP-1

PROFILE DESCRIPTION

Site No. : PP-1 Survey Date : 21 JAN. '89

A. Information of the Site

Soil Mapping Unit : Yc-dl FAO Classification : Calcic Yermosols, deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S2k

Location : North West side in the Pilot Farm Site

Landform : Wadi (branch of Wadi)

Elevation : 282.5 m Slope : <1%

Micro Relief : Even

Land use : Slightly grazing of camel and wildlife

Vegetation : Grasses <1% Stipagrostis plumosa

B. Information of the Soil

Parent Material : Recent alluvium over subrecent and old alluvium

Drainage : Imperfect

Flood Hazard : Slight-may flood during major storm events

Surface Feature : Loose sand and gravel 70-90% (0.1-1.0cm in diameter, 0.2-0.3cm dominant)

Evidence of Erosion : None

Wind blown Sand Hazard : Slight

C. Brief Description of the Profile

Deep profile developed on old and well weathered alluvium.

Loose topsoil indicates a sedimental layer of gravelly sand.

Subangular blocky structure develops well in subsoil. And under layers have massive structure.

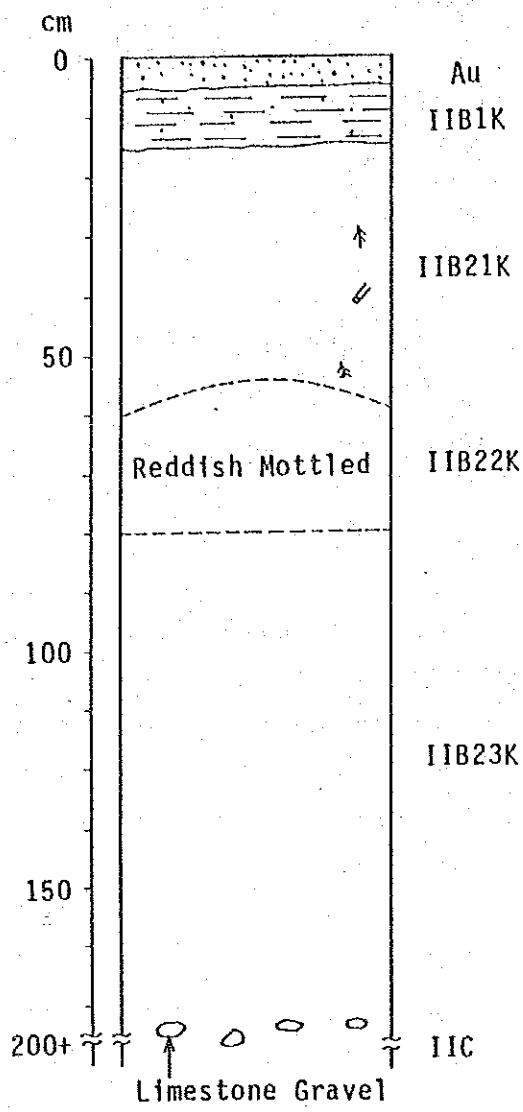
Compactness and silt content increase with depth.

Consistency of subsoil is hard to very hard in dry, but very friable to friable in moist. Fine roots are observed up to 50cm in depth. There is a high content of $CaCO_3$ throughout the profile.

This soil has moderate suitability of irrigated agriculture development.

p. Profile Description (PP-1)

Horizon	Depth (cm)	Description
Au	0 - 5	Dull yellow orange (10YR 7/4) dry, yellowish brown (10YR 5/6) moist; gravelly coarse sand, 40% gravel (2-5mm in diameter); dry loose, moist loose; single grain; a few roots; a few pores; strong reaction to HCl; clear smooth to:
IIB1k	5 - 15	Dull orange (7.5YR 7/4) dry, bright brown (7.5YR 5/6) moist, fine sand, 20% gravel (1-2mm in diameter); dry slightly hard, moist very friable; weak platy; a few roots; a few fine pores; violent reaction to HCl; clear smooth to:
IIB21K	15 - 55	Light yellow orange (10YR 8/3) dry, bright yellowish brown (10YR 6/6) moist; loam, 10% gravel (1-2mm in diameter); dry very hard, moist friable; subangular blocky; a few roots; a few fine pores; common $CaCO_3$ concretions, violent reaction to HCl; no gypsum; gradual wavy to:
IIB22K	55 - 80	Dull yellow orange (10YR 7/4) dry, bright yellowish brown (10YR 6/6) moist, slight paly, many bright reddish brown (5YR 5/6) mottled; loam, <10% gravel (1-2mm in diameter); dry extremely hard, moist friable; no roots; common $CaCO_3$ concentrations, violent reaction to HCl; no gypsum seen; gradual wavy to:
IIB3K	80 - 170	Bright reddish brown (5YR 5/8) dry, reddish brown (5YR 4/8); silty loam, <10% gravel (1-2mm in diameter); dry extremely hard, moist friable; no roots, common $CaCO_3$ concentrations, violent reaction to HCl; no gypsum seen; Hand augered from 160cm to 200cm:
	170 - 200	Reddish brown (5YR 4/8) moist; angular limestone gravel (2-5cm in diameter); violent reaction to HCl:
	200 +	Too hard to auger


cm
0
50
100
150
200+
Au
IIB1K
IIB21K
Reddish Mottled
IIB22K
IIB23K
IIC
Limestone Gravel

PP-1 (Pilot farm)

Sampl'g Depth (cm)	Bulk density (g/cm³)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
5	1.52	54.6	0.9	44.5	11.2	50.8	43.2	6.0	—	Sand	18	32	0.3	0.5	7.26	0.403
50	1.46	56.5	3.1	40.4	6.7	30.9	29.1	34.0	6.0	Loam	35	18	0.5	0.5	6.94	3.40
90	1.59	60.2	3.5	36.3	1.5	27.1	32.9	34.0	6.0	Loam	38	14	0.6	0.4	6.87	4.54
130	1.57	62.1	4.8	33.1	6.0	23.6	34.4	30.0	12.0	Loam	42	14	0.2	0.4	6.98	3.89

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
0.13	35.0	64.0	2.3	0.26	14.6	15.8	2.10	0.85	0.76	0.29	0.6	0.95	3.0	0.05	>100	0.040
1.09	48.0	57.0	4.0	0.30	14.6	27.4	6.80	3.35	23.0	1.03	10.2	28.5	5.4	0.10	>100	0.045
1.45	57.0	63.0	3.3	0.26	10.7	30.8	12.5	7.80	24.0	1.08	7.5	33.4	11.9	0.10	>100	0.025
1.24	40.0	65.0	4.0	0.30	15.3	26.1	7.6	5.20	25.0	1.08	9.9	32.6	6.2	0.10	>100	0.015

Organic matter (%)
0.8
0.9
0.5
0.3

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(6)-2 Summary of Pit Excavation Survey, PP-2

PROFILE DESCRIPTION

Site No. : PP-2 Survey Date : 24 JAN. '89

A. Information of the Site

Soil Mapping Unit : Yc-vs

FAO Classification : Calcic Yermosols, very shallow

USDA Classification : Typic Calciorthids

Land Suitability Classification : N2xd

Landform : Eroded gravel hill

Location : North edge of the centre of the Pilot Farm Site

Elevation : 282.5 m Slope : 4%

Micro Relief : undulating

Land use : None

Vegetation : grasses <1% Stipagrostis plumosa

B. Information of the Soil

Parent Material : Limestone

Drainage : Poor

Flood Hazard : None

Surface Feature : Limestone gravel (10cm in diameter - 10%, 2-10cm in diameter - 60%)

Evidence of Erosion : Eroded gravel

Wind blown Sand Hazard : Strong

C. Brief Description of the Profile

Very shallow profile developed on limestone, weathered marl.

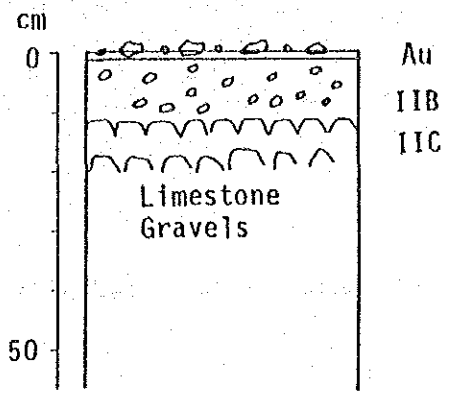
Soil depth is only 12cm.

This soil is not suitable for irrigated agriculture development.

D. Profile Description (PP-2)

Horizon	Depth (cm)	Description
Au	0 - 0.5	Dull yellow orange (10YR 7/4) dry, dull yellowish brown (10YR 5/4) moist, gravelly sandy loam, 60% gravel (2-10cm in diameter); dry loose, moist loose; single grain; no roots; strong reaction to HCl; no gypsum; clear smooth to:

IIBK	0.5 - 12	Light yellow orange (10YR 8/4) dry, bright yellowish brown (10YR 6/6) moist, gravelly sandy loam, 30% gravel (2-3cm in diameter); dry soft, moist very friable; subangular blocky; no roots; violent reaction to HCl; no gypsum; clear wavy to:
IIC	12 -	White; weathered alluvium with limestone gravel (5-10cm in diameter)



(6)-3 Summary of Pit Excavation Survey, PP-3

PROFILE DESCRIPTION

Site No. : PP-3 Survey Date : 22 JAN. '89

A. Information of the Site

Soil Mapping Unit : Yc-d_1 FAO Classification : Calcic Yermosol, deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S2k

Location : South of the centre of the Pilot Farm Site

Landform : Wadi (branch of Wadi)

Elevation : 283.0 m Slope : <1%

Micro Relief : Even

Land use : Camel and Wildlife grazing, Water flooding due to pumping test of JICA No.3 pump.

Vegetation : cover 10%

harbs 5% Fagonia bruguieri, Euphorbia SP, Erodium SP

grasses 5% Stipagrostis plumosa

B. Information of the Soil

Parent Material : Recent alluvium over subrecent and old alluvium (well weathered marl)

Drainage : Imperfect

Flood hazard : Slight-may flood during major storm events

Surface feature : Accumulation of salts is observed here and there. Loose fine sand

Evidence of erosion : None

Wind blown sand hazard : None

C. Brief Description of the Profile

Deep profile developed on old alluvium. Cracks developed well in the profile. Loose topsoil passes into weak platy subsurface soil. Subangular blocky structure develops well in subsoil and under layers have massive structure with gypsum mesh.

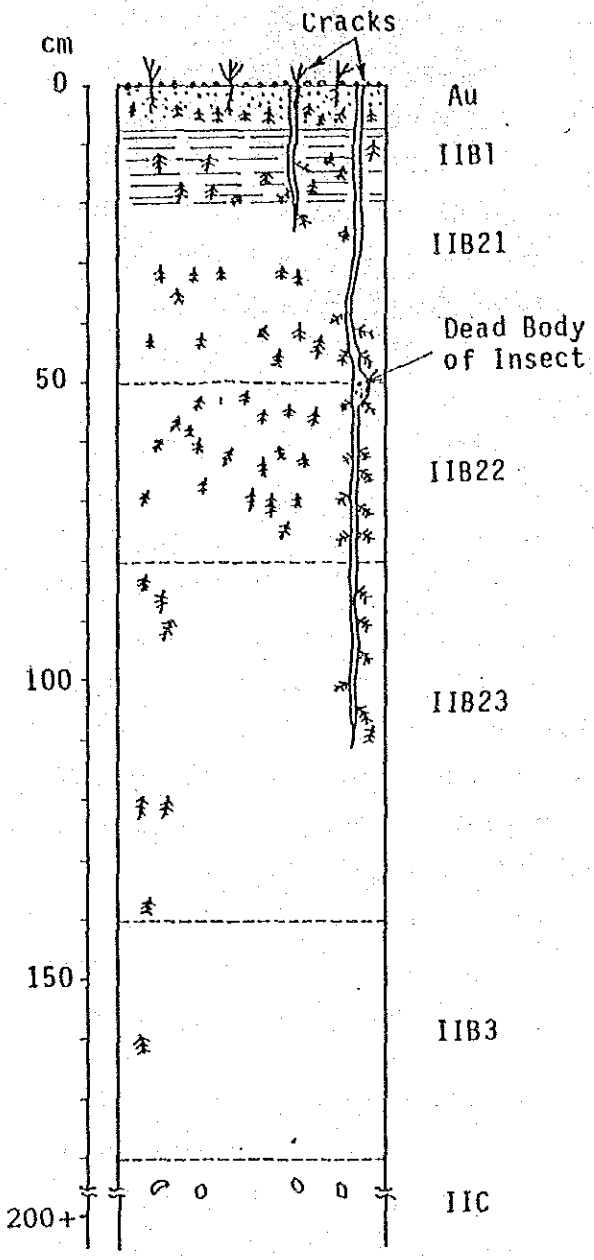
Profile is still moist due to pumping test, and roots are observed up to 160cm depth, especially along cracks.

Consistency is from very friable to friable in moist.

D. Profile Description (PP-3)

Horizon	Depth (cm)	Description
Au	0 - 7	Dull yellow orange (10YR 7/4) dry, dull yellowish brown (10YR 5/4) moist; fine sand, 20% gravel (1-5mm diameter); dry loose, moist loose; single grain; many roots, common pores (1-2mm); violent reaction to HCl; clear smooth to:
IIB1K	7 - 20	Light yellow orange (10YR 8/4) dry, bright yellowish brown (10YR 6/6) moist; sandy loam, <1% gravel (1mm diameter); dry slightly hard, moist very friable; platy; crack (4cm in width); many roots, common pores (1-2mm); violent reaction to HCl; clear smooth to:
IIB21K	20 - 50	Dull yellow orange (10YR 7/4) dry, dull yellow orange (10YR 6/4) moist, few orange (5YR 7/6) mottled; silty loam; dry hard, moist friable; subangular blocky; crack (3cm in width) with dead bodies of insect; common fine roots; common fine pores (1mm); violent reaction to HCl; few gypsum crystal; gradual wavy to:
IIB22K	50 - 80	Dull yellow orange (10YR 7/4) dry, dull yellow orange (10YR 6/4) moist, orange (5YR 6/6) mottled 20%; silty loam; dry hard, moist friable; subangular blocky; crack (1-2cm in width); abundant fine roots; common fine pores; violent reaction to HCl; few gypsum crystal; gradual wavy to:
IIB23K	80 - 140	Bright yellowish brown (10YR 6/6) dry, yellowish brown (10YR 5/6) moist, orange (5YR 6/6) mottled 20%; silty loam; dry hard, moist friable; massive; crack (up to 110cm); few fine roots; common fine pores; violent reaction to HCl; gypsum mesh; gradual wavy to:
IIB3K	140 - 180	Orange (5YR 6/6) moist; silty loam; moist friable; wind weathered limestone gravels (2-3cm in diameter) 5%; massive; few fine roots (up to 160cm); few fine pores; violent reaction to HCl; gypsum mesh; Hand augered from 160cm to 200cm

IIC	180 - 200	Orange (5YR 6/6) moist; silty loam; angular limestone (5cm in diameter) 60%
	200 +	Too hard to auger



PP-3 (Pilot farm)

Sampl'g Depth (cm)	Bulk density (g/cm^3)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
15	1.43	51.9	9.2	38.9	12.9	33.8	53.2	2.0	2.0	Sand	20	27	0.3	0.7	7.26	0.666
40	1.46	60.2	7.1	32.7	10.4	38.8	46.2	12.0	3.0	Loamy Sand	33	16	0.4	0.6	7.06	1.97
70	1.70	57.0	8.6	34.4	7.4	32.4	35.6	18.0	14.0	Sandy Loam	38	12	0.6	0.5	6.84	3.99
120	0.58	61.2	11.3	27.5	2.8	28.2	39.8	18.0	14.0	Sandy Loam	39	11	0.5	0.5	6.89	2.38

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
0.21	34.0	62.0	3.4	0.26	18.6	18.3	2.6	1.70	2.0	0.34	1.4	3.1	3.4	0.10	>100	0.030
0.63	73.0	34.0	2.3	0.38	19.5	11.8	6.8	3.10	9.0	0.80	4.1	10.8	8.8	0.10	>100	0.028
1.27	58.0	44.0	2.3	0.34	19.8	11.6	15.4	11.6	12.0	0.85	3.3	18.4	21.3	0.15	>100	0.028
0.76	55.0	80.0	1.8	0.44	24.5	7.3	7.3	5.9	9.0	1.60	3.5	9.7	14.0	0.10	>100	0.020

Organic matter (%)
0.6
0.5
0.5
0.4

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(6)-4 Summary of Pit Excavation Survey, PP-4

PROFILE DESCRIPTION

Site No. : PP-4 Survey Date : 23 JAN. '89

A. Information of the Site

Soil Mapping Unit : Yc-d1 FAO Classification : Calcic Yermosols, deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S2k

Location : Center of the Pilot Farm Site

Landform : Wadi

Elevation : 283.0 m Slope : <1%

Micro Relief : Even

Land use : Slightly grazing of camel and wildlife

Vegetation : grasses <1% Stipagrostis plumosa

B. Information of the Soil

Parent Material : Recent alluvium over subrecent and old alluvium (Well weathered)

Drainage : Moderately well

Flood Hazard : Slight-may flood during major storm events

Surface Feature : Loose sand and gravel 90% (2-3mm in diameter)

Evidence of Erosion : None

Wind blown Sand Hazard : Slight

C. Brief Description of the Profile

Deep profile developed on old alluvium (well weathered).

Surface soil is loose and gravely sand.

Subsoil have subangular blocky structure, and under layers have massive structure. Texture of subsoil is silty loam.

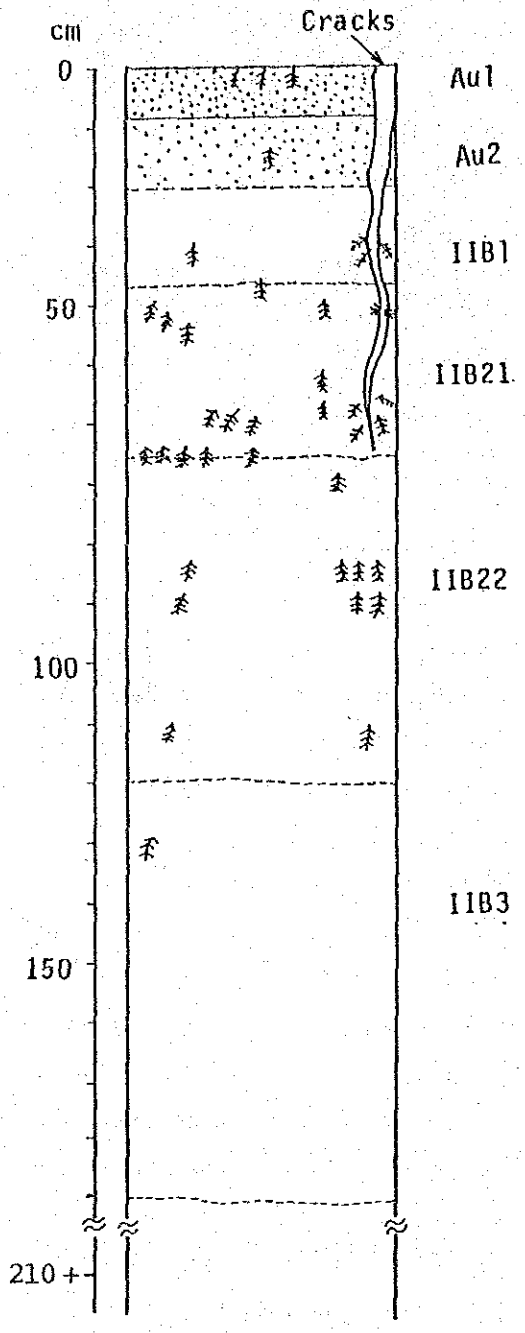
Compactness and silt content increase with depth.

Consistency of subsoil is hard to very hard in dry, but very friable in moist. Cracks develope well in the profile. Fine roots are observed up to 130cm depth. There is no gypsum and high content of $CaCO_3$ throughout the profile.

This soil is moderately suitable for irrigated agriculture development.

D. Profile Description (PP-4)

Horizon	Depth (cm)	Description
Au	0 - 7	Dull yellow orange (10YR 7/4) dry, dull yellowish brown (10YR 5/4) moist; gravelly sand, 60% gravel (1-3mm in diameter); dry loose, moist loose; single grain; crack (20cm in width); few fine roots; common pores; strong reaction to HCl; clear smooth to:
IIB1K	7 - 20	Dull orange (7.5YR 7/4) dry, orange (7.5YR 6/6) moist; gravelly sand, 50% gravel (1-3mm in diameter); dry hard, moist very friable; subangular blocky; crack; few fine roots; common pores; common $CaCO_3$ concretions; violent reaction to HCl; clear smooth to:
IIB21K	20 - 37	Dull yellow orange (10YR 7/4) dry, bright brown (10YR 5/6) moist; sandy loam, 20% gravel (1-3mm in diameter); dry very hard, moist very friable; subangular blocky; crack; common fine roots; common fine pores; common $CaCO_3$ concretions; violent reaction to HCl; gradual wavy to:
IIB22K	37 - 65	Dull orange (7.5YR 7/4) dry, bright brown (7.5YR 5/6) moist; silty loam; dry very hard, moist friable; subangular blocky; crack; common fine roots, common fine pores; many $CaCO_3$ concretions; violent reaction to HCl; gradual wavy to:
IIB23K	65 - 120	Dull orange (7.5YR 7/4) dry, orange (7.5YR 6/6) moist; silty loam; dry very hard, moist friable; massive; crack; common fine roots; few fine pores; many $CaCO_3$ concretions, violent reaction to HCl; gradual wavy to:
IIB31K	120 - 190	Dull orange (5YR 6/4) dry, bright reddish brown (5YR 5/6) moist; silty loam; dry very hard, moist friable; massive; few fine roots (up to 130cm); few fine pores; common $CaCO_3$ concretions; violent reaction to HCl; Hand augered from 160cm to 210cm
IIB32K	190 - 210 +	Bright reddish brown (5YR 5/6) moist; silty loam, 20% limestone gravels (1-2cm in diameter); violent reaction to HCl:


cm
Cracks
0
50
100
150
210+
Au1
Au2
IIB1
IIB21
IIB22
IIB3

PP-4 (Pilot farm)

Sampling Depth (cm)	Bulk density (g/cm³)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
15	1.55	56.1	1.4	42.5	7.0	29.1	60.9	8.0	2.0	Sand	22	41	0.2	0.7	7.25	0.275
55	1.53	61.1	2.3	36.6	11.1	31.8	58.2	8.0	2.0	Sand	25	22	0.2	0.8	7.18	0.338
90	1.57	53.8	3.8	42.4	7.8	21.6	66.4	10.0	2.0	Sand	28	18	0.2	0.6	7.15	0.837
130	1.68	62.8	5.0	32.2	13.8	11.4	42.6	32.0	14.0	Loam	35	15	0.3	0.6	7.06	1.517

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
0.09	30.0	59.0	2.1	0.28	15.3	13.8	1.0	0.45	1.0	0.30	1.2	1.6	1.10	0.05	>100	0.025
0.11	50.0	67.0	2.3	0.24	19.0	12.1	0.60	0.40	2.0	0.37	2.8	2.4	0.85	0.10	>100	0.025
0.27	35.0	62.0	4.6	0.26	19.8	23.2	1.20	0.60	6.0	0.55	0.6	7.6	0.65	0.10	>100	0.020
0.49	54.0	62.0	2.1	0.26	14.6	14.4	2.15	1.30	11.0	0.70	8.5	12.1	2.90	0.15	>100	0.010

Organic matter (%)
0.5
0.5
0.4
0.2

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(6)-5 Summary of Pit Excavation Survey, PP-5

PROFILE DESCRIPTION

Site No. : PP-5 Survey Date : 25 JAN. '89

A. Information of the Site

Soil Mapping Unit : Yc-dl FAO Classification : Calcic Yermosols, deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S2k

Location : North west side of the Pilot Farm Site

Landform : Wadi

Elevation : 283.5 m Slope : <1%

Micro Relief : Even

Land use : Slightly grazing of camel and wildlife

Vegetation : Herbs and Grasses <1%, Fagonia SP

Stipagrostis plumosa

B. Information of the Soil

Parent Material : Recent alluvium over subrecent and old alluvium

Drainage : Moderate well

Flood Hazard : Slight-may flood during major storm events

Surface Feature : Loose sand and gravel 90% (2-3mm in diameter)

Evidence of Erosion : None

Wind blown Sand Hazard : None

C. Brief Description of the Profile

Deep profile developed on old alluvium.

Topsoil is loose sand. Subsurface soil is sand and have weak platy structure. Subsoil have subangular blocky structure, and under layers have massive structure. Cracks develope well in the profile. Fine roots are observed up to 90cm in depth, especially along the cracks.

Consistency is hard to very hard in dry, but friable to very friable in moist.

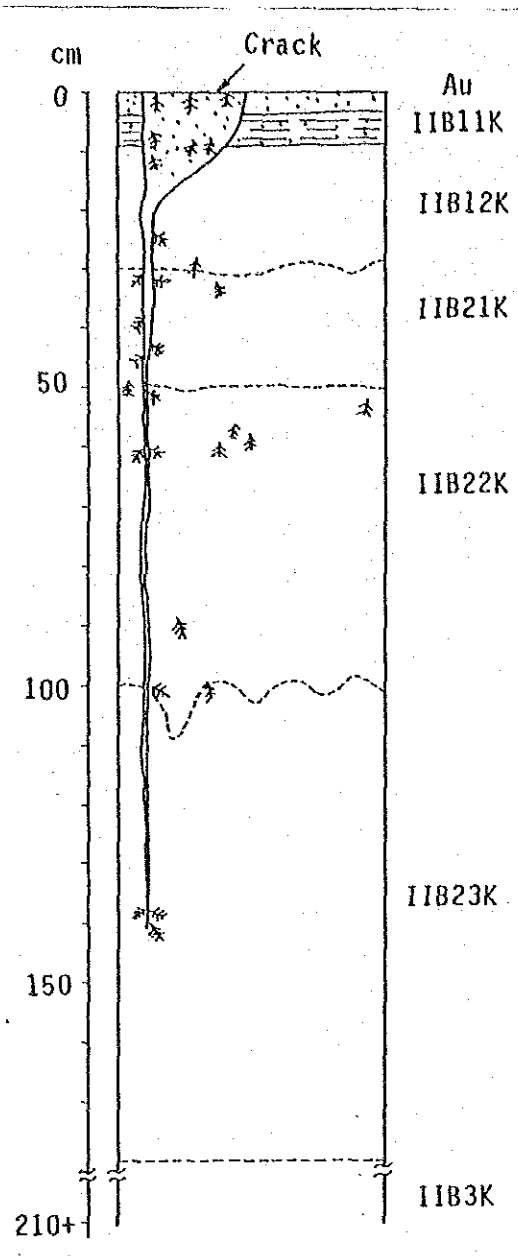
There is no gypsum. There is high content of $CaCO_3$ throughout the profile.

This soil is moderately suitable for irrigated agriculture development.

D. Profile Description (PP-5)

Horizon	Depth (cm)	Description
Au	0 - 4	Dull yellow orange (10YR 7/4) dry, dull yellowish brown (10YR 5/4) moist; sand, 20% gravel (1-5mm in diameter); dry loose, moist loose; single grain; crack (30cm in width); few fine roots; few fine pores; strong reaction to HCl; clear smooth to:
B	4 - 9	Dull orange (7.5YR 7/4) dry, orange (7.5YR 6/6) moist; sand, 15% gravel (1-3mm in diameter); dry slightly hard, moist very friable; weak platy; crack (30cm in width); few fine roots; few fine pores; strong reaction to HCl; clear smooth to:
B	9 - 30	Dull orange (7.5YR 7/4) dry, orange (7.5YR 6/6) moist; silty loam; 10% gravel (1-2mm in diameter); dry hard, moist friable; subangular blocky; crack (5-20cm in width); few fine roots; common fine pores; common $CaCO_3$ concretions; violent reaction to HCl; gradual smooth to:
B	30 - 50	Dull yellow orange (10YR 7/3) dry, bright yellowish brown (10YR 6/6) moist; silty loam, 5% gravel (1-2mm in diameter); dry very hard, moist friable; subangular blocky; crack (5cm in width); few fine roots; common fine pores; many $CaCO_3$ concretions; violent reaction to HCl; gradual smooth to:
B	50 - 100	Dull yellow orange (10YR 7/3) dry, bright yellowish brown (10YR 6/6) moist; silty loam, 5% gravel (1-2mm in diameter); dry very hard, moist friable; massive; crack (2-3cm in width); few fine roots; common fine pores; many $CaCO_3$ concretions; violent reaction to HCl; gradual wavy to:
B	100 - 180	Light gray (7.5YR 8/2) dry, dull orange (7.5YR 7/4) moist; silty loam, 5% gravel (1-2mm in diameter); dry extremely hard, moist friable; massive; crack (1cm in width); few fine roots; common fine pores; many $CaCO_3$ concretions; violent reaction to HCl; Hand augered from 150cm to 230cm

180 - 210 + Dull orange (7.5YR 7/4) moist; silty loam; subangular limestone gravel (2-3cm in diameter); violent reaction to HCl:



PP-5 (Pilot farm)

Sampl'g Depth (cm)	Bulk density (g/cm³)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
10	1.56	59.0	1.3	39.7	9.4	27.2	62.8	8.0	2.0	Sand	25	29	0.2	0.7	7.02	1.635
40	1.56	58.9	2.6	38.5	11.4	31.9	44.1	18.0	6.0	Sandy Loam	32	22	0.2	0.5	7.08	2.46
80	1.64	61.9	3.3	34.8	21.6	24.7	47.3	20.0	8.0	Sandy Loam	36	24	0.5	0.4	7.01	3.50
120	1.65	73.7	3.7	22.6	19.9	28.1	42.9	20.0	6.0	Sandy Loam	42	20	0.6	0.4	6.92	5.37

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
0.52	32.0	54.0	4.6	0.28	19.5	23.6	1.20	0.55	13.1	1.5	21.3	14.3	1.9	0.15	>100	0.035
0.79	55.0	62.0	4.6	0.26	18.6	24.7	1.80	1.20	20.0	1.6	16.4	22.4	2.0	0.20	>100	0.030
1.12	61.0	46.0	2.5	0.26	11.3	22.1	1.90	1.30	30.0	1.8	23.8	30.6	4.2	0.20	>100	0.025
1.72	40.0	91.0	2.0	0.28	10.9	18.3	7.80	4.10	40.0	1.8	16.4	47.1	6.3	0.25	>100	0.010

Organic matter (%)
0.7
0.6
0.5
0.2

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(6)-6 Summary of Pit Excavation Survey, PP-6

PROFILE DESCRIPTION

Site No. : PP-6 Survey Date : 24 JAN. '89

A. Information of the Site

Soil Mapping Unit : Yc-dl FAO Classification : Calcic Yermosols, deep

USDA Classification : Typic Calciorthids

Land Suitability Classification : S2k

Location : South west side of the Pilot Farm Site

Landform : Wadi

Elevation : 284.0 m Slope : <1%

Micro Relief : Even

Land use : Camel and Wildlife grazing, water-flooding due to pumping test of JICA NO.4 pump

Vegetation : Cover 10%

Herbs 5% Fagonia bruguieri, Euphorbia sp.
Monsonia heliotropioides,

Grasses 5% Stipagrostis plumosa

B. Information of the Soil

Parent Material : Recent to old alluvium

Drainage : Moderate Well

Flood Hazard : Slight-may flood during major storm events

Surface Feature : Loose sand and gravel 60% (0.1-2.0cm in diameter)

Evidence of Erosion : None

Wind blown Sand Hazard : Slight

C. Brief Description of the Profile

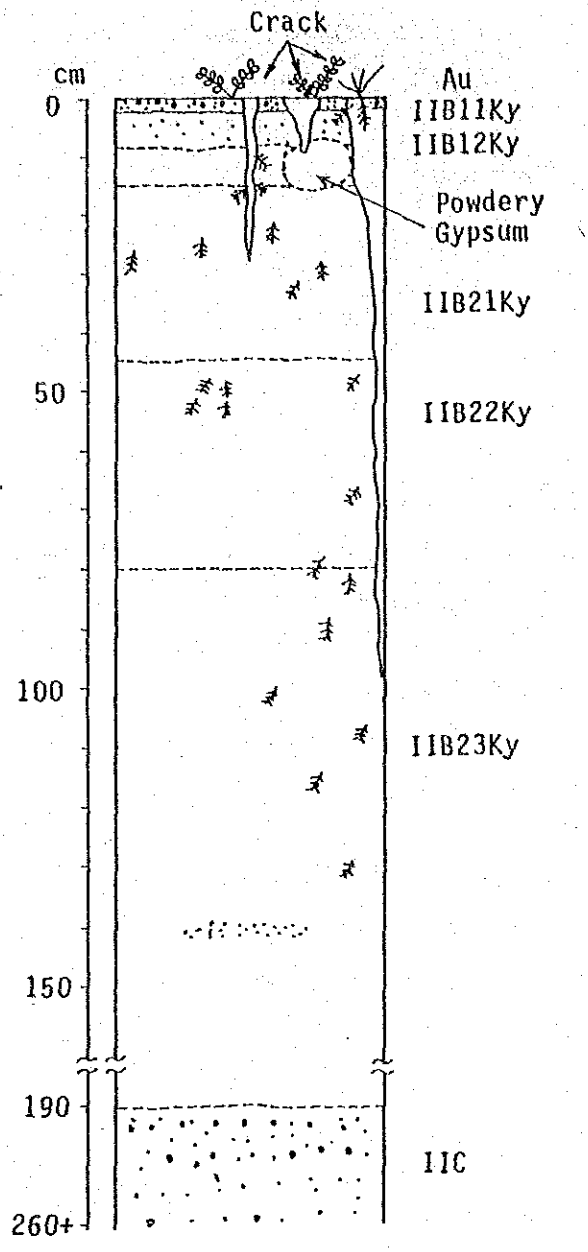
Deep profile developed on old alluvium. The profile is still moist due to pumping test. Cracks filling up the sandy loam soil were developed well in the profile. Surface soil is loose and gravely sand. Powdery gypsum, whose size is about 5 by 10cm, occures on the subsurface soil. There are gypsum mesh throughout the subsoil. Also $CaCO_3$ is rich. Yellowish mottles are observed below 50cm depth.

Roots are observed up to 130cm in depth.

D. Profile Description (PP-6)

Horizon	Depth (cm)	Description
Au	0 - 2	Dull yellow orange (10YR 7/4) dry, yellowish brown (10YR 5/6) moist; gravelly sand, 60% gravel (1-5mm in diameter); dry loose, moist loose; single grain; cracks (3-10cm in width); common roots; strong reaction to HCl; gypsum; clear smooth to:
IIB11Ky	2 - 8	Light yellow orange (10YR 8/4) dry, dull yellow orange (10YR 6/4) moist; sandy loam, 30% gravel (1-5mm in diameter); dry soft, moist very friable; subangular blocky; cracks; common fine roots; many pores; violent reaction to HCl; gypsum rich; abrupt smooth to:
IIB12Ky	8 - 15	Dull yellow orange (10YR 7/4) moist; silty loam, 20% gravel (1-5mm in diameter); moist very friable; weak subangular blocky; cracks; common fine roots; many pores; violent reaction to HCl; powdery gypsum; abrupt smooth to:
IIB21Ky	15 - 45	Orange (7.5YR 6/6) moist; silty loam, 10% gravel (1-5mm in diameter); moist friable; weak subangular blocky; cracks; common fine roots; many fine pores; violent reaction to HCl; gypsum rich; abrupt smooth to:
IIB22Ky	45 - 80	Dull yellow orange (10YR 7/4) moist; orange (7.5YR 6/8) mottled 20%; silty loam, 5% gravel (1-5mm in diameter); moist friable; weak subangular blocky; crack; common fine roots; common fine pores; violent reaction to HCl; gypsum mesh; abrupt smooth to:
IIB23Ky	80 - 190	Dull yellow orange (10YR 6/4) moist; orange (7.5YR 6/8) mottled 20%; silty loam, 5% gravel (1-5mm in diameter); moist friable; massive; crack; few fine roots; few fine pores; violent reaction to HCl; gypsum mesh; Hand augered from 160cm to 260cm
IIC1	190 - 220	Orange (7.5YR 6/6) moist; gravelly silty loam, 50% gravel (1-10mm in diameter); moist very farm; violent reaction to HCl

IIC2 220 - 260 + Light yellow orange (7.5YR 8/3) moist; gravelly silty loam 60% gravel (1-10mm in diameter); moist very farm; violent reaction to HCl



PP-6 (Pilot farm)

Sampl'g Depth (cm)	Bulk density (g/cm^3)	Distribution of three phases			Gravel (%)	Soil particle (%)				Texture	Sat'n (%)	$CaCO_3$ (%)	Gypsum (%)	Avail P (PPM)	pH (1:2.5)	EC (1:5) ms/cm
		Solid (%)	Water (%)	Air (%)		C.Sand	F.Sand	Silt	Clay							
5	1.47	55.6	3.8	40.6	11.3	31.3	52.4	16.0	—	Sandy Loam	32	35	0.3	0.6	7.07	1.062
35	1.34	73.7	12.2	14.1	30.4	18.2	61.8	18.0	2.0	Sandy Loam	30	28	0.7	0.5	6.81	2.56
70	1.64	62.0	11.9	26.1	10.7	31.7	52.3	14.0	2.0	Sandy Loam	29	17	0.3	0.2	7.04	1.053
120	1.61	60.5	9.3	30.2	12.7	23.4	44.6	30.0	2.0	Sandy Loam	36	16	0.5	0.2	6.88	5.57

TSS (%)	Exchangeable cations (me/100g)				CEC * (me/100g)	ESP* (%)	Soluble cations (me/ℓ)				SAR (me/ℓ)	Soluble anions (me/ℓ)			Base Saturation (%)	Total N (%)
	Ca	Mg*	Na*	K			Ca	Mg	Na	K		Cl	SO_4	HCO_3		
0.34	50.0	61.0	3.2	0.16	14.6	21.9	3.55	2.20	4.0	0.85	2.4	6.2	4.3	0.10	>100	0.025
0.82	72.0	64.0	4.3	0.12	14.1	30.5	15.30	7.75	2.0	0.54	0.6	7.8	17.6	0.20	>100	0.025
0.34	46.0	60.0	4.4	0.24	17.4	25.3	4.95	2.70	2.0	0.85	1.0	5.4	5.0	0.10	>100	0.020
1.78	40.0	58.0	2.9	0.30	14.6	19.9	4.00	2.1	48.0	1.60	27.4	49.1	6.4	0.15	>100	0.010

Organic matter (%)
0.5
0.5
0.4
0.2

* Note :
Data not used in the analysis of this study.
Should be referred with reanalysis at the site.

(7) Summary of Auger Boring Survey

Legend of Auger Boring

1. Area

D :	DAUKA	WM :	WADI MOKHAWRIM
ED :	EAST DAUKA	Q :	QUITBEET
SD-1 :	SOUTH DAUKA-1	H :	HANFEET
SD-2 :	SOUTH DAUKA-2	NH :	NORTH HANFEET
S :	SHASR	HA :	HAILAT AL-RAKAH
SS :	SOUTH SHASR		

2. Drainage Classification (FAO 1977)

0 :	Very poorly drained
1 :	Poorly drained
2 :	Imperfectly drained
3 :	Moderately well drained
4 :	Well drained
5 :	Somewhat excessively drained
6 :	Excessively drained

3. Soil

Soil Classification (TABLE 3.5.1)

4. Suit

Land Suitability Classification (TABLE 3.5.4)

5. Land Use

N :	None
CG :	Camel grazing
CV :	Cultivation

6. Vegetation

tree :	> 6 m in height
Shrubs :	1 - 4 m
herbs :	0.3 - 1
grasses :	> 0.3

7. Consistency

dl :	dry and loose	ml :	moist and loose
ds :	dry and soft	mvf :	moist and very triable
dsh :	dry and slightly hard	mf :	moist and triable
dh :	dry and hard	mfi :	moist and firm
dvh :	dry and very hard	mvfi :	moist and very firm
deh :	dry and extremely hard	mefi :	moist and extremely firm

8. Reaction to Hcl

e :	slight :	slight free carbonate
es :	strong	
ev :	violent :	high free carbonate

9. Others

- :	None
/ :	No data
> :	greater than
< :	less than

(7)-1 Results of Auger Boring in the Study Area

Auger No.	Area	Soil	Suit	Elevation (m)	Landform	Parent Material	Drainage	Surface Stoniness/gravel		Vegetation		Landuse	Erosion	Depth (cm)	Color	Texture	Gravel		Consistence	Reaction to HCl	Gypsum	PH (1:2.5)	EC (1:5) mS/cm	Remarks
								Size (cm)	Cover (%)	Compo	Cover (%)						Size (cm)	Content (%)						
1	SD_2	Yc-s	N_2	275	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	1~3	60	herbs	< 1	CG	wind	0~ 10	10YR 5/6	LS	/	/	dl	es	–	7.9	0.157	
										grasses	< 1			10~ 20	10YR 6/6	SL	/	/	dsh	ev	–	/	/	
														20~ 30	10YR 6/6	SL	/	/	dh	ev	–	8.1	0.113	
2	SD_2	Yc-s	N_2	275	Flat plain of old alluvium Undulating	Recent deposition on weathered limestone	3	0.5~2	70	herbs	< 1	CG	wind	0~ 6	10YR 5/6	LS	/	/	dl	ev	–	8.1	0.130	
										grasses	< 1			6~ 12	10YR 6/6	SL	/	/	dsh	ev	–	8.0	0.124	
														12~ 30	10YR 6/6	SL	/	/	dh	/	–	/	/	
3	SD_2	Yc-s	N_2	275	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5~1	70	herbs	< 1	CG	wind	0~ 8	10YR 5/6	LS	/	/	dl	es	–	8.1	0.119	
										grasses	< 1			8~ 20	10YR 6/6	LS	/	/	dsh	ev	–	8.0	0.125	
4	SD_2	Yc-d_1	S_2	260	Wadi undulating	Recent alluvium	4	0.3~1	60	herbs	< 1	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	es	–	8.4	0.110	Near P-3
										grasses	< 1			10~ 20	10YR 6/6	SL	–	–	dsh	ev	–	/	/	
														20~100	10YR 6/6	SL	–	–	dh	ev	–	8.0	0.123	
5	ED	Yc-s	N_2	260	Flat plain of old alluvium undulating	Recent deposition on weathered limestone	3	0.5~5	70	herbs	20	CG	wind	0~ 6	10YR 5/4	LS	–	–	dl	es	–	8.2	0.116	
										grasses	< 1			6~ 15	10YR 6/6	LS	–	–	dsh	ev	–	8.1	0.146	
6	ED	Yc-s	N_2	260	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5~1	70	grasses	10	CG	wind	0~ 7	10YR 5/6	LS	–	–	dl	ev	–	7.9	0.130	
														7~ 17	10YR 6/6	LS	–	–	dsh	ev	–	8.0	0.235	
7	SD_1	L-vs	N_2	260	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5~2	70	grasses	10	CG	wind	0~ 6	10YR 5/6	LS	–	–	dl	ev	–	7.8	0.205	
8	SD_1	Yc-s	N_2	260	Flat plain of old alluvium Undulating	Recent deposition on weathered limestone	3	0.5	80	grasses	1	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	es	–	7.9	0.115	
														10~ 40	10YR 6/6		–	–	dh	ev	–	7.5	0.151	
9	SD_1	Yy-s	N_2	260	Flat plain of old alluvium Undulating	limestone	3	0.5	80	grasses	5	CG	wind	0~ 3	10YR 5/6	LS	–	–	dl	ev	–	7.4	0.845	
														3~ 20	5YR 5/8	SL	–	–	dch	ev	abundant	7.8	0.602	
10	SD_1	L-vs	N_2	250	Eroded gravel hill Undulating	limestone	2	1~3	90	grasses	< 1	N	wind	0~ 4	10YR 6/6	LS	–	–	dl	es	–	8.4	0.154	
														4~	(5YR 6/8)	Rock	–	–	dch	ev	–	/	/	
11	SD_1	Yy-s	N_2	250	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5	70	grasses	1	CG	wind	0~ 5	10YR 5/6	LS	–	–	dl	es	–	8.3	0.229	
														5~ 30	10YR 6/6	LS	–	–	dvh	ev	common	7.6	1.150	
12	SD_1	Jc-s	N_2	250	Alluvial plain between hill Undulating	Recent alluvium	5	1	80	herbs	15	CG	water	0~ 10	10YR 6/4	fine LS	0.2 ~0.8	50	dl	ev	–	8.0	0.106	
										grasses				10~ 20	10YR 6/4	fine LS	0.2 ~0.8	60	dsh	/	–	/	/	
														20~ 30	10YR 6/4	fine LS	0.2 ~0.8	70	dh	ev	–	8.4	0.140	
13	NH	Yc-s	N_2	295	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5	70	shrubs	1	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	es	–	8.8	0.113	
										grasses	5			10~ 20	7.5YR 5/6	LS	–	–	dh	/	–	/	/	
														20~ 30	7.5YR 5/6	LS	–	–	dvh	ev	–	8.7	0.120	
14	SD_2	Yc-s	N_2	270	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5	80	grasses	1	N	wind	0~ 10	10YR 5/6	LS	–	–	dl	es	–	8.7	0.132	
														10~ 20	7.5YR 5/6	LS	–	–	dh	ev	–	8.8	0.122	
15	SD_2	Yc-s	N_2	270	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5	60	grasses	1	N	wind	0~ 10	10YR 5/6	LS	–	–	dl	es	–	8.0	0.131	
														10~ 20	10YR 7/6	LS	–	–	dh	/	–	/	/	
														20~ 40	10YR 7/6	LS	0.2 ~1	60	dh	ev	–	8.6	0.099	
16	SD_2	Yc-s	N_2	270	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5~1	70	shrubs	1	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	ev	–	8.8	0.103	
										grasses	30			10~ 20	10YR 6/6	SL	–	–	dh	/	–	/	/	
														20~ 40	10YR 6/6	SL	0.5 ~1	40		ev	–	8.8	0.117	
17	SD_2	Yc-s	N_2	270	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	1	80	grasses	1	N	wind	0~ 10	10YR 5/6	LS	–	–	dl	ev	–	8.7	0.132	Soft lime
														10~ 20	10YR 6/6	SL	–	–	dh	ev	–	8.8	0.115	
18	SD_2	L-vs	N_2	275	Eroded gravel hill Hilly	limestone	2	3~5	90	–	–	N	wind	0~ 5	10YR 6/6	LS	–	–	dl	ev	/ abundant	/	/	
														5~								/	/	
19	D	Yc-s	N_2	200	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5	80	herbs	10	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	ev	–	7.7	0.270	
										grasses	1			10~ 20	10YR 6/6	LS	–	–	dh	/	–	/	/	
														20~ 35	7.5YR 6/8	LS	–	–	dh	ev	–	7.3	0.880	
20	SD_1	Yc-s	N_2	240	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5	80	herbs	< 1	CG	wind	0~ 12	10YR 6/6	SL	–	–	dl	es	–	7.6	0.167	
										grasses	2													

Augor No.	Area	Soil	Soil	Elevation (m)	Landform	Parent Material	Drainage	Surface Stoniness/Gravel		Vegetation		Landuse	Erosion	Depth (cm)	Color	Texture	Gravel		Consistence	Reaction to HCl	Gypsum	PH (1:2.5)	EC (1:5) mS/cm	Remarks
								Size (cm)	Cover (%)	Compo	Cover (%)						Size (cm)	Content (%)						
21	R	Yy-s	N_2	320	Gravel plain	Gypsic Alluvium	2	0.5~1	80	–	–	N	wind	0~ 3	10YR 5/6	Gravelly L.	–	–	dl	ev	–	7.1	1.401	
														3~ 20	5YR 5/8	L.	–	–	dch	/	–	/	/	
														20~ 25	5YR 8/3	L.	–	–	dch	ev	Abundant	7.0	5.42	
22	SD_2	Yc-md_2	S_3	270	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	1	80	Grasses	1	N	wind	0~ 10	10YR 5/6	Gravelly L.	/	/	dl	ev	–	8.1	0.152	
														10~ 20	10YR 6/6	L.	–	–	dsh	/	–	/	/	
														20~ 50	7.5YR 5/6	L.	–	–	dvh	ev	–	8.1	0.146	
23	SD_2	Jc-s	N_2	275	Wadi Flat	Recent alluvium	5	0.3~0.5	90	herbs	1	CG	water	0~ 10	10YR 6/6	S	0.2 ~0.5	60	dl	ev	–	7.7	0.124	
										grasses	5			10~ 20	7.5YR 6/8	S	0.2 ~0.5	70	dvh	ev	–	8.1	0.137	
24	SD_2	Jc-d_3	S_3	270	Wadi Flat	Recent alluvium	5	0.5	80	herbs	3	CG	water	0~ 10	10YR 5/6	S	0.1 ~2	60	dl	ev	–	7.9	0.134	near P-2
										grasses	10			10~ 30	10YR 6/6	S	0.2	70	ds	/	–	/	/	
														30~ 50	10YR 5/8	S	0.2	60	dsh	ev	–	8.1	0.129	
														50~ 80	10YR 5/8	S	0.3	30	dh	ev	–	8.3	0.151	
25	SD_2	Yc-s	N_2	275	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5~1	90	shrubs	< 1	N	wind	0~ 10	10YR 5/4	LS	–	–	dl	ev	–	7.4	0.146	
										herbs	< 1			10~ 30	10YR 5/6	LS	–	–	dh	ev	–	8.0	0.129	
										grasses	< 1													
26	SD_2	Jc-s	N_2	275	Wadi Flat	Recent alluvium	5	1	90	grasses	5	CG	water	0~ 20	10YR 5/6	S	/	/	dl	ev	–	/	/	
27	SD_2	Yc-s	N_2	275	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	1	90	herbs	< 1	CG	wind	0~ 10	10YR 5/4	LS	–	–	dl	ev	–	7.8	0.146	
										grasses	2			10~ 20	10YR 5/6	SL	–	–	dvh	ev	–	8.0	0.150	
28	SD_2	Yc-s	N_2	275	Flat plain of gold alluvium Flat	Recent deposition on weathered limestone	3	1	80	grasses	3	CG	wind	0~ 10	10YR 5/6	SL	–	–	dl	cs	–	8.1	0.154	$CaCO_3$ cementation
														10~ 20	10YR 6/6	SL	–	–	dvh	/	–	/	/	
														20~ 40	10YR 6/6	SL	–	–	dvh	ev	–	8.0	0.160	
29	SD_2	L-vs	N_2	275	Eroded gravel hill	limestone	2	5	80	–	–	N	wind	0~ 5	10YR 5/6	gravelly LS	0.2~0.5	80	dl	ev	–	/	/	
30	SD_2	Jc-s	N_2	275	wadi Undulating	Recent alluvium	5	0.5~1	80	herbs	5	CG	wind	0~ 5	10YR 6/4	LS	–	–	dl	ev		7.6	0.189	
										grasses	5			5~30	10YR 6/6	gravelly LS	0.3	50	dl	ev	below30cm abundant	7.3	1.307	
31	SD_2	Yc-md_1	S_2	275	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5	80			N	wind	0~ 5	10YR 5/6	LS	–	–	dl	es	–	7.3	0.155	
														5~ 10	7.5YR 5/6	LS	–	–	dvh	/	–	/	/	
														10~ 50	7.5YR 5/6	SL	–	–	dvh	ev	–	8.4	0.145	
32	SD_2	Yc-d_1	S_2	270	wadi undulating	Recent alluvium	3	0.5~1	80	grasses	< 1	N	wind	0~ 10	10YR 5/6	fine S	0.3	30	dl	ev	–	7.4	0.190	
														10~ 30	10YR 6/6	LS	–	–	ds	ev	–	/	/	
														30~ 50	10YR 6/6	LS	–	–	dh	ev	5%	7.5	2.16	
														50~120	10YR 6/6	SL	–	–	dvh	ev	–	7.7	2.30	
33	SD_2	YC-d_1	S_2	270	wadi Flat	Recent alluvium	4	0.5	80	grasses	< 1	N	wind	0~ 20	10YR 5/6	gravelly S	0.3	70	dl	es	–	8.1	0.180	
														20~ 60	10YR 7/6	S	–	–	dh	ev	–	/	/	Softlime 30%
														60~100	10YR 7/6	SL	–	–	dh	ev	–	8.5	0.212	Softlime 30%
34	SD_2	Yy-s	N_2	275	Eroded gravel hill undulating	limestone	2	2~5	80	shrubs	< 1	N	wind	0~ 10	10YR 5/6	SL	–	–	dl	es	–	/	/	
										herbs	< 1			10~ 25	7.5YR 6/6	L.	–	–	dvh	ev	60%	/	/	
35	SD_2	Jc-s	N_2	275	Wadi on bed rock	Recent alluvium	4	0.5~1	80	herbs	1	N	water	0~ 10	10YR 6/4	SL	–	–	dl	ev	–	/	/	
														10~ 30	7.5YR 6/6	gravel	0.3	70	dh	ev	–	/	/	
36	SD_2	Yc-s	N_2	275	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5	60	grasses	< 1	N	wind	0~ 15	10YR 5/6	LS	–	–	dl	ev	–	/	/	
														15~		limestone			dch	ev	–	/	/	
37	SD_2	Yy-s	N_2	275	Flat plain of old alluvium Flat	limestone	2	1~2	90	herbs	3	CG	wind	0~ 5	10YR 5/6	LS	–	–	dl	ev	–	/	/	
														5~ 15	/	L.			dch	ev	abundant	/	/	
38	SD_2	Yc-d_1	S_2	260	Wadi Flat	Recent Alluvium	3	0.5~1	90	herbs	1	CG	wind	0~ 10	10YR 5/6	fine S	–	–	dl	es	–	8.2	0.153	Near P-3
										grasses				10~ 20	10YR 4/6	fine S	–	–	dh	ev	–	/	/	
														20~ 50	10YR 5/6	SL	–	–	dh	ev	–	8.4	0.161	
														50~100	10YR 5/6	SL	–	–	dh	ev	–	8.2	0.330	
39	SD_2	L-vs	N_2	275	Flat plain of old alluvium Flat	limestone	2	1	80	herbs	1	CG	wind	0~ 6	7.5YR 5/6	SL	–	–	dl	ev	–	/	/	
										grasses									dvh	ev	–	/	/	
40	SD_2	Yc-s	N_2	270	Flat plain of old alluvium undulating	limestone	3	0.3~0.5	70	shrubs	< 1	CG	wind	0~ 5	10YR 5/6	LS	–	–	dl	ev	–	/	/	Near P-1
										grasses	< 1			5~ 20	10YR 6/6	LS	–	–	dh	ev	–	/	/	

Auger No.	Area	Soil	Suit	Elevation (m)	Landform	Parent Material	Drainage	Surface Stoniness/gravel		Vegetation		Landuse	Erosion	Depth (cm)	Color	Texture	Gravel		Consistence	Reaction to HCl	Gypsum	PH (1:2.5)	EC (1:5) mS/cm	Remarks
								Size (cm)	Cover (%)	Compo	Covor (%)						Size (cm)	Content (%)						
41	SD_2	Yc-d_1	S_2	270	Vadl Flat	Recent Alluvium	3	0.5~1	70	grasses	5	CG	wind	0~ 10	10YR 5/6	S	0.2 ~0.5	40	dl	ov	–	8.1	0.173	Near P-1
														10~ 25	10YR 6/6	SL	–	–	dh	ov	–	/	/	
														25~ 65	10YR 6/6	SL	–	–	dvh	ov	–	8.1	0.662	
														65~100	10YR 7/4	SL	–	–	dch	ov	–	/	/	
42	SD_2	Yc-md_2	S_3	270	Vadl Flat	Recent Alluvium	3	0.2~1	70	shrubs	<1	CG	wind	0~ 10	10YR 5/6	fine S	–	–	dl	es	–	8.2	0.190	
										grasses	5			10~ 20	10YR 6/6	LS	–	–	dh	ov	–	/	/	
														20~ 30	10YR 6/6	SL	–	–	dh	ov	–	/	/	
														30~ 70	10YR 7/4	SL	–	–	dch	ov	–	8.8	0.151	Softlime
43	SD_2	Yc-d_1	S_2	270	Vadl Flat	Recent Alluvium	3	0.5~2	70	grasses	2	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	es	–	8.6	0.175	
														10~ 20	10YR 6/6	SL	–	–	dh	ov	–	/	/	Softlime 20%
														20~ 55	7.5YR 6/6	SL	–	–	dch	ov	–	8.7	0.209	Softlime 30%
														55~100	7.5YR 6/6	SL	–	–	dch	ov	–	8.2	0.541	Softlime 30%
44	SD_2	Yc-md_2	S_3	260	Vadl Flat	Recent Alluvium	4	0.5~2	80	herbs	5	CG	wind	0~ 10	10YR 5/6	S	0.5~ 1	40	dl	es	–	8.6	0.179	
										grasses	1			10~ 20	10YR 6/6	LS	–	–	dh	ov	–	/	/	
														20~ 80	10YR 6/6	LS	1	20	dch	ov	–	8.6	0.150	limestone
45	SD_2	JC-s	N_2	260	Vadl Flat	Recent Alluvium	4	0.3~5	80	herbs	3	CG	Slight	0~ 5	10YR 5/6	LS	–	–	dl	es	–	/	/	
										grasses	5		water	5~ 20	7.5YR 7/4	LS	–	–	dh	ov	–	/	/	
46	SD_2	Jc-d_2	S_2	270	Vadl Flat	Recent Alluvium	4	0.3~1	80	shrubs	<1	CG	Slight	0~ 10	10YR 5/6	gravelly S	0.3~0.5	60	dl	es	–	8.4	0.184	Near P-5
										grasses	3		water	10~ 20	7.5YR 5/6	S	–	–	dh	ov	–	/	/	
														20~ 50	10YR 6/6	SL	–	–	dvh	ov	–	8.5	0.132	
														50~ 70	10YR 6/6	SL	–	–	dch	ov	–	8.6	0.147	
47	SD_2	Yc-md_2	S_3	270	Vadl Flat	Recent Alluvium	3	0.5~1	80	grasses	5	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	es	–	8.5	0.180	
														10~ 20	10YR 6/6	SL	–	–	dh	ov	–	/	/	
														20~ 70	10YR 6/6	SL	–	–	dch	ov	–	8.4	0.209	
48	SD_2	L-vs	N_2	275	Eroded grvel terrace Undulating	limestone	2	1~5	80	–	–	N	wind	0~ 8	10YR 5/6	LS	1	8	dl	es	–	/	/	
														8~	/				dch	es	abundant	/	/	
49	ED	Yy-s	N_2	260	Flat plain of old alluvium Undulating	limestone	2	0.3~1	80	herbs	2	CG	wind	0~ 10	10YR 5/6	SL	–	–	dl	es	–	/	/	
										grasses	10			10~ 30	10YR 6/6	SL	–	–	ds	es	abundant	7.7	2.96	
50	SD_1	Yc-s	N_2	250	Flat plain of old alluvium Undulating	Recent deposition on weathered limestone	3	0.5~1	60	grasses	30	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	es	–	8.3	0.178	
														10~ 25	7.5YR 5/6	SL	–	–	dh	ov	–	/	/	
														25~ 40	7.5YR 6/6	SL	–	–	dh	ov	–	8.0	0.133	
51	SD_1	Yc-s	N_2	250	Flat plain of old alluvium Undulating	Recent deposition on weathered limestone	3	0.3~1	70	grasses	30	CG	wind	0~ 10	10YR 5/6	gravelly LS	0.1 ~0.2	30	dl	es	–	/	/	
														10~ 30	10YR 6/6	LS	–	–	dh	ov	–	/	/	
52	SD_1	Yy-s	S_3	250	Flat plain of old alluvium Undulating	limestone	3	0.3~1	70	grasses	20	CG	wind	0~ 20	10YR 5/6	LS	–	–	dl	es	–	7.6	5.29	
														20~ 50	2.5YR 4/6	SL	–	–	dch	ov	aburdant	7.7	10.79	
53	SD_1	L-vs	N_2	240	Eroded gravel terrace Undulating	limestone	3	0.5~10	95	grasses	5	CG	wind	0~ 5	10YR 6/6	SL	–	–	dl	ov	–	/	/	
														5~	7.5YR 8/1	–	–	–	dh	ov	–	/	/	limestone
54	D	Yc-md_2	S_3	200	Fan Undulating	Alluvium on weathered limestone	3	–	–	–	–	CV	–	0~ 20	10YR 5/6	gravelly LS	0.2	50	dl	ov	–	/	/	farm
														20~ 50	10YR 8/3	gravelly SL	0.2	50	ds	ov	–	7.7	0.385	G.W.35cm
55	SD_1	L-vs	N_2	240	Flat plain on weathered limestone Undulating	limestone	3	0.3~1	60	grasses	1	N	wind	0~ 5	10YR 5/6	SL	–	–	dl	ov	–	/	/	
														5~	5YR 7/4	–	–	–	dh	ov	common	/	/	limestone
56	SD_2	Yc-md_2	S_3	270	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.3~1	90	grasses	5~10	CG	wind	0~ 10	10YR 5/6	LS	–	–	dl	ov	–	/	/	
														10~ 25	10YR 6/6	LS	–	–	dh	ov	–	/	/	
														25~ 30	10YR 6/6	SL	–	–	dch	ov	–	/	/	softlime
														30~ 50	10YR 7/4	SL	–	–	dch	ov	–	/	/	softlime
57	SD_2	Yc-s	N_2	275	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.3~1	70	herbs	5	CG	wind	0~ 10	10YR 5/6	SL	–	–	dl	es	–	8.5	0.185	
										grasses	5			10~ 20	10YR 5/6	SL	–	–	dh	ov	–	/	/	
														20~ 40	10YR 6/6	SL	–	–	dch	ov	–	8.5	0.137	
58	SD_2	Yc-s	N_2	260	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.3~1	70	herbs	5	CG	wind	0~ 10	10YR 5/6	fine S	–	–	dl	es	–	/	/	
										grasses	5			10~ 20	10YR 6/6	LS	–	–	dh	ov	–	/	/	

Auger No.	Area	Soil	Suit	Elevation (m)	Landform	Parent Material	Drainage	Surface Stoniness/gravel		Vegetation		Landuse	Erosion	Depth (cm)	Color	Texture	Gravel		Consistence	Reaction to HCl	Gypsum	PH (1:2.5)	EC (1:5) mS/cm	Remarks
								Size (cm)	Cover (%)	Compo	Cover (%)						Size (cm)	Content (%)						
59	SD_2	Yc-d_1	S_2	260	Wadi Flat	Recent alluvium	4	0.5~1	60	herbs grasses	5 20	CG	wind	0~ 10 10~ 90 90~	10YR 5/6 10YR 6/6 10YR 6/6	fine S LS LS	– – –	– – –	dl deh deh	ov ev ov	– – –	8.3 8.5 /	0.169 0.146 /	
60	SD_1	Yc-s	N_2	251	Flat plain of old alluvium undulating	Recent deposition on weathered limestone	3	0.3~2	70	grasses	10	CG	wind	0~ 5 5~ 15	10YR 5/6 7.5YR 5/8	S SL	– –	– –	dl dh	es ev	– –	/ /	/ /	
61	SD_1	Yc-s	N_2	250	Flat plain of old alluvium undulating	Recent deposition on weathered limestone	3	1~3	70	grasses	1	N	wind	0~ 10 10~ 30	10YR 5/6 7.5YR 5/8	LS LS	– –	– –	dl dh	es ev	– –	/ /	/ /	
62	SD_1	Yc-s	N_2	250	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5~5	60	grasses	10	CG	wind	0~ 5 5~ 20	10YR 4/6 10YR 5/6	LS SL	– –	– –	dl dh	es ev	– –	/ /	/ /	
63	SD_2	Jc-ad_2	S_3	270	Wadi Flat	Recent alluvium	4	0.2~0.8	80	grasses	20	CG	wind	0~ 5 5~ 20 20~ 50	10YR 5/4 10YR 5/6 7.5YR 5/6	gravelly LS SL SL	0.2 – 	50 – 	dl dh	es ev	– – abundant	8.6 / 8.7	0.150 / 0.154	Near P-1
64	SD_1	Jc-ad_2	S_3	240	Wadi Flat	Recent alluvium	4	0.5	80	herbs grasses	10 5	CG	Slight water	0~ 5 5~ 30 30~ 50	10YR 5/6 10YR 6/6 7.5YR 6/6	gravelly S gravelly LS gravelly LS	0.2 0.2 0.2	60 60 50	dl dh deh	es ev ev		8.4 / 8.1	0.180 / 0.289	
65	SD_1	Jc-s	N_2	240	Flat plain of old alluvium Flat	Recent deposition on weathered limestone	3	0.5~3	70	grasses	5	CG	wind	0~ 5 5~ 25	10YR 5/6 10YR 6/6	LS gravelly LS	– 0.2	– 60	dl dh	es ev	– –	/ /	/ /	
66	D	Jc-ad_2	S_3	200	Flat plain Flat	Recent alluvium	5	0.2~1	90	herbs grasses	5 5	CG	–	0~ 5 5~ 50	10YR 5/6 10YR 6/6	S gravelly LS	– 0.2~0.3	– 70	dl dh	es ev	– –	8.3 7.9	0.268 2.41	
67	D	Jc-ad_2	S_2	200	Flat plain Flat	Recent alluvium	5	2~3	70	herbs	10	CG	wind	0~ 5 5~ 25 25~	10YR 5/6 10YR 6/6 10YR 6/6	gravelly S gravelly LS gravelly LS	0.3 0.5 2	50 60 90	dl dh dh	es ev ev	– – –	/ / /	/ / /	
68	S	Rc-d	S_2	287	Alluvial Fan Undulating	Recent deposition	5	–	–	–	–	CY	–	0 ~140	10YR 5/6	fine S	–	–	dl	es	–	7.6 8.2	5cm 1.226 70cm 0.331	Date
69	S	Yy-s	N_2	289	Flat plain of old alluvium Undulating	Recent deposition on weathered limestone	3	0.2~0.5	70	Shrubs	1	CG	wind	0~ 5 5~ 12	10YR 5/6 10YR 6/6	LS SL	0.2 –	30 –	dl dh	es ev	– below 12cm abundant	/ /	/ /	
70	S	Jc-s	N_2	290	Wadi Flat	Recent alluvium	5	0.5~2	80	herbs	20	CG	water	0~ 5 5~ 45	10YR 5/6 10YR 6/6	gravelly S gravelly S	0.5 0.5	80 90	dl dl	es es	– –	/ /	/ /	
71	IIA	Yc-ad_1	S_2	270	Wadi Undulating	Recent alluvium	4	–	–	–	–	CY	–	0~ 25 25~ 50	10YR 5/6 10YR 5/6	gravelly S gravelly LS	0.2 ~0.3 0.2 ~0.3	60 60	dl dh	es ev	– –	8.0 7.8	0.419 3.96	Roase Grass
72	ED	Yy-s	N_2	235	Flat plain of old alluvium Flat	limestone	4	0.1~1	70	herbs grasses	1	N	wind	0~ 5 5~ 15 15~ 40	10YR 5/6 10YR 6/6 10YR 7/6	gravelly S LS SL	0.5 ~1 – –	30 – –	dl dh dvh	es ev ev	 common common	/ / /	/ / /	
73	VH	Yy-s	N_2	240	Flat plain of old alluvium Undulating	limestone	3	0.3~1	70	herbs	1	N	wind	0~ 5 5~ 10	10YR 5/6 2.5YR 4/6	SL SH	– –	– –	dl dh	ev ev	– abundant	7.6 7.6	0.53 8.88	
74	VH	Jc-s	N_2	240	Wadi Flat	Recent alluvium	5	0.5~1	70	herbs grasses	10 5	CG	water	0~ 5 5~ 40	10YR 5/6 10YR 5/6	S gravelly LS	– 0.3 ~0.5	– 70	dl dsh	es ev	– –	/ /	/ /	
75	Q	Yc-s	N_2	300	Flat plain of old alluvium Flat	limestone	3	0.2~3	70	grasses	< 1	CG	wind	0~ 5 5~ 75	10YR 5/6 10YR 8/6	SL CL	– –	– –	dl dh	es ev	– coomon	/ /	/ /	weathered limestone
76	H	Jc-d_1	S_1	320	Alluvial toeslope Undulating	Recent alluvium	4	0.2	80	shrubs grasses	20 1	CG	Slight wind water	0~ 5 5~ 30 30~100	10YR 5/6 10YR 5/6 7.5YR 5/6	LS LS SL	0.2 0.2 0.2	5 10 10	dl ds dh	es ev ev	– – –	8.3 / 8.6	0.164 / 0.131	
77	SD_2	Yc-s	N_2	275	Eroded gravel terrace Flat	limestone	3	1 ~3	70	herbs grasses	2 < 1	CG	wind	0~ 5 5~ 25	10YR 5/6 7.5YR 6/6	LS LS	– –	– –	dl dh	es ev	– –	/ /	/ /	
78	SD_2	Jc-s	N_2	275	Wadi Flat	Recent alluvium	4	0.5~1	70	herbs graases	1 1	CG	Slight water	0~ 5 5~ 45	10YR 5/4 10YR 5/6	LS SL	– –	– –	dl dh	ev ev	– –	/ /	/ /	

Auger No.	Area	Soil	Suit	Elevation (m)	Landform	Parent Material	Drainage	Surface Stoniness/gravel		Vegetation		Landuse	Erosion	Depth (cm)	※ Color	Texture	Gravel		Consistence	Reaction to HCl	Gypsum	PH (1:2.5)	EC (1:5) mS/cm	Remarks
								Size (cm)	Cover (%)	Compo	Cover (%)						Size (cm)	Content (%)						
79	D	Jc-d_1	S_2	200	Wadi side Flat	Recent alluvium	5	0.5~2	80	herbs grasses	10 1	CG	slight water	0~ 5 5~ 20 20~100	10YR 5/6 10YR 6/6 10YR 6/6	S S S	0.3 0.3 0.2	70 90 60	dl ds ds	es es ev	– – –	8.2 / 8.5	0.185 / 0.315	
80	D	Yc-s	N_2	200	Flat plain Flat	Recent deposition on weathered limestone	4	0.5	80	herbs grasses	20 1	CG	wind	0~ 5 5~ 20	10YR 5/6 10YR 6/6	LS LS	0.3 –	30 –	dl dh	es ev	– –	/ /	/ /	
81	NH	Yc-s	N_2	295	Flat plain of old alluvium Flat	limestone	3	0.2~1	80	shrubs grasses	<1 <1	N	Wind	0~ 2 2~ 4 4~ 10	10YR 5/4 10YR 5/6 7.5YR 5/6	Gravelly S LS LS	0.1 ~0.2 – –	30 – –	dl dh dh	ev ev ev	– – –	/ / /	/ / /	
82	SD_2	Yc-d_1	S_2	270	Wadi Flat	Recent alluvium	3	0.3~0.5	70	grassos	5	CG	Slight water	0~ 3 3~ 8 8~100	10YR 5/4 10YR 6/6 10YR 6/6	S SL SL	0.2 ~0.3 – –	30 – –	dl ds dh	ev ev ev	– – –	/ / /	/ / /	
83	Q	Jc-s	N_2	300	Wadi Flat	Recent alluvium	5	–	–	–	–	CV	Slight Water	0~ 10 10~ 30 30~	10YR 6/4 7.5YR 7/6 7.5YR 6/8	S Gravelly S Gravelly S	– 2 ~10 3 ~ 5	– 30 70	dl sl dl sl dl sl	ev ev ev	– – –	8.1 / 8.3	0.176 / 0.252	Farm
84	SD_2	Yc-s	S_2	269	Wadi Flat	Alluvium	3	0.2~0.5	90	grasses	5	CG	Slight Water	0~ 2 2~ 20 20~ 90 90~	10YR 5/4 10YR 5/4 7.5YR 5/6 7.5YR 5/6	gravelly S gravelly S SIL SIL	0.2 ~0.5 0.2 ~0.5 – –	40 60 – –	dl sl dh svf dh sf dh sf	es ev ev ev	– – – –	/ 8.6 / 8.4	/ 0.133 / 0.509	Near the pilot farm
85	SD_2	Yc-s	N_2	270	Weak gravel hill Undulating	Weathered marls	2	10 ~20	30	grasses	3	CG	Wind	0~ 2 2~ 40 40~(150)	7.5YR 5/6 7.5YR 5/6 7.5YR 7/4	gravelly S SIL SIL	0.2 ~0.5 – –	80 – –	dvh dvh dvh	ev ev ev	– – –	/ 8.4 8.0	/ 0.242 1.075	Near the pilot farm
86	SD_2	Yc-d_1	S_2	269	Alluvial toeslope Undulating	Alluvium	4	0.3~0.5	70	grasses	<1	N	Wind	0~ 15 15~ 60 60~(160)	10YR 5/4 10YR 5/6 10YR 6/4	S SL SL	– – –	– – –	dl sl dh svf dh sf	ev ev ev	– – –	8.7 / 9.1	0.120 / 0.276	Near the pilot farm
87	SD_2	Yc-d_1	S_2	267	Wadi Flat	Alluvium	3	0.2~1.0	90	grasses	<1	CG	Wind	0~ 2 2~ 10 10~ 60 60~	10YR 5/4 7.5YR 6/6 10YR 6/4 10YR 7/4	gravelly S SL gravelly SIL gravelly SIL	– – 0.2 ~1.0 0.2 ~1.0	– – 40 50	dl sl ds svf dh sf dh sf	es ev ev ev	– – few common	/ 8.2 / 8.2	/ 0.953 / 1.882	Near the pilot farm
88	HA	Yy-s	N_2	270	Wadi bank Undulating	Weathered marls	4	–	–	Shrubs	<1	–	wind	0~ 10 10~ 50 50~	10YR 5/6 10YR 6/6 –	SL SL limestone	– – –	– – –	ds svf dh sf – –	ev ev ev	abundant abundant abundant	8.1 8.1 /	3.930 3.760 /	Hand dug well
89	HA	Yy-d	S_3	270	Wadi bank Undulating	Alluvium	3	–	–	–	–	CV	–	0~ 20 20~ 35 35~110 110~	10YR 7/4 10YR 5/3 10YR 6/3 –	SL SL SIL limestone	– – – –	– – – –	svf svf sf svfl	es es ev ev	– – common –			Farm (Rhodes grass)
90	S	Yc-d	S_2	290	Flat plain Flat	Alluvium	3	0.2~ 0.5	70	–	–	CV	wind	0~ 2 2~ 20 20~ 50 50~150+	10YR 5/4 10YR 5/6 10YR 5/6 10YR 5/8	gravelly S SL L L	0.2~0.5 0.1~0.3 – –	30 10 – –	sl svf svf sf	ev ev ev ev	– few few few			Farm (Dates)
91	S	Kc-d	S_3	287	Alluvial Fan Undulating	Recent deposition	5	–	–	–	–	CV	–	0~ 3 3~ 80 80~130	10YR 6/4 7.5YR 5/6 7.5YR 5/6	S SL SL	– 1.0~2.0 3.0~5.0	– 5 10	sl svf svf	ev ev es	– few few			Farm
92	S	Kc-sd	S_3	290	Alluvial Fan Undulating	Alluvium	5	–	–	–	–	CV	–	0~ 30 30~ 80 80~150+	10YR 6/6 10YR 6/6 10YR 6/6	S gravelly SIL gravelly SIL	– 0.5~5.0 5.0	– 40 60	sl svf svf	ev ev ev	– – –			Farm
93	SD_2	Yc-d_1	S_2	267	Wadi Flat	Alluvium	3	0.2~0.5	70	grasses	2	CG	wind	0~ 10 10~ 50 50~150+	10YR 5/4 10YR 6/6 7.5YR 6/6	gravelly S SL SIL	0.2~0.3 0.2~0.3 0.2~0.3	70 20 15	dl sl dh svf dvh sf	es ev ev	– – –			Near the pilot farm
94	SD_2	Yc-d_1	S_2	265	Wadi Flat	Alluvium	3	0.5~1.0	80	grasses	3	CG	wind	0~ 5 5~ 60 60~150+	10YR 5/4 10YR 6/6 7.5YR 6/6	gravelly S SL SIL	0.2~0.3 – –	30 – –	ds svf dh sf dvh sf	ev ev ev	– – –			
95	SD_2	Yc-d_1	S_2	270	Wadi Flat	Alluvium	4	0.2~0.5	70	herbs grasses	1 5	CG	wind	0~ 20 20~ 70 70~150+	10YR 5/4 7.5YR 5/6 7.5YR 5/8	gravelly S SL L	0.2~0.5 – –	60 – –	dl sl dh svf dvh sf	es ev ev	– – –			
96	SD_2	Yc-sd_2	S_3	270	Wadi Flat	Alluvium	4	0.2~0.5	70	grasses	5	CG	wind	0~ 12 12~ 50 50~	10YR 5/4 7.5YR 5/6 –	gravelly S SL limestone	0.2~0.5 – –	30 – –	ds svf dh svf – –	es ev –	– – –			

※ Color of No.83 ~ 102 are in moist.

Auger No.	Area	Soil	Suit	Elevation (m)	Landform	Parent Material	Drainage	Surface Stoniness/gravel		Vegetation		Landuse	Erosion	Depth (cm)	※ Color	Texture	Gravel		Consistence	Reaction to HCl	Gypsum	PH (1:2.5)	EC (1:5) mS/cm	Remarks
								Size (cm)	Cover (%)	Compo	Cover (%)						Size (cm)	Content (%)						
97	SD_2	Yc-s	N_2	270	Flat plain Flat	Alluvium	3	1.0	70	herbs grasses	<1 <1	CG	wind	0~ 10 10~ 40 40~	10YR 5/4 7.5YR 5/6	gravelly SiL SL limestone	0.1~2.0 0.1~1.0 –	30 10 –	ds avf dh avf	es ev –	– – –			
98	SD_2	Yc-sd_2	S_3	270	Wadi Flat	Alluvium	3	0.2~1.0	90	grasses	<1	CG	wind	0~ 20 20~ 60 60~	10YR 5/4 10YR 5/6 –	S SL limestone	0.2~0.3 – –	10 – –	dl ml dh avf – –	es ev –	– – –			
99	SD_2	Yc-d_1	S_2	260	Wadi Flat	Alluvium	3	0.2~1.0	80	trees shrubs herbs grasses	<1 <1 <1 5	CG	wind	0~ 13 13~ 60 60~150+	10YR 5/4 7.5YR 5/6 7.5YR 5/6	gravelly S SL SL	0.2~0.5 – –	30 – –	dl ml dh avf dh mf	es ev ev	– – –			Near P-3
100	HA	Yc-d_1	S_2	270	Wadi bank Flat	Alluvium	3	–	–	–	–	CV	–	0~ 40 40~150	7.5YR 6/6 2.5YR 7/2	gravelly SL SL	2.0 1.0~3.0	30 10	avf mf	ev ev	– –			
101	SD_2	Yc-sd_2	S_3	265	Wadi Undulating	Alluvium	3	0.2~0.5	90	grasses	<1	CG	wind	0~ 6 6~ 60 60~	10YR 5/4 10YR 5/6 –	S SL limestone	– – –	– – –	dl ml dh mf – –	es ev –	– – –			
102	SD_2	Yc-d_1	S_2	265	Wadi Flat	Alluvium	3	0.2~1.0	70	grasses	20	CG	–	0~ 10 10~ 40 40~150+	10YR 5/4 10YR 6/6 7.5YR 8/2	S SL SiL	0.2~0.3 – –	20 – –	ml avf mf	es ev ev	– – –			Near the pilot farm

※ Color of No.83 ~ 102 are in moist.

(7)-2 Results of Auger Boring in the Pilot Farm Site

Auger No.	Soil	Suit	Elevation (m)	Landform	Parent Material	Drainage	Surface stone/gravel Size (cm)	Surface stone/gravel Coverage (%)	Vegetation Composition	Vegetation Coverage (%)	Depth (cm)	Color Dry	Color Moist	Texture	Gravel Size(mm)	Gravel Cont.(%)	Concistence	Reaction to HCl	Gypsum	pH (1:2.5)	EC (1:5) mS/cm	Remarks
PA-1	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.5-0.8	70	grasses	<1	0-15	10YR8/4	10YR6/6	S	3	60	dl,ml	es	-	8.5	0.108	
											15-55	10YR8/2	10YR7/3	SL	-	-	dh,mf	ev	-	8.3	0.643	
											55-120+	2.5Y8/2	10YR7/2	CL	-	-	dvh,mf	ev	-	/	/	
2	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.3-0.5	80	grasses	<1	0-15	10YR7/4	10YR6/4	S	3	60	dl,ml	es	-	8.6	0.087	
											15-70	10YR7/4	10YR6/6	S	3-5	60	dh,mf	ev	-	/	/	
											70-120+	10YR7/6	10YR6/6	SL	3-5	20	dvh,mf	ev	-	8.7	0.085	
3	Yc-vs	N2	282.5	Toeslope of eroded gravel hill	Limestone	2	0.2-0.3	70	grasses	<1	0-15	10YR7/4	10YR6/6	S	2-3	30	dl,ml	es	-	8.6	0.064	
											15-	10YR8/3	10YR6/6	-	-	-	deh	ev	-	/	/	limestone
4	Yc-vs	N2	282.5	Toeslope of eroded gravel hill	Limestone	2	0.2-3.0	70	grasses	<1	0-30	10YR8/3	10YR6/6	SL	20-30	60	dh,mf	ev	-	8.5	0.076	
											30-	-	-	-	-	-	deh	ev	-	/	/	limestone
5	Yc-vs	N2	282.5	Toeslope of eroded gravel hill	Limestone	2	0.5-5.0	70	grasses	<1	0-20	10YR8/3	10YR6/6	SL	2-3	60	dh,mf	es	-	8.5	0.08	
											20-	-	-	-	-	-	deh	ev	-	/	/	limestone
6	L-vs	N2	283.0	Toeslope of eroded gravel hill	Limestone	2	1.0-5.0	60	herbs	<1	0-8	10YR7/3	10YR6/6	SL	30	60	dl,ml	ev	-	8.2	0.123	
									grasses	<1	8-	-	-	-	-	-	-	ev	-	/	/	limestone
7	L-vs	N2	283.5	Toeslope of eroded gravel hill	Limestone	2	0.3-0.8	80	shrubs	<1	0-3	10YR7/3	10YR6/4	SL	2-3	40	dl,ml	es	-	8.4	0.071	
									grasses	<1	3-10	7.5YR6/6	7.5YR6/8	SL	3	40	dh,mf	ev	-	/	/	
											10-	-	-	-	-	-	-	-	-	/	/	limestone
8	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.3-0.6	70	grasses	<1	0-20	7.5YR8/4	7.5YR6/6	SL	5	30	dl,ml	es	-	8.5	0.074	
											20-130+	7.5YR8/4	7.5YR6/6	L	2-3	10	dh,mf	ev	-	8.7	0.09	
9	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.2-0.3	70	grasses	<1	0-7	10YR8/4	10YR5/4	S	2-8	60	dl,ml	es	-	8.5	0.081	
											7-25	7.5YR8/4	7.5YR5/6	SL	2-5	15	ds,mvf	es	-	/	/	
											25-40	7.5YR8/4	7.5YR6/6	SL	2-10	10	dh,mf	ev	-	/	/	
											40-130+	7.5YR8/3	7.5YR6/6	L	-	-	dvh,mf	ev	-	8.6	0.136	
10	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.3-5.0	80	grasses	<1	0-20	10YR7/3	10YR5/3	S	2-5	60	dl,ml	es	-	8.6	0.082	
											20-60	7.5YR8/6	7.5YR5/6	SL	1-2	5	dh,mf	ev	-	/	/	
											60-120+	7.5YR8/3	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	8.4	0.267	
11	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.2-0.3	80	grasses	<1	0-4	10YR8/4	10YR5/4	S	1-5	60	dl,ml	es	-	8.5	0.11	
											4-30	10YR8/4	10YR6/6	S	1-6	60	dh,mf	ev	-	/	/	
											30-100+	10YR8/3	10YR7/4	SiL	-	-	dvh,mf	ev	-	8.6	0.131	
12	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.2-0.3	80	grasses	<1	0-20	10YR7/3	10YR5/4	S	1-2	50	dl,ml	es	-	8.6	0.077	
											20-40	10YR8/3	10YR6/4	SL	-	-	dh,mf	ev	-	/	/	
											40-130+	10YR8/3	10YR6/4	L	-	-	dvh,mf	ev	-	8.6	0.318	
13	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.2-0.3	80	grasses	<1	0-20	10YR7/3	10YR6/4	S	1-2	40	dl,ml	es	-	/	/	
											20-35	7.5YR8/4	7.5YR6/6	S	1-3	40	dh,mf	ev	-	8.6	0.08	
											35-55	7.5YR8/3	7.5YR7/6	L	1-3	20	dh,mf	ev	-	/	/	
											55-120+	7.5YR8/3	7.5YR7/6	SiL	-	-	dh,mf	ev	-	8.4	0.286	
14	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-10	7.5YR8/4	7.5YR5/4	S	1-3	60	dh,mf	es	-	8.5	0.085	
											10-35	7.5YR8/6	7.5YR6/6	SL	1-2	30	dvh,mf	ev	-	/	/	
											35-70+	7.5YR8/3	10YR7/4	L	-	-	dvh,mf	ev	-	8.3	0.308	
15	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.2-0.3	80	grasses	<1	0-5	10YR7/3	7.5YR5/4	S	1-3	80	dh,mf	es	-	/	/	crust
											5-30	7.5YR8/4	7.5YR6/6	L	-	-	dvh,mf	ev	-	8.1	0.645	
											30-100+	7.5YR8/3	7.5YR7/4	SiL	-	-	dvh,mf	ev	-	8.2	0.492	
16	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-10	7.5YR7/6	7.6YR6/6	S	1-3	30	dh,mf	es	-	/	/	crust
											10-35	7.5YR7/4	7.5YR5/6	SL	-	-	dvh,mf	ev	-	8.5	0.122	
											35-100+	7.5YR8/4	7.5YR6/6	L	-	-	dvh,mf	ev	-	8.4	0.323	
17	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-15	10YR7/4	10YR5/4	S	1-5	60	dl,ml	es	-	/	/	
											15-40	7.5YR8/6	7.5YR6/6	SL	-	-	dh,mf	ev	-	8.5	0.112	
											40-120+	7.5YR8/4	7.5YR7/6	L	-	-	dvh,mf	ev	-	8.4	0.461	
18	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.1-0.5	60	grasses	<1	0-20	10YR7/4	10YR6/4	S	1-5	60	dl,ml	es	-	/	/	
											20-50	10YR8/4	10YR6/6	SL	-	-	dh,mf	ev	-	8.6	0.087	
											50-120+	7.5YR8/3	7.5YR6/6	L	-	-	dvh,mf	ev	-	8.4	0.268	
19	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.1-0.5	60	grasses	<1	0-5	10YR7/4	10YR6/4	S	1-5	60	dl,ml	es	-	/	/	
											5-100+	7.5YR7/4	7.5YR5/6	SL	-	-	dh,mf	ev	-	8.3	0.182	
												7.5YR7/4	7.5YR5/6	L	-	-	dvh,mf	ev	-	8.1	1.085	
20	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.1-0.5	70	grasses	<1	0-15	10YR7/3	10YR6/4	S	1-2	60	dl,ml	es	-	8.1	0.481	
											15-90+	10YR8/2	10YR7/4	L	-	-	dvh,mf	ev	-	8	1.089	
21	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.2-0.3	70	grasses	<1	0-8	10YR7/3	10YR5/4	SL	2-3	30	dl,ml	es	-	8.5	0.87	
											8-20	10YR8/4	7.5YR6/6	S	1-3	40	dh,mf	ev	-	/	/	
											20-100+	10YR8/4	10YR7/4	SiL	-	-	dvh,mf	ev	-	8.2	0.716	
22	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.2-0.3	70	grasses	<1	0-8	10YR7/3	10YR6/4	S	2-3	40	dl,ml	es	-	8.5	0.093	
											8-20	7.5YR8/4	7.5YR5/6	SL	1-3	30	dh,mf	ev	-	/	/	
											20-100+	10YR8/2	10YR7/4	SiL	-	-	dvh,mf	ev	-	8.5	0.171	
23	Yc-dl	S2	282.5	Wadi	Alluvium	3	0.1-1.0	70	grasses	<1	0-12	10YR7/3	10YR5/4	S	1-10	60	dl,ml	es	-	/	/	
											12-26	10YR8/4	7.6YR6/6	SL	1-3	30	dh,mf	es	-	8.2	0.109	
											26-120+	7.5YR8/4	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	8.1	0.309	
24	Yc-dl	S2	283.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-7	10YR7/3	10YR6/4	SL	2-3	30	dl,ml	es	-	/	/	
											7-25	7.5YR8/4	7.5YR6/6	SL	1	5	dh,mf	ev	-	8.3	0.107	
											25-45	7.5YR8/3	7.5YR6/6	SL	1	5	dvh,mf	ev	-	/	/	
											45-100+	7.5YR8/3	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	8.3	0.12	
25	Yc-dl	S2	283.0	Wadi	Alluvium	3	0.2-0.3	80	grasses	<1	0-3	10YR7/3	10YR6/4	S	1-3	40	dl,ml	es	-	/	/	
											3-30	10YR8/3	10YR6/6	SL	1-3	60	dh,mf	ev	-	8.3	0.101	
											30-100+	7.5YR8/4	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	8.3	0.23	
26	Yc-dl	S2	283.0	Wadi	Alluvium	3	0.1-0.3	80	grasses	<1	0-8	10YR7/3	10YR6/4	S	1-3	30	dl,ml	es	-	8.2	0.129	
											8-130+	10YR8/3	10YR6/6	L	1-20	5	dvh,mf	ev	-	8	0.841	
27	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.1-0.3	80	grasses	<1	0-10	7.5YR8/4	10YR6/4	SL	2-3	30	dl,ml	es	-	8.6	0.091	
											10-60	10YR8/2	10YR7/4	SL	-	-	dvh,mf	ev	-	/	/	
											60-120+	7.6YR8/3	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	8.1	1.08	
28	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.1-0.3	80	grasses	<1	0-8	10YR8/4	10YR6/4	L	1-3	50	dl,ml	es	-	7.8	0.129	
											8-100+	7.5YR8/2	10YR7/3	SiL	-	-	dvh,mf	ev	few	7.7	2.08	
29	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.1-0.3	80	grasses	<1	0-10	10YR7/4	10YR6/4	SL	1-3	60	dl,ml	es	-	8.2	0.132	
											10-100+	10YR8/2	10YR7/3	SiL	-	-	dvh,mf	ev	-	8.1	1.792	
30	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.1-1.0	80	grasses	<1	0-4	10YR8/4	10YR6/4	SL	1-5	60	dl,ml	es	-	7.7	0.115	
											4-60	7.6YR8/4	7.5YR6/6	SL	1-3	10	dh,mf	ev	-	/	/	
											60-100+	7.6YR8/3	7.5YR7/4	SiL	-	-	dvh,mf	ev	-	8.3	0.105	
31	Yc-dl	S2	282.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-12	10YR7/3	10YR6/4	SL	1-3	60	dl,ml	es	-	8.3	0.102	
											12-66	10YR8/4	10YR6/6	SiL	-	-	dh,mf	ev	-	8.1	0.675	ant's pore
											66-120+	7.5YR8/4	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	/	/	
32	Yc-dl	S2	282.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-3	10YR7/3	7.5YR5/4	S	1-3	60	dl,ml	es	-	/	/	
											3-30	10YR7/4	10YR6/6	S	-	-	dh,mf	ev	-	8.2	0.136	
											30-100+	10YR8/3	10YR7/6	SiL	-	-	dvh,mf	ev	-	8	0.782	

Auger No.	Soil	Soil	Eleva-tion (m)	Landform	Parent Material	Drain-age	Surface stone/gravel Size (cm)	Coverage (%)	Vegetation Compo-sition	Cover-age(%)	Depth (cm)	Color Dry	Color Moist	Texture	Gravel Size(mm)	Gravel Cont.(%)	Concislence	Reaction to HCl	Gypsum	pH (1:2.5)	EC (1:5) mS/cm	Remarks
33	Yc-dl	S2	282.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-8	10YR7/3	10YR6/4	S	1-3	30	dl,ml	es	-	/	/	
											8-15	7.5YR8/4	10YR6/6	SL	1-3	40	dh,mf	ev	-	8	0.247	
											15-130+	10YR8/3	10YR7/4	SiL	-	-	dvh,mf	ev	-	8	1.056	
34	Yc-dl	S2	283.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-13	10YR7/3	10YR6/4	S	1-3	30	dl,ml	es	-	8.3	0.116	
											13-45	7.5YR8/6	10YR7/6	L	1-3	40	dh,mf	ev	-	/	/	
											45-100+	7.5YR8/4	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	8.4	0.512	
35	Yc-dl	S2	283.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	10	0-10	10YR8/4	10YR5/4	SL	1-3	20	dl,ml	es	-	8.1	0.369	
											10-130+	10YR8/3	10YR7/4	SiL	-	-	dh,mf	ev	few	8.2	2	
36	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-10	10YR7/4	10YR5/6	S	1-3	10	dl,ml	es	-	8	0.646	
											10-130+	10YR8/2	10YR7/3	SiL	-	-	dh,mf	ev	-	7.7	2.14	
37	L-vs	N2	284.0	Toeslope of eroded gravel hill	Alluvium	1	10	30	grasses	<1	0-5	10YR8/2	10YR7/4	S	1-3	30	ds,mf	es	-	7.9	0.455	
											5-10	White	White	-	/	/	dvh,mf	ev	abundant	/	/	Gypsum
38	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.1-0.5	70	grasses	20	0-10	10YR8/4	10YR5/4	S	1-3	20	dl,ml	es	-	8.2	0.199	
											10-130+	10YR8/3	10YR7/3	SiL	-	-	dh,mf	ev	few	7.9	0.358	
39	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.1-0.5	70	grasses	<1	0-10	10YR7/3	10YR5/6	SL	1-5	20	dl,ml	es	-	/	/	
											10-50	10YR8/4	10YR5/6	SL	-	-	dh,mf	ev	-	8.2	0.141	
											50-130+	10YR8/2	10YR7/4	SiL	-	-	dvh,mf	ev	-	8.1	0.386	
40	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.2-1.0	80	grasses	<1	0-6	10YR7/3	10YR5/4	S	1-5	20	dl,ml	es	-	/	/	
											6-50	10YR7/6	10YR6/6	L	1-2	20	dh,mf	ev	-	8.3	0.114	
											50-130+	10YR8/3	10YR6/6	SiL	-	-	dvh,mf	ev	-	8.1	0.947	
41	Yc-dl	S2	282.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-7	10YR7/4	10YR6/4	S	1-5	10	dl,ml	es	-	8.2	0.213	
											7-30	10YR8/3	10YR6/6	L	-	-	dh,mf	es	-	/	/	
											30-130+	10YR8/2	10YR7/4	SiL	-	-	dvh,mf	ev	-	7.8	2.55	
42	Yc-dl	S2	282.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-3	10YR7/3	10YR5/4	SL	1-2	30	dl,ml	es	-	/	/	
											3-30	10YR8/4	10YR6/6	L	-	-	dh,mf	es	-	8.4	0.123	
											30-120+	10YR8/3	10YR6/6	SiL	-	-	dvh,mf	ev	-	8.2	0.548	
43	Yc-dl	S2	282.0	Wadi	Alluvium	3	0.2-0.3	80	grasses	<1	0-3	10YR7/4	10YR5/4	SL	2-3	60	dl,ml	es	-	/	/	
											3-30	7.5YR7/4	10YR6/6	L	2-3	20	ds,mvf	es	-	8.5	0.169	
											30-120+	10YR8/3	10YR6/6	SiL	-	-	dvh,mf	ev	-	8.3	0.776	
44	Yc-dl	S2	282.0	Wadi	Alluvium	3	0.1-0.5	70	grasses	<1	0-6	10YR7/4	10YR5/6	S	2-3	30	dl,ml	es	-	/	/	
											6-25	7.5YR8/4	7.5YR6/6	SL	1-2	10	ds,mvf	ev	-	8.5	0.21	
											25-100+	7.5YR8/4	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	8.1	1.54	
45	Yc-dl	S2	283.0	Wadi	Alluvium	2	0.1-0.5	70	grasses	<1	0-20	10YR7/3	10YR5/4	SL	1-3	20	dl,ml	es	-	8.6	0.136	
											20-30	10YR7/4	10YR6/6	SL	1-3	60	dh,mf	es	-	/	/	
											30-100+	10YR8/3	10YR6/6	SiL	-	-	dvh,mf	ev	-	8.6	0.268	
46	Yc-dl	S2	283.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	<1	0-10	10YR7/4	10YR5/6	S	2-3	10	dl,ml	es	-	8.5	0.143	
											10-18	10YR7/4	10YR5/6	S	2-3	60	ds,mvf	es	-	/	/	
											18-100+	10YR8/3	10YR7/4	SiL	-	-	dvh,mf	ev	few	8.3	1.032	
47	Yc-dl	S2	284.0	Wadi	Alluvium	2	0.1-0.5	80	grasses	<1	0-10	10YR7/4	10YR5/4	S	1-3	40	dl,ml	es	-	8.6	0.122	
											10-20	7.5YR8/4	7.5YR6/6	SL	1	30	dh,mf	ev	-	/	/	
											20-80+	10YR8/3	10YR6/4	SiL	-	-	dvh,mf	ev	-	8.5	0.272	
48	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.2-0.3	80	grasses	<1	0-7	10YR7/4	10YR5/4	S	1-5	40	dl,ml	es	-	8.1	0.619	
											7-25	10YR8/3	10YR6/4	L	-	-	dh,mf	es	-	/	/	
											25-120+	10YR8/3	10YR6/6	SiL	-	-	dvh,mf	ev	few	8	2.2	
49	Yc-dl	S2	283.5	Wadi	Alluvium	3	0.1-1.0	80	grasses	5	0-2	10YR7/4	10YR5/6	S	1-5	20	dl,ml	es	-	/	/	
											2-40	7.5YR8/4	7.5YR6/6	SiL	-	-	dvh,mf	ev	-	8.3	0.256	
											40-120+	10YR8/2	7.5YR6/6	SiL	-	-	dvh,mf	ev	common	8	1.835	
50	Yc-dl	S2	284.0	Wadi	Alluvium	3	0.1-0.5	80	grasses	10	0-10	7.5YR7/4	10YR5/6	SL	3-10	30	dl,ml	es	-	8.5	0.373	
											10-40	-	7.5YR7/6	L	-	-	mvf	ev	few	8.2	0.5	
											40-150+	-	10YR8/4	SiL	-	-	mvf	ev	common	8	1.589	

APPENDIX A-3.3
Agriculture

TABLE A-3.3.1 Agricultural Situation of Hilat Al-Rakah

Summation of Nine Farms * surveyed in Feb. 1989

Item	Datails sum up nine farms	Item	Datails sum up nine farms
1. Owner	9 persons	7. Farm Area	225.00 fd
Owner's Address	4 persons are living in Salalah. 5 persons are living in Thumrait. No one is living in his farm.	Items :	Area Numbers 15.0 fd : 6 farms 30.0 fd : 2 farms 75.0 fd : 1 farms
Farm Establishment	1984 - 1988	8. Cultivation	
2. Laborers		(1) Cultivated Area	56.78 fd
Foreigners	17 persons (9 farms)	/ Farm Area %	25.2 %
Wage : RO / month	60 - 70 RO	(2) Forage crops fd	27.20 fd
3. Well	All are using the shallow wells.	(2)/(1) %	47.9 %
		Rhodes grass	26.50 fd
Number of Wells	10 wells (using in 9 farms)	Alfalfa	0.70 fd
Depth of Well	Aver. 62.6 feet	(3) Vegetable fd	13.58 fd
Depth of Water	〃 17.1 〃	(3)/(1) %	23.9 %
Irrigation system	Almost using local furrow irri. system. Some farms use sprinkler and drip irri. systems.	Tomato	4.43 fd
		Egg-plant	0.40 fd
		Onion	1.15 fd
		Sweet potato	1.85 fd
		Potato	1.30 fd
		Turnip	0.76 fd
		Cucumber	0
		Carrot	0.10 fd
		Water melon	2.63 fd
		Sweet melon	0.10 fd
		others	0.86 fd
4. Machinery	No Mach.: 2 farms	(4) Fruit plants fd	16.00 fd
Items :	Cooperative : 6 farms	(4)/(1) %	28.2 %
	Independent : 1 farm	Date palm	13.85 fd
		others	2.15 fd
5. Appli. of Ferti.	Using	(5) Preparing for	
Compost	100 %	next crops fd	0 fd
Che. Ferti. NPK	67 %	(5)/(1) %	0 %
〃 Urea	78 %		
6. Livestock	Farms with Livestock : 5 farms		

Note : JICA Team survey in Feb. 1989 * : Some parts of 42 farms in Hailat Al-Rakah

TABLE A-3.3.2 Agricultural Situation of Dauka-1

Summation of Four Local Farms

Item	Local Farms (sum up 4 farms)	Item	Local Farms (sum up 4 farms)
1. Owner Name	——	8. Cultivation	
Owner's Address	All the land-owners are not living in farms.	(1) Cultivated Area	9.82 fd
		/ Farm Area %	9.8 %
Farm Establishment	1984-1987 esta.	(2) Forage crops fd	3.98 fd
2. Farm Area	Total : 100.0 fd	(2)/(1) %	40.5 %
(Total of 4 farms)	Aver. : 25.0 fd	Rhodes grass	3.95 fd
		Alfalfa	0.03 fd
3. Laborer :		(3) Vegetable fd	3.72 fd
Foreigner	1-2 persons / farm	(3)/(1) %	37.9 %
Wage : RO / month	60-70 RO / month	Tomato	1.05 fd
4. Well	All using abandoned flowing well.	Egg-plant	0.23 fd
		Onion	0.37 fd
Irrigation system	Using local furrow irrigation system. But some new systems are also introduced.	Sweet potato	1.39 fd
		Cucumber	0.38 fd
		others	0.30 fd
5. Machinery		(4) Fruit plants fd	1.20 fd
Tractor	0	(4)/(1) %	12.2 %
Attachment	0	Date palm	0.95 fd
		others	0.25 %
6. Live-stock	Farm with Livestock : 1 Farm	(5) Preparing for next crops fd	0.94 fd
		(5)/(1) %	9.4 %
7. Appli. of Ferti.	For all farms	(6) Developing	
Compost	Compost : yes	new field fd	3.00 fd
Che. Ferti. NPK	Che.NPK : no	/ Farm Area %	3.0 %
〃 Urea	Urea : yes		

Note : JICA Team survey in Feb. 1989

TABLE A-3.3.3 Agricultural Situation of Dauka-2

Farm of Center Pivot Irrigation

Item	Details	Item	Details
1. Owner's Name	——	8. Cultivation	
Owner's Address	Thumrait	(1) Cultivated Area	32.10 fd
Farm Establishment	1988	/ Farm Area %	75.0 %
2. Farm Area	42.8 fd	(2) Forage crops fd	32.05 fd
		(2)/(1) %	99.8 %
3. Laborer	1	Rhodes grass	32.05 fd
Foreigners	4	Alfalfa	0
Wage : RO / month	60 RO	3) Vegetable fd	0.05 fd
4. Well	Using Abandoned flowing well	(3)/(1) %	0.2 %
		Tomato	0.03 fd
Irrigation system	Center Pivot sys. 240m rad. with 5 spans	Egg-plant	0
		Onion	0.01 fd
		Sweet potato	0.01 fd
Working time	morning - 3 hrs evening - 2 hrs	Cucumber	0
		others	0
5. Machinery		(4) Fruit plant fd	0 fd
Tractors	Tractors 2	(4)/(1) %	0 %
Attachments	Attachments 11	Date palm	0
		others	0
6. Live-stocks		(5) Preparing for	
Camels	65	next crops fd	0 fd
Goat	-	(5)/(1) %	0 %
Cattle	0		
7. Appli. of Ferti.		(6) Developing	
Compost	Yes	new field fd	10.70 fd
Che. Ferti. NPK	Yes (15:15:15)	/ Farm Area %	25.0 %
〃 Urea	Yes		

Note : JICA Team survey in Feb. 1989

TABLE A-3.3.4 Agricultural Situation of Shasr-1

Old Farm inside the village

Item	Inside Farm	Item	Inside Farm
1. Owner	6 persons (cooperation)	7. Cultivation	
Owner's Address	All the owners are living in or near the village.	(1) Cultivated Area / Farm Area %	11.00 fd 73.3 %
Farm Establishment	Est. in 1970's	(2) Forage crops fd	1.00 fd
2. Farm Area	15.0 fd	(2)/(1) %	9.1 %
3. Laborers (items) :		Rhodes grass	0.55 fd
Land-owners	2 persons	Alfalfa	0.45 fd
Foreigners	4 persons	(3) Vegetable fd	2.00 fd
Wage : RO / month	60 RO	(3)/(1) %	18.2 %
4. Well	Using the Spring (Oasis)	Tomato	0
Irrigation system	Using local furrow irrigation system.	Egg-plant	0.40 fd
		Onion	0
		Sweet potato	0.05 fd
		Turnip	0.30 fd
		Cucumber	0.76 fd
Water quality	Good	others	0.49 fd
5. Machinery		(4) Fruit plants fd	6.50 fd
Tractor	0	(4)/(1) %	59.1 %
Attachment	0	Date palm	5.50 fd
		others	1.00 fd
6. Appli. of Ferti.		(5) Preparing for next crops fd	1.50 fd
Compost	Yes	(5)/(1) %	13.6 %
Che. Ferti. NPK	No		
〃 Urea	No		

Note : JICA Team survey in Feb. 1989

TABLE A-3.3.5 Agricultural Situation of Shasr-2

Summation of Three New Outside Farms

Item	Outside Farms (sum up 3 farms)	Item	Outside Farms (sum up 3 farms)
1. Owner	4 persons	7. Cultivation	
Owner's Address	3 persons are living in the village. 1 person is living in Thumrait.	(1) Cultivated Area	6.50 fd
		/ Farm Area %	5.9 %
Farm Establishment	1986 - 1988	(2) Forage crops fd	1.00 fd
		(2)/(1) %	15.4 %
2. Farm Area	110.0 fd	Rhodes grass	1.00 fd
		Alfalfa	0
3. Laborers (items) :		(3) Vegetable fd	2.55 fd
Land-owner	1 person	(3)/(1) %	39.2 %
Foreigners	3 persons		
Wage : RO / month	60 - 70 RO	Tomato	1.20 fd
		Egg-plant	0.65 fd
4. Well	Using the Spring : 1 farm	Onion	0.20 fd
	Using the Shallow Well : 2 farms	Sweet potato	0
		Turnip	0.13 fd
		Cucumber	0.25 fd
Irrigation system	Using local furrow irrigation system.	others	0.12 fd
		(4) Fruit plants fd	1.80 fd
		(4)/(1) %	27.7 %
5. Machinery			
Tractor	0	Date palm	1.80 fd
Attachment	0	others	0
6. Appli. of Ferti.		(5) Preparing for	
Compost	Yes	next crops fd	1.15 fd
Che. Ferti. NPK	No	(5)/(1) %	17.7 %
〃 Urea	No		

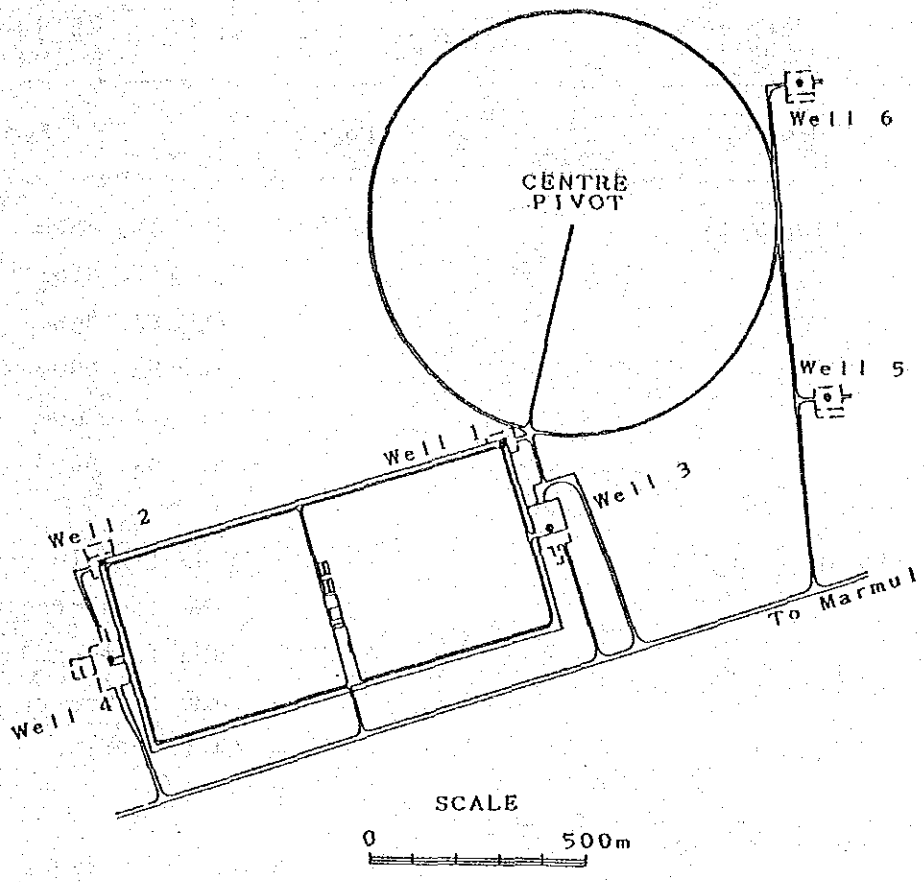
Note : JICA Team survey in Feb. 1989

TABLE A-3.3.6 PAMAP's Total Purchase Average Price and Volume in Salalah and Banana Factory for the Year 1987

Produce	Price (R.O.)		Volume (kg)	
	Local	Imported	Local	Imported
Banana	0.163	0.383	21,271	88,435
Banana Green	0.139		3,330,567	
Coconut Dry	0.171		9,424	
Coconut Green	0.162		55,318	
Papaya	0.139		246,624	
Lime	0.254	0.354	388,395	665
Cabbage Chinese	0.220		9,521	
Cabbage Green	0.156	0.142	905,274	43,670
Cabbage Red	0.179	0.241	34,425	380
Chilli	0.312	0.368	179,584	3,117
Cucumber	0.158		54	
Cucumber Long	0.253	0.295	202,541	3,000
Cucumber Small	0.288	0.266	117,361	23,206
Cucumber Yellow	0.176	0.231	1,046	700
Tomato	0.207	0.173	1,463,030	277,681
Eggplant	0.171		341	
Eggplant Black Long	0.086	0.125	43,214	2,880
Eggplant Black Round	0.085	0.120	463,004	9,483
Eggplant White	0.112	0.189	17,578	160
Squash	0.159		717	
Squash Big	0.148	0.490	80,556	60
Squash Small	0.229	0.259	190,872	9,777
Water Melon	0.111	0.104	944,907	20,735
Cauliflower	0.234	0.476	114,528	19,119
Okra	0.272	0.475	95,794	1,573
Potato	0.182	0.171	446,105	153,385
Carrot	0.187	0.215	40,237	55,466
Onion Dry	0.080	0.084	110,361	177,502
Onion Spring Leaves	0.128	0.462	4,650	10
Onion Spring	0.145	0.205	46,244	5,294
Sweet Pepper Long	0.127	0.150	68,150	5
Sweet Pepper Round	0.239	0.261	73,910	9,301
Sweet Corn	0.144	0.246	32,725	1,777
Lettuce	0.273	0.281	86,261	15,225
Orange	0.157	0.185	95,934	265,840
Dates Dry	0.824		70,732	
Dates Dry Powder				
Dates Fresh	0.318	0.350	43,185	165

Source: PAMAP (Salalah), 1987

FIG. A-3.3.1 P.D.O Farm Profile



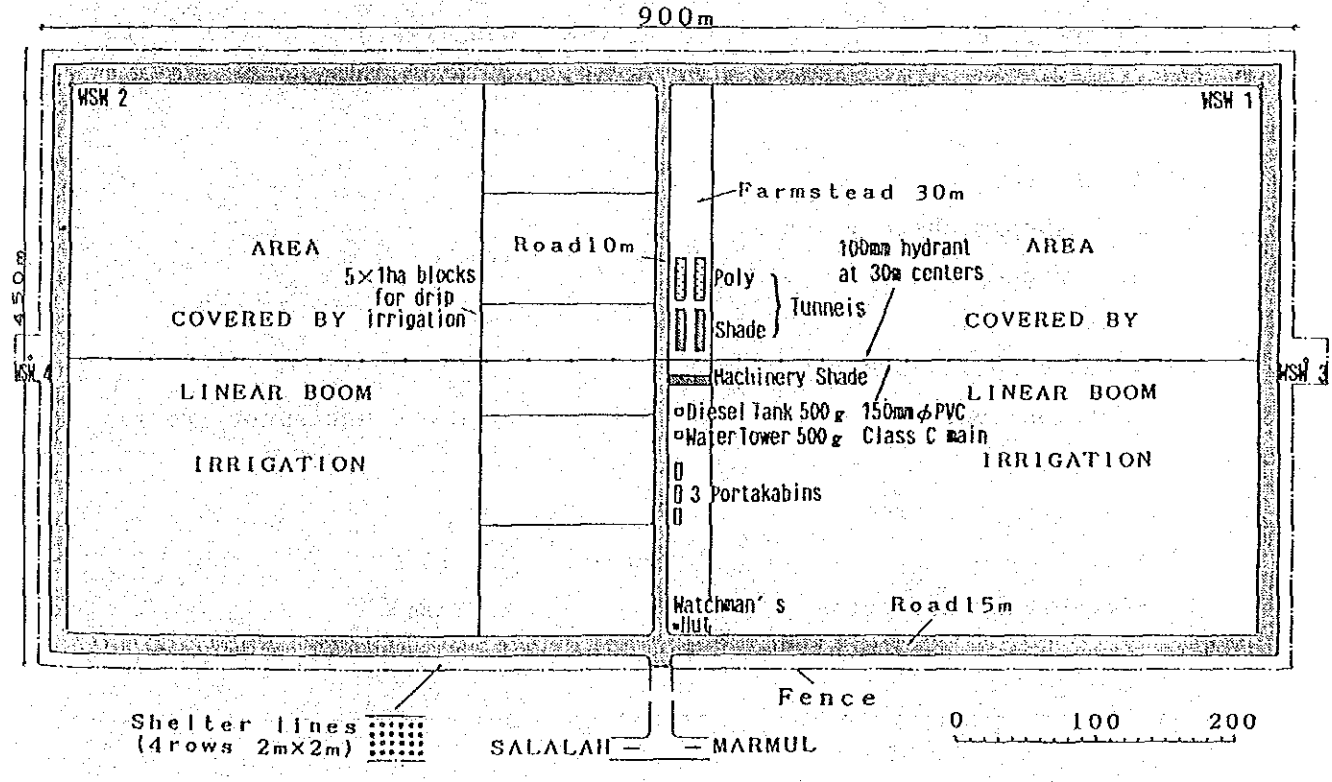


TABLE A-3.3.7 Summary of P.D.O Farm Facility

Description	Q'ty	Remarks
A. Production Well	6 Nos	'85 MAY, 450m 19 l/sec
		'85 MAY, 450m 15 l/sec
		'86 FEB, 540m 46 l/sec
		'86 FEB, 590m 15 l/sec
		'87 APR, 540m 46 l/sec
		'87 JUN, 540m 64 l/sec
B. Field Area in 1984	38 ha	30ha : Field crops
		1ha : Vegetables
		3ha : Orchard crops
		4ha : Amenity and timber tree
Field Area in 1987	63 ha	Centre Pirot
C. Irrigation Facilities		
(1) Linear boom irrigator	6 sets	After Feb. 1987
(2) Trickle system	1 set	Vegetables & Trees
(3) Centre Pivot	1 set	63ha field
(4) Linear irrigator	2 sets	Up to Feb. 1987
D. Buildings etc.		
(1) Worksshop/machinery shade		
(2) mobile hausing unit	2	
(3) Generator	1	
(4) Water supply & sewerage	1	
(5) Container unit	3	Seed and equipment storage
E. Appurtenant Facilities		
(1) Road	3,150 m	RCR 15 m
(2) Wind-break facilities		4 Lines

TABLE A-3.3.7

Description	Q'ty	Remarks
F. Machinery		
(1) Tractors	3 Nos	4WD
(2) Baler	1 No	
(3) Forklift	1 No	
(4) Subsoiler	1 No	
(5) Cultivator	1 No	
(6) Seeder	2 Nos	
(7) Mower	1 No	
(8) Rake	2 Nos	
(9) Trailer	1 No	
(10) Weighbridge	2 Nos	
(11) Communications	1 set	Welder (gas/electric)
(12) Tools & Equipment		Tool kit
		Jack (5 ton)
		Mobile compressor
(13) Pick-up truck	2 Nos	
(14) Stationwagon	1 No	

TABLE A-3.3.8 Constraints and Countermesures for Crop Cultivation

Constraint		Damages	Countermeasures
Meteorology	- Wind velocity	Soil erosion,Crop lodging	Shelter belt,Fence,Vinyl tunne
	- High temperature	Low growth rate of temperate crops	Crop selection,selection of cropping period
	- Low temperature (Dec. Jan.)	Low yield of forage crop, and	Selection of growth period
	- Rapid rise in temperature in March	Limit the production of temperate and sub-tropical vegetables, and growing season for wheat and barley	- ditto -
	- High humidity (from Sept. to April)	Difficult to product dry hay, disease injury	- ditto - Application of agricultural chemicals
Water	- High salinity content (low Na content)	Salt injury especially for annual crops	Introduction of crops with hig salinity tolerance, leaching
	- High salfate content		
Soil	- Low CEC	Nutrient losses by leaching	Fertilizer application
	- High bulk density	Restriction of root development	Top soil ploughing with one-w heavy disc harrow
	- Development of crust	Low germination rate	- ditto -
	- Puffy lead to development of algae	Lodging of crop	- ditto -
	- Low available water capacity		Frequent irrigation schedulin

TABLE A-3.3.9 List of Crop Cultivation In P.D.O Farm

Forage Crops	Cereals	Vegetaables	Orchards
Rhodes grass	Wheat	Tomato	Dates palm
6 varieties	16 varieties	Egg plant	4 varieties
Alfalfa		Water melon	Limes
2 varieties	Barley	Cucumber	Lemons
Italian ryegrass	12 varieties	Squash	Grapefurit
1 varieties		Okra	Algerian Tangerine
Oats		Canteloupe	Valencia Orange
3 varieties		Cabbage	Figs
		Onion	
Others:		Sweet Corn	
Tropical grass		Green Pepper	
6 crops		Califlower	
		Others: 3 crops	

Source : Study team hearing, 1987
The Desert Agricultural Project, A Report on Project Development on March 1988. PDO 1988

TABLE A-3.3.10 Results of Crop Trial in P.D.O Farm

	Corp	① Rhodes Gram	② Alfalfa	③ Sweet Corn	④ Tomatoes
Total days	Variety	Katambora	Karyati or Granada	Merit	Pearsons Al
	Sowing or Planting Date	Spring or Autumn	Nov-Jan	mid-Sep, early-Jan	early-Oct
	Seed	35~40kg/ha	34kg/ha	—	—
	Harvert	60—80 days	60days, then montly	70—80 days	late Jan to May
	Total Days	60—80 days	60 days	70—80 days	170 — 180 days
	Fertileser	2,000 kgN/ha/a 500 kgP2OH5/ha/a	500 kgP2O5/ha/a	20 g TSP/hole/week	20 g TSP/plant/week 4 g Urea/plant/week
	Plant Protection	Shoot fly gras foppers	caterpillars aphids, mites	stem borer caterpillor	birds, caterpillars sun scald
	Yield	45 t/ha	Granada:17 t/ha Karyati:15.6 t/ha	4~6 t/ha	50— 125 t/ha
	Comments	Recommendable as the mort puitable crop.	Better to sow after soil reclaimed.	Now naige Grain are now considered	Labour denand is high.

	Corp	⑤ Squash	⑥ Cucumber	⑦ Cabbage	⑧ Caililflower
Total days	Variety	Grey Zuchini	Sprint	Coponhagen	Snow ball
	Sowing or Planting Date	mid-Oct	Later-Oct	mid-Nov	early-Nov
	Seed	—	—	—	—
	Harvert	Dec to Jan	Dec-Harch	Jan-Harch	early Nov
	Total Days	100 — 200 days	120 — 130 days	100 — 130 days	90— 100 days
	Fertileser	20 g TSP/plant/week 4 g Urea/plant/week	20 g TSP/plant/week 4 g Urea/plant/week	20 g TSP/plant/week 4 g Urea/plant/week	20 g TSP/plant/week 4 g Urea/plant/week
	Plant Protection	white fly caterpillars A	white fly Aphio	Birds Caterpillars	Birds, miners Caterpillers
	Yield	25—40 t/ha	8—19 t/ha	15—32 t/ha	7—22 t/ha
	Comments	The two celder months are good fruits provede.	—	Proved as excellent winter crop.	—

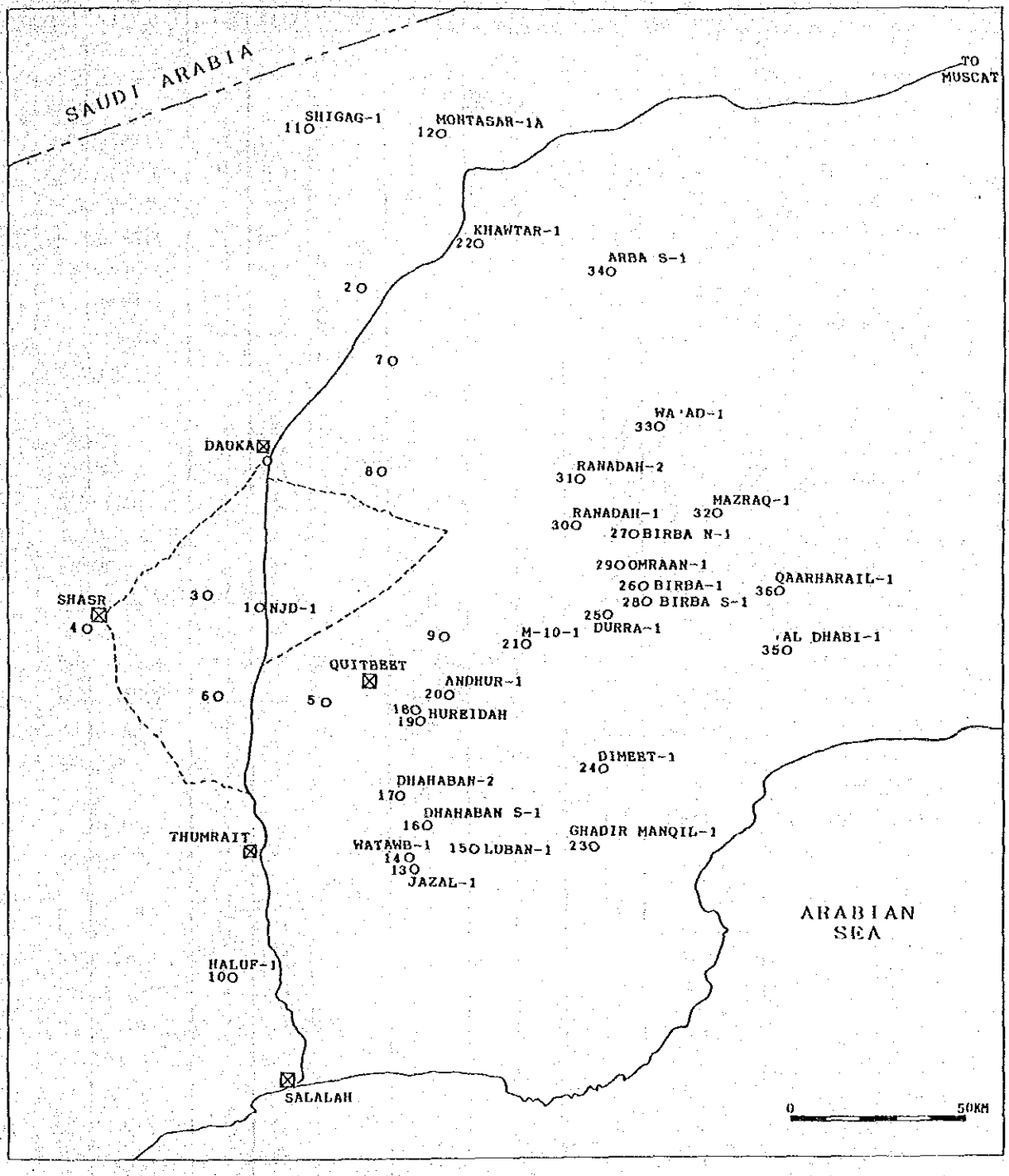
APPENDIX – 4

GROUNDWATER RESOURCES

APPENDIX A-4.1
Groundwater Survey

Page

A-4.1.1 Location of Exploration Bore Hole



PAWR BORE HOLES

2. BG117784AA 4. YA715978AA 6. ZV099779AA 8. BF263460AA
3. ZA035301AA 5. BE094486AA 7. BF298464AA 9. BF410641AA

A-4.1.2(1) Summary of Exploration Bore Holes in the Nejd: Availability of Logging Data

Ser. No.	Bore Hole I.D.	Data Availability (+)							
		Lithology	Fossil	Caliper	Gamma	Resistivity	S.P.	Density	Porosity
	JICA								
1	NJD-1	+	–	+	+	+	+	+	+
	PAWR								
2	BG117784AA	+	–	–	+	+	+	–	–
3	ZA035301AA	+	–	+	+	+	+	–	–
4.	YA715978AA	+	–	–	+	+	–	–	–
5	BE094486AA	+	–	+	+	+	–	–	–
6	ZV099779AA	+	–	–	+	+	–	–	–
7	BF298464AA	+	–	+	+	+	+	–	–
8	BF263460AA	+	–	+	+	+	–	–	–
9	BF410641AA	+	–	+	+	+	+	–	–
	PDO								
10	HALUF-1	+	+	–	–	–	–	–	–
11	SHIGAG-1	+	+	+	+	–	–	–	–
12	MONTASAR-1A	+	+	–	–	–	–	–	–
13	JAZAL-1	+	+	–	+	–	–	+	–
14	WATAWB-1	+	+	+	+	–	–	+	–
15	LUBAN-1	+	+	+	+	–	–	+	–
16	DHAHABAN S-1	+	+	+	+	–	–	+	–
17	DHAHABAN-2	+	+	+	+	–	–	+	–
18	HUREIDAH-1	+	–	+	+	–	–	+	–
19	HUREIDAH-2	+	–	+	+	–	–	+	–
20	ANDHUR-1	+	+	–	+	–	–	–	–
21	H-10-1	+	+	–	–	–	–	–	–
22	KHAWTAR-1	+	+	–	+	–	–	–	–
23	GHADIR HANQIL-1	+	+	–	+	–	–	–	–
24	DIHEET-1	+	+	+	+	–	–	+	–
25	DURRA-1	+	+	+	+	–	–	+	–
26	BIRBA-1	+	+	–	+	–	–	+	–
27	BIRBA NORTH-1	+	+	–	+	–	–	+	–
28	BIRBA SOUTH-1	+	+	–	+	–	–	+	–
29	OHRAAN-1	+	–	+	+	–	–	+	–
30	RANADAH-1	+	–	+	+	–	–	–	–
31	RANADAH-2	+	+	+	+	–	–	+	–
32	MAZRAQ-1	+	+	–	–	–	–	–	–
33	WA'AD-1	+	+	–	+	–	–	–	–
34	ARBA SOUTH-1	+	+	+	+	–	–	+	–
35	AL DHABI-1	+	–	+	+	–	–	+	–
36	QAARHARAIL-1	+	+	–	–	–	–	–	–

A-4.1.2(2) Summary of Exploration Bore Holes in the Nejd: Geological Division in Bore Hole

Ser. No.	Bore Hole I.D.	Ground Level (m)	Geological Division (Sole Depth in meters)					
			Alluvium	Fars	Dammam	Rus	Upper UER	Lower UER
	JICA							
1	NJD-1	282	–	–	30	140	270	>400
	PAWR							
2	BG117784AA	142	–	–	42	>95	nd	nd
3	ZA035301AA	265	–	–	–	143	239	>300
4	YA715978AA	290	–	–	–	128	206	>250
5	BE094486AA	310	–	–	48	126	260	>553
6	ZV099779AA	330	–	–	22	116	224	>300
7	BF298464AA	180	–	–	74	218	346	>400
8	BF263460AA	220	–	–	46	116	308	>400
9	BP410641AA	270	–	–	52	112	268	>287
	PDO							
10	HALUF-1	663	–	–	–	270	280	564
11	SHIGAG-1	141	15	–	30	254	381	673
12	MONTASAR-1A	113	nd	nd	nd	nd	nd	629
13	JAZAL-1	509	–	–	20	97	306	637
14	WATAWB-1	507	–	–	82	258	406	721
15	LUBAN-1	501	–	–	18	92	319	657
16	DHAHABAN S-1	441	–	–	65	143	323	668
17	DHAHABAN-2	399	–	–	–	76	213	534
18	HUREIDAH-1	339	–	–	–	73	227	541
19	HUREIDAH-2	326	–	–	–	65	220	549
20	ANDHUR-1	309	–	–	23	92	259	583
21	M-10-1	259	–	–	51	81	240	567
22	KHAWTAR-1	190	59	–	69	245	380	673
23	GHADIR MANQIL-1	504	–	–	–	–	231	582
24	DIMEET-1	344	–	–	–	77	306	666
25	DURRA-1	248	–	–	32	106	240	580
26	BIRBA-1	238	–	–	12	85	308	634
27	BIRBA NORTH-1	216	–	–	–	30	229	561
28	BIRBA SOUTH-1	237	9	–	21	95	277	622
29	OMRAAN-1	228	–	–	34	119	237	595
30	RANADAH-1	237	–	–	17/60	96	247	557
31	RANADAH-2	224	–	–	32	97	232	529
32	MAZRAQ-1	204	–	–	63	93	nd	570
33	WA'AD-1	215	20	–	68	97	222	nd
34	ARBA SOUTH-1	179	–	24	34	143	272	547
35	AL DHABI-1	279	–	–	137	291	549	900
36	QAARHARAIL-1	300	–	–	24	144	388	685