5. RESULTS AND DISCUSSION

5.1. SOIL STUDIES OF EL FAYOUM DEPRESSION :

According to the Soil Map of Egypt (1979), the soils of El Fayoum depression belong to three orders; Aridisols, Entisols and Vertisols (according to Soil Taxonomy, USDA, 1975). In the current study soil profiles representing each of these orders were studied to evaluate their capability and suitability for the cultivation of certain crops. The characteristics of these soils in each order according to the results obtained in this study areas are as follows;

5.1.1. Aridisols : in El Fayoum depression are divided into three subgroups (Calcids, Salids and Gypsids according to Soil Taxonomy U.S.D.A. (1998).

5.1.1.1. Typic Haplocalcids : These soils are located around the whole depression (eastern, western, southern and north western parts). They are represented by 9 profiles (No. 1, 2, 3, 4, 5, 6, 7, 8, 9). All these profiles have a calcic horizon at some depths within one meter from the soil surface which include enrichment of $CaCO_3$ in form of concretions and nodules. The texture of the soils varied from sandy to clay. The depth of the water table ranged between 85 cm and 120 cm. The pH values vary between 7.5 to 8.6. The soils are non to slightly saline, the EC of the soil extract ranged between 0.5 mmhos/cm to 3.7 mmhos/cm, except for profile No. (16) where the salinity ranges between 2.21 to 4.92 mmhos/cm, The EC values increased with depth in some profiles. The

soils are different in the values of ESP which ranged between 8.10 to 38.20. Most soils have slightly to moderately values (profiles 4, 5 and 9) where the ESP values are less than 15% but in profile No. 3 the ESP values was high or highly alkaline. The remained profiles are moderately alkaline (10.5% to 23.4%). In most soils, the highest ESP values were found in surface and subsurface layers, except profiles No. (4 and 6) where the highest values in the deepst layer. The organic matter content ranged between 0.3% to 1.95%. The highest amount was in the surface layer and decreased with depth. The $CaCO_3$ content ranges between 9.36% to 26.40%, and contain a calcic horizons in different depths. The distribution of $CaCO_3$ within the different profiles was different. In profiles No. (1, 2, 4 and 8) $CaCO_3$% increased with depth, while in the other profiles $CaCO_3$ % was highest in the surface and subsurface layers. Most of the $CaCO_3$ is mainly in concentration form of different sizes and shapes. In profiles No. (1, 2) of hard layer $CaCO_3$ was observed. This layer may affect the root growth. The CEC varied between 4.4 to 37.8 meq/100 gm soils. In profiles No. (2 and 4) it is between 4.4 to 18.05 meq/100 gm but in profile No. (1, 3, 6 and 9) it ranges between 10.30 to 37.80 meq/100 gm while the other profiles (5, 7 and 8) it ranges between 13.9 to 27.10 meq/100 gm.

The dominant soluble cations were Ca^{2+} and Na^{+} followed by Mg^{2+}, while in most profiles Cl^{-} is the dominant anion followed by $SO_4^{=}$ but in profiles (1, 2 and 4) $SO_4^{=}$ is the dominant followed by Cl^{-}. The soils of this unit are nearly level. The soils are poorly to moderately drained. Many coarse gravels are present on the surface but in profile No. (2

Table (11) Some chemical analyses of the Typic Haplocalcids soils in El Fayoum depression.

Profil No.	Depth (cm)	No	pH 1:2.5	EC mmhos 1:5	C.E.C. meq/100gm soil	ESP %	O.M (%)	$CaCO_3$ (%)	Soluble cations (meq/100 gm soil)				Anions (meq/100 gm soils)			
									Ca^{++}	Mg^{++}	Na^{+}	K^{+}	SO_4^{--}	Cl^{-}	HCO_3^{-}	CO_3^{--}
1	0-20	1	7.81	1.90	10.80	23.40	1.95	20.69	9.25	8.75	2.35	1.70	6.43	2.63	12.99	-
	20-40	2	7.88	1.40	18.30	19.40	1.40	17.75	4.75	16.75	2.13	5.80	20.93	3.00	5.50	-
	40-60	3	7.61	3.30	33.10	17.10	0.65	15.16	32.50	38.75	1.13	0.70	60.95	4.63	3.00	-
	60-85	4	7.70	3.60	37.80	18.30	0.53	14.81	43.00	37.75	1.10	0.60	70.52	4.38	7.50	-
	85-100	5	7.95	1.70	10.30	15.20	0.30	26.40	8.25	14.00	1.20	0.55	19.25	2.25	2.50	-
2	0-25	6	8.11	3.10	12.00	21.50	1.30	18.51	7.00	11.00	11.25	2.20	23.07	5.88	2.56	-
	25-45	7	8.28	1.10	13.10	15.85	0.90	18.87	2.50	6.00	6.31	1.19	7.25	3.75	5.00	-
	45-63	8	8.38	0.90	7.30	11.30	0.75	19.68	2.75	5.25	4.30	0.96	8.76	2.60	2.50	-
	63-74	9	8.36	0.80	6.47	14.10	0.60	17.23	1.50	6.00	4.23	0.88	4.98	2.63	5.20	-
	74-85	10	8.62	0.90	4.35	16.25	0.55	19.35	2.25	3.75	3.11	0.65	2.63	2.13	5.02	-
3	0-25	11	8.41	0.90	33.10	35.10	1.90	18.12	3.25	6.01	2.25	1.10	2.10	3.00	7.50	-
	25-45	12	8.36	1.40	28.40	38.20	1.30	18.03	6.50	3.75	2.85	0.88	4.85	4.13	5.01	-
	45-65	13	8.11	2.60	30.15	22.35	0.85	17.49	33.50	1.25	1.91	0.75	22.78	4.63	10.03	-
	65-90	14	8.22	3.70	11.95	23.85	0.70	15.71	4.00	2.30	8.80	1.3	26.11	3.50	7.52	-
4	0-15	15	8.50	1.60	13.38	12.60	1.30	9.37	2.25	11.50	1.11	0.82	6.05	2.13	7.50	-
	15-25	16	8.30	1.60	18.05	11.50	1.10	10.28	2.25	8.50	1.21	0.95	3.41	2.01	7.48	-
	25-50	17	8.30	1.80	10.45	8.10	0.90	13.90	1.75	11.75	1.30	0.55	8.10	2.25	5.01	-
	50-65	18	8.28	1.20	11.35	8.12	0.65	15.70	2.01	7.50	2.35	1.20	4.42	3.63	5.01	-
	65-85	19	8.13	1.10	7.10	15.12	0.55	18.56	2.50	6.01	3.10	0.88	1.73	3.25	7.50	-
5	0-30	20	8.3	3.40	22.40	23.10	1.80	17.90	3.10	6.75	15.75	1.25	14.10	9.50	3.75	-
	30-55	21	8.1	2.30	16.80	25.30	1.30	17.70	3.25	7.55	17.95	1.90	9.80	18.25	2.55	-
	55-80	22	8.3	1.80	13.90	24.10	0.90	16.60	3.55	7.75	15.55	0.75	15.85	10.00	1.75	-
	80-120	23	7.90	2.00	20.95	20.80	0.65	15.90	3.10	6.25	13.50	0.95	9.95	12.35	1.50	-
6	0-20	24	7.57	2.21	25.50	12.70	1.50	12.80	3.65	8.22	8.96	0.95	7.92	12.97	0.75	-
	20-40	25	7.64	3.60	33.30	10.15	1.10	17.70	8.85	12.31	14.13	1.15	6.07	29.33	0.83	-
	40-65	26	7.48	4.55	37.50	8.65	0.95	15.30	14.81	13.30	13.65	1.85	8.21	34.17	0.92	-
	65-90	27	7.63	4.65	31.90	8.05	0.70	11.70	15.51	12.13	13.45	2.30	9.68	32.60	1.14	-
	90-110	28	7.77	4.92	28.20	15.30	0.65	10.80	14.70	13.10	16.15	1.95	12.95	31.92	1.03	-
7	0-20	29	8.02	1.60	20.30	18.50	1.40	15.20	5.45	3.30	6.10	0.90	5.12	9.83	0.75	-
	20-45	30	7.93	1.64	17.50	21.30	1.10	14.30	7.10	2.90	6.90	0.65	8.02	7.86	1.39	-
	45-75	31	7.64	2.85	15.85	20.10	0.80	12.70	12.20	5.30	10.30	0.45	17.88	8.90	1.73	-
	75-120	32	7.78	1.20	16.40	18.40	0.75	14.30	5.70	2.30	4.35	0.30	7.03	6.38	0.42	-
8	0-20	33	7.45	1.49	25.80	16.40	1.60	15.50	6.95	2.95	4.25	0.30	5.94	7.48	0.88	-
	20-45	34	8.12	1.67	27.10	21.10	1.20	16.70	7.55	2.80	7.10	0.30	7.45	8.08	1.10	-
	45-65	35	7.72	1.99	22.20	22.30	0.70	15.60	6.80	3.75	8.95	0.65	8.32	10.37	1.27	-
	65-90	36	7.65	2.25	18.40	20.10	0.40	16.20	8.90	3.65	8.25	0.55	7.93	12.49	0.93	-
9	0-20	37	7.67	1.10	33.10	18.35	1.30	23.10	4.90	1.10	3.85	0.30	4.13	5.12	0.85	-
	20-50	38	7.45	1.75	31.0	18.80	0.95	25.30	10.30	1.90	4.30	0.30	7.38	8.25	1.13	-
	50-75	39	7.34	2.91	26.7	12.10	0.80	24.10	18.20	3.80	6.20	0.25	14.77	12.30	1.35	-
	75-100	40	7.35	2.45	19.8	10.50	0.65	20.80	16.70	2.30	4.95	0.20	12.13	10.75	1.20	-

Table (12) Practical size distribution of Typic Haplocalcids soils.

Profile No.	Depth cm	Sand (%)		Silt (%)	Clay (%)	Texture
		Coarse	Fine			
1	0-20	6.10	25.70	35.10	33.10	CL
	20-40	6.80	24.30	33.80	35.10	CL
	40-60	4.30	24.90	39.70	31.20	CL
	60-85	2.80	22.10	41.30	33.80	CL
	85-100	2.30	23.80	43.20	30.70	CL
2	0-25	6.90	25.30	41.80	26.00	L
	25-45	4.10	22.20	43.90	29.80	CL
	45-63	16.10	65.80	8.70	9.40	LS
	63-74	31.80	55.30	5.60	7.30	S
	74-85	28.60	61.30	4.30	5.80	S
3	0-25	20.30	28.60	19.30	31.80	SCL
	25-45	23.40	26.80	16.80	32.60	SCL
	45-65	15.80	14.80	25.60	43.80	C
	65-90	11.30	15.80	27.30	45.80	C
4	0-15	5.30	27.90	39.40	27.40	L
	15-25	4.80	28.30	40.10	26.80	L
	25-50	6.40	33.10	25.80	39.70	CL
	50-65	3.80	40.30	30.10	25.80	L
	65-85	3.40	42.70	32.60	21.30	SL
5	0-30	6.80	46.10	17.80	30.30	SCL
	30-55	20.10	36.30	25.30	18.30	SL
	55-80	24.40	38.80	26.30	10.50	SL
	80-120	28.10	45.80	15.80	10.30	SL
6	0-20	28.40	21.50	21.80	28.30	SCL
	20-40	18.30	15.90	22.30	43.50	C
	40-65	14.20	16.20	24.10	45.50	C
	65-90	10.40	2040	19.40	49.80	C
	90-110	5.70	17.10	23.80	53.40	C
7	0-20	29.30	22.50	15.50	32.70	SCL
	20-45	24.10	22.00	18.40	35.50	SC
	45-75	17.30	23.40	20.20	39.10	CL
	75-120	15.20	26.00	18.10	40.70	C
8	0-20	5.20	9.70	43.80	41.30	SIC
	20-45	9.40	13.80	40.10	36.80	CL
	45-65	12.50	30.00	25.30	32.20	CL
	65-90	13.70	32.50	20.10	33.70	SCL
9	0-20	29.40	30.00	22.30	18.30	SL
	20-50	31.60	37.80	14.40	11.20	SL
	50-75	17.10	16.50	25.30	39.30	CL
	75-100	14.20	17.90	27.10	40.80	C

Table (12) Practical size distribution of Typic Haplocalcids soils.

Profile No.	Depth cm	Sand (%)		Silt (%)	Clay (%)	Texture
		Coarse	Fine			
1	0-20	6.10	25.70	35.10	33.10	CL
	20-40	6.80	24.30	33.80	35.10	CL
	40-60	4.30	24.90	39.70	31.20	CL
	60-85	2.80	22.10	41.30	33.80	CL
	85-100	2.30	23.80	43.20	30.70	CL
2	0-25	6.90	25.30	41.80	26.00	L
	25-45	4.10	22.20	43.90	29.80	CL
	45-63	16.10	65.80	8.70	9.40	LS
	63-74	31.80	55.30	5.60	7.30	S
	74-85	28.60	61.30	4.30	5.80	S
3	0-25	20.30	28.60	19.30	31.80	SCL
	25-45	23.40	26.80	16.80	32.60	SCL
	45-65	15.80	14.80	25.60	43.80	C
	65-90	11.30	15.80	27.30	45.80	C
4	0-15	5.30	27.90	39.40	27.40	L
	15-25	4.80	28.30	40.10	26.80	L
	25-50	6.40	33.10	25.80	39.70	CL
	50-65	3.80	40.30	30.10	25.80	L
	65-85	3.40	42.70	32.60	21.30	SL
5	0-30	6.80	46.10	17.80	30.30	SCL
	30-55	20.10	36.30	25.30	18.30	SL
	55-80	24.40	38.80	26.30	10.50	SL
	80-120	28.10	45.80	15.80	10.30	SL
6	0-20	28.40	21.50	21.80	28.30	SCL
	20-40	18.30	15.90	22.30	43.50	C
	40-65	14.20	16.20	24.10	45.50	C
	65-90	10.40	2040	19.40	49.80	C
	90-110	5.70	17.10	23.80	53.40	C
7	0-20	29.30	22.50	15.50	32.70	SCL
	20-45	24.10	22.00	18.40	35.50	SC
	45-75	17.30	23.40	20.20	39.10	CL
	75-120	15.20	26.00	18.10	40.70	C
8	0-20	5.20	9.70	43.80	41.30	SIC
	20-45	9.40	13.80	40.10	36.80	CL
	45-65	12.50	30.00	25.30	32.20	CL
	65-90	13.70	32.50	20.10	33.70	SCL
9	0-20	29.40	30.00	22.30	18.30	SL
	20-50	31.60	37.80	14.40	11.20	SL
	50-75	17.10	16.50	25.30	39.30	CL
	75-100	14.20	17.90	27.10	40.80	C

and 9) medium and coarse gravels are present in the deep layers (between 77 cm to 90 cm). Few gypsum crystals are found in profiles No. (6 and 9). The agricultural production in this unit is moderate due to high $CaCO_3$ content, medium water table level and high alkalinity.

5.1.1.2. Typic Haplosalids.

Most of these soils are located adjacent to Qarun Lake. They are represented by profiles No. 10 and 11. The soil are covered by a salt crust from 1 to 4 cm thick and are poorly drained. The texture of these unit varied from sandy clay loam to clay. The water table depth is less than 100 cm. The pH values ranged from 8.03 to 8.47. The soils are highly saline, the EC values ranged between 8.6 to 14 mmhos/cm. The EC values increased in the surface and subsurface layer and decreased with depth. There are many deep and wide cracks in the surface. These soils are moderately to highly alkaline (ESP between 12.8 to 35.19). The $CaCO_3$ content range between 8.38% to 11.74%, the highest content is present in the subsurface layer (38 cm to 50 cm deep) and decrease with depth. The organic matter content ranged between 0.22% to 1.63%, the highest content in surface and subsurface layers due to the many coarse roots of the natural plants in these subsurface layers. CEC values varied slightly in the surface (26.0 to 18.40 meq/100 gm), while it increased in the subsurface (21.3 to 42.3 meq/100 gm) and became decrease gradually. Na^+ is the dominant soluble cation followed by Mg^{2+} while $SO_4^=$ is the dominant anion followed by Cl^-. The soils of this unit are highly saline, high water level poorly drained, highly alkaline. This means that the soil of this unit are not suitable for agricultural purpose.

Table (13) Some chemical analyses of the Haplosalids soils in El Fayoum depression.

Profile No.	Depth (cm)	No	pH 1:2.5	EC mmhos 1:5	C.E.C. meq/100gm soil	ESP %	O.M (%)	$CaCO_3$ (%)	Soluble Cations (meq/100 gm soil)				Soluble Anions (meq/100 gm soil)			
									Ca^{++}	Mg^{++}	Na^{+}	K^{+}	SO_4^{--}	Cl^{-}	HCO_3^{-}	CO_3^{--}
10	0-27	41	8.16	12.50	1.63	10.49	26.0	25.16	10.25	18.00	33.15	9.15	37.05	21.00	12.50	-
	27-38	42	8.03	14.10	1.06	10.83	42.3	21.23	20.75	33.50	45.80	7.10	83.30	13.88	10.00	-
	38-60	43	8.11	10.10	0.72	8.78	34.80	25.75	10.75	30.75	42.80	5.00	56.29	16.01	7.00	-
	60-77	44	8.47	9.90	0.39	8.38	14.08	35.19	1.50	8.70	19.85	3.80	8.99	14.75	10.11	-
	77-100	45	8.07	8.60	0.22	8.88	18.10	33.65	3.25	16.29	19.35	2.30	21.97	16.88	2.25	-
11	0-20	46	8.17	9.60	1.53	10.57	18.40	18.40	6.50	18.75	3.35	1.15	16.87	7.88	5.00	-
	20-50	47	8.28	10.60	0.97	11.74	21.30	17.80	5.25	8.50	6.75	1.15	8.90	5.25	7.50	-
	50-70	48	8.43	9.80	0.75	9.04	17.10	15.30	4.75	6.75	10.55	1.30	5.47	5.38	12.50	-
	70-100	49	8.32	8.80	0.38	9.18	16.80	12.80	4.25	4.50	13.35	1.15	7.37	5.88	10.00	-

According to Soil Taxonomy (1998) these soils could be classified as Haplosalids.

5.1.1.3. Typic Haplogypsids.

These soils are located in the north eastern part of the depression beside the desert fringes and is represented by two profiles (No. 12 and 13). The texture of the soils are clayey, sandy clay loam and sandy loam. The water table depth is more than 110 cm drainage is moderately to good. The area is irrigated by mixed water from the Nile and drainage water. The pH values varied between 7.27 and 8.3. The soils are not to slightly saline (EC between 1.32 and 2.32 mmhos/cm). The organic matter is very low ranging from 0.4% to 1.5%. The higher percentages are is in the surface layer and become decrease gradually with depth. These soils are highly to moderately alkaline (ESP varied between 17.4 to 30.10, the highly amount in the deep layer. CEC values varied between 21.3 to 37.5 meq/100 gm. The soils contained high amount of $CaCO_3$%, it varied between 17.8% to 21.80% many lime, concentration at different sizes and much of gypsum is found as crystals in a subsurface layers and increase with depth and many coarse gypsic accumulation which increase with depth. Ca^{2+} is the dominant soluble cation followed by Na^{+} while $SO_4^{=}$ is the dominant soluble anion follow by Cl^{-}. These soils are moderately to strongly slope. In this unit the highly $CaCO_3$%, $CaSO_4$ % and alkalinity and the low O.M. reduce the agricultural production.

According to Soil Taxonomy (1998), these soils are classified as Haplogypsids.

The soils have a gypsic horizon in the upper 1 m.

Table (14) Some chemical analyses of Typic Haplogypsids soils of El Fayoum depression.

Profile No.	Depth (cm)	No	pH 1:2.5	EC mmhos 1:5	O.M.	$CaCO_3$ %	CEC meq/100gm soil	ESP (%)	Soluble Cations (meq/100 gm soil)				Soluble Anions (meq/100 gm soil)			
									Ca^{++}	Mg^{++}	Na^{+}	K^{+}	SO_4^{--}	Cl^{-}	HCO_3^{-}	CO_3^{--}
12	0-35	50	7.41	1.44	1.30	19.1	21.3	22.4	7.95	1.35	4.30	0.55	9.19	4.22	0.65	-
	35-70	51	8.03	1.32	0.90	17.8	23.2	28.3	8.35	1.60	3.15	0.35	9.30	3.46	0.73	-
	70-110	52	7.56	1.47	0.60	18.30	28.1	30.10	9.10	2.70	3.75	0.30	8.63	5.94	0.68	-
13	0-25	53	7.27	1.68	1.50	21.80	30.1	27.3	10.45	3.10	2.20	0.40	10.23	4.62	1.10	-
	25-40	54	7.29	1.88	0.80	19.30	33.3	23.1	11.20	2.90	3.90	0.30	11.27	5.96	0.95	-
	40-70	55	7.69	1.71	0.60	20.10	37.5	18.7	12.85	1.40	2.60	0.20	10.51	5.63	0.90	-
	70-100	56	7.40	2.32	0.40	18.90	35.8	17.4	14.70	3.20	4.50	0.30	12.60	8.96	1.08	-

Table (15) Practical size distribution of Typic Haplosalids and Haplogypsids soils.

Profile No.	Depth cm	Sand (%)		Silt (%)	Clay (%)	Texture
		Coarse	Fine			
10	0-27	3.50	48.60	16.80	31.10	SCL
	27-38	2.30	44.60	18.60	34.50	SC
	38-60	2.10	18.10	25.80	54.00	C
	60-77	22.00	30.50	14.10	33.40	SCL
	77-100	22.90	37.80	20.80	18.50	SL
11	0-20	4.70	19.20	25.30	50.80	C
	20-50	6.80	12.70	27.20	53.30	C
	50-70	5.10	20.30	28.10	46.50	C
	70-100	4.30	23.50	30.20	42.00	C
III Tyic Haplogypsic						
12	0-35	7.50	48.10	18.10	26.30	SCL
	35-70	22.60	50.80	10.50	16.10	SL
	70-100	23.40	58.10	8.50	10.00	LS
13	0-25	12.50	57.40	9.10	21.00	SCL
	25-40	9.30	48.20	14.30	28.20	SCL
	40-70	7.10	38.50	22.10	32.30	SCL
	70-110	8.30	39.90	14.50	42.30	C

5.1.2. Entisol.

In El Fayoum depression the Entisols are divided into: Torrifluvents and Torripsamments.

5.1.2.1. Typic Torrifluvents.

They are represented by profile No. (14), and are located in the central part of the depression. The pH values varies between 8.40 to 8.60. These soils are slightly saline (EC values ranged between 1.8 to 3.70 mmhos/cm). The organic matter content varied between 0.4 to 1.8%. They are slightly to moderately alkaline (ESP ranged between 13.5 to 16.7), the high content in the surface. The CEC values varied between 30.2 to 34.2 meq/100 gm. The soil texture varied between sandy clay loam to sandy loam Na^+ is the dominant soluble cation followed by Mg^{2+} and $SO_4^=$ is the dominant soluble anion followed by Cl^-. These soils are well drained and nearly level. The water table depth is more than 120 cm. These soils are Torrifluvents.

5.1.2.2. Typic Torripsamments.

These soils are located in the south western part of the depression are represented by profile No. (15). The texture of these soils varies between sandy clay loam and sandy. The water table depth is more than 110 cm. The pH values ranged between 7.8 to 8.5. The soils are moderately saline EC values ranged between 3.6 to 4.8 mmhos/cm). The low OM content is low (0.4% to 1.10%). The soils are moderately alkaline (ESP varies between 13.5 to 20.10%) and CEC values varied between 8.4 to 10.5 meq/100 gm. $CaCO_3$ content ranged between 8.8 to

Table (16) Some chemical analysis of the Typic Torripsamment and Typic Torrifluvents.

Prof. No.	Depth cm	Nc	PH 1:2.5	EC mmhos 1:50	O.M. %	$CaCo_3$ %	CEC meq/ 100 gm soil	ESP %	Soluble cations (meq/100 g soil) Ca^{++}	Mg^{++}	Na^{+}	K^{+}	S. Anions (meq/100 g soil) $So_4^{=}$	Cl^{-}	HCo_3^{-}	$Co_3^{=}$
	0-35	57	8.6	2.30	1.80	6.40	30.20	16.70	0.9	1.30	1.90	0.20	2.8	0.9	0.6	-
14	30-60	58	8.4	3.70	1.10	6.30	33.55	14.80	0.8	1.10	1.60	0.30	2.1	0.9	0.8	-
	60-80	59	8.5	2.40	0.50	6.95	34.20	13.55	0.8	0.9	2.50	0.2	1.9	2.00	0.5	-
	80-120	60	8.5	1.80	0.40	5.75	31.85	13.50	0.6	0.90	3.30	0.1	2.3	2.1	0.5	-
		Typic Torripsamments														
	0-25	61	7.8	3.8	1.10	11.70	10.30	20.10	0.6	1.20	2.60	0.2	3.40	0.90	0.30	-
15	25-50	62	8.4	4.3	0.80	10.80	9.60	17.80	0.9	1.80	2.10	0.3	3.80	1.10	0.20	-
	50-70	63	8.5	4.8	0.65	8.80	8.40	15.40	1.40	2.10	2.40	0.2	3.60	2.30	0.20	-
	70-110	64	8.1	3.6	0.40	9.10	10.50	13.50	1.30	1.60	2.10	0.1	4.00	0.8	0.30	-

Table (17) Con. Particle size distribution of Typic Torrifluvents and Typic Torripsamments soils.

Profile No.	Depth cm	Sand % Coarse	Sand % Fine	Silt %	Clay %	Texture
	0-35	40.10	30.50	8.30	21.10	SCL
14	35-60	25.40	39.90	14.80	19.90	SL
	60-100	25.70	36.40	22.50	15.40	SL
	100-120	23.10	37.10	21.60	18.20	SL
		II Typic Tarripsamments				
	0-25	37.50	28.10	8.60	25.80	SCL
15	25-50	45.80	41.10	2.30	8.70	LS
	50-70	58.80	32.80	2.60	5.80	S
	70-110	54.70	37.60	2.30	5.40	S

11.70%, the highest amount is in the surface and decreased with depth. Few fine lime conceretion are formed in the surface and subsurface layers.

Na^+ is the dominant soluble cation followed by Mg^{2+} while $SO_4^=$ is the dominant soluble anion followed by Cl^-. These soils are moderately to strongly. Sloping, many medium and coarse gravels on the surface. They are moderately drained and not good irrigation water. These soils are not suitable for agricultural production actually due to the poorly drainage, low OM content, high alkalinity but potentially may be suitable.

These soils are classified according to Soil Taxonomy (1998) as Torripsamments.

5.1.3. Vertisols :

5.1.3.1. Typic Haplotorrerts :

The soils of this unit are located in the central part of the depression and they are the most fertile soils. This unit is represented by 9 profiles (No. 16, 17, 18, 19, 20, 21, 22, 23 and 24). The pH values varied between 7.53 to 8.60. These soils are slightly saline (The EC values varied between 0.88 to 3.6 mmhos/cm). The EC values are higher in the surface layers and become decrease with depth. The soils have O.M. content, varieing between 0.2% and 2.60%, the highest amount in the surface layer and decreased with depth, O.M. varies between 1.7 to 2.6% in the surface and 0.3% to 0.66% in the depth layer. These soils are slightly to moderately alkaline (ESP varies between 9.70 to 33.10%, it

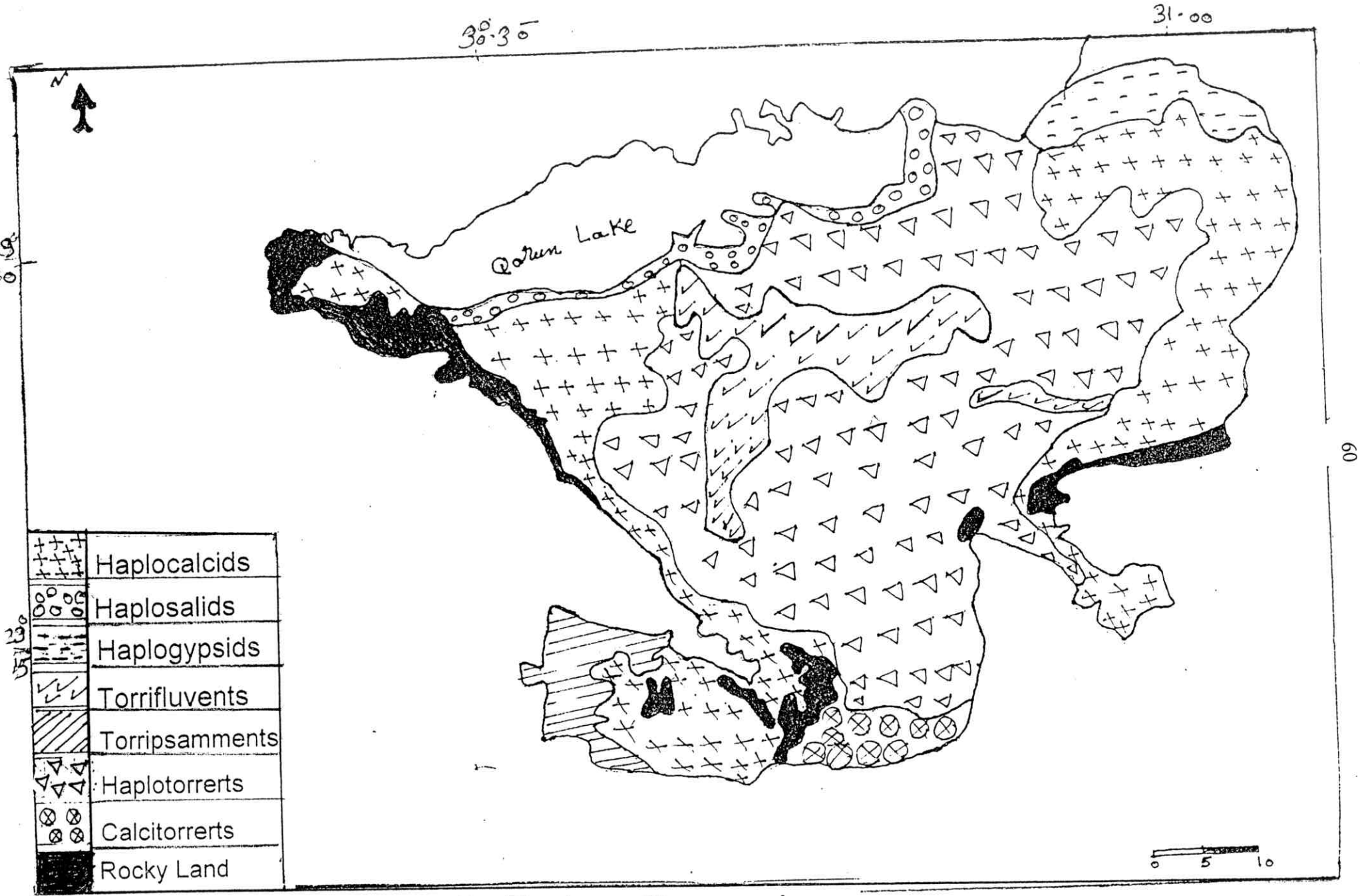

Fig. (9): The Soil Map of El - Fayoum Depression.

(Soil Map of Egypt . Part 4, 1979)

Table (18) Some chemical analysis of Typic Haplotorrrerts soil.

Prof. No.	Depth cm	No.	pH 1:2.5	EC mmhos 1:50	O.M %	$CaCO_3$ %	CEC meq/ 100gm soil	ESP %	Soluble cations (meq/100 gm soil)				S. Anions (meq/100 gm soil)			
									Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$So_4^{=}$	Cl^{+}	HCo_3^{-}	$Co_3^{=}$
16	0-20	65	8.10	2.80	1.78	4.58	10.14	10.30	1.75	3.75	8.75	0.90	8.25	5.10	1.80	-
	20-55	66	8.30	1.90	0.97	3.57	8.21	10.20	1.50	3.25	9.15	0.70	9.10	4.00	1.50	-
	55-75	67	8.20	1.25	0.74	4.10	10.61	9.70	1.25	5.50	9.35	0.65	11.50	4.25	0.95	-
	75-90	68	8.10	1.90	0.33	3.57	7.48	12.90	1.50	2.25	7.35	0.65	7.70	2.30	1.75	-
	90-110	69	8.30	0.95	0.30	2.77	7.77	13.70	1.25	2.50	6.10	0.85	6.67	2.38	1.65	-
17	0-30	70	7.59	0.88	1.80	6.50	33.85	22.10	2.80	1.10	4.90	0.20	6.05	2.38	0.55	-
	30-55	71	7.53	0.95	1.30	4.80	36.70	20.50	2.70	1.10	5.95	0.20	6.80	2.70	0.40	-
	55-75	72	7.61	1.12	0.95	3.50	32.70	18.40	3.90	1.80	5.40	0.30	7.75	2.72	0.90	-
	75-110	73	7.82	1.39	0.70	2.75	27.50	17.30	3.15	2.10	8.30	0.20	8.28	4.98	0.82	-
	110-120	74	7.90	1.76	0.20	2.80	26.80	17.15	6.25	2.20	9.20	0.30	9.30	7.72	0.85	-
18	0-30	75	7.90	1.80	1.70	5.30	40.1	9.80	0.20	0.60	1.20	0.20	0.50	1.30	0.40	-
	30-60	76	8.30	1.30	1.40	5.90	35.25	10.85	0.20	0.50	1.30	0.1	0.50	1.00	0.40	-
	60-90	77	8.50	1.70	0.60	4.50	31.30	12.50	0.40	0.50	1.80	0.1	0.40	1.20	0.40	-
	90-120	78	8.50	1.60	0.50	3.90	34.30	12.80	0.40	0.30	2.10	0.1	0.80	1.80	0.30	-
20	0-30	79	8.1	3.10	2.10	6.30	22.30	21.70	6.80	11.80	15.30	0.2	3.10	29.50	1.50	-
	30-70	80	8.50	2.40	1.30	8.10	36.50	19.30	5.30	8.10	13.30	0.1	3.10	21.90	1.80	-
	70-100	81	8.10	1.85	0.80	5.80	41.80	22.30	4.10	5.80	9.10	0.1	2.30	15.90	0.90	-
	100-130	82	8.60	1.30	0.40	3.90	41.10	33.1	2.70	7.30	4.50	0.1	2.80	11.10	0.70	-
21	0-30	83	7.90	3.60	2.10	6.80	21.50	20.30	3.40	21.3	15.90	0.2	9.70	30.1	1.10	-
	30-70	84	8.40	3.10	1.30	7.30	32.60	22.50	2.60	20.1	13.30	0.2	5.70	29.3	1.10	-
	70-95	85	7.90	2.20	0.80	6.30	33.50	19.80	2.80	13.3	8.80	0.1	3.30	20.1	1.60	-
	95-130	86	8.30	1.90	0.60	5.20	31.80	24.30	1.50	8.40	4.30	0.1	3.80	8.72	1.70	-

Table (19) cont.

Prof. No.	Depth cm	No.	pH 1:2.5	EC mmhos 1:50	O.M %	$CaCO_3$ %	CEC meq/ 100gm soil	ESP %	Soluble cations (meq/100 gm soil)				S. Anions (meq/100 gm soil)			
									Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$So_4^{=}$	Cl^{+}	HCo_3^{-}	$Co_3^{=}$
22	0-30	87	7.80	2.70	2.60	8.30	38.30	10.30	0.90	0.70	1.90	0.6	0.7	2.60	0.8	-
	30-65	88	8.10	2.10	1.90	9.10	40.20	10.60	0.80	0.7	2.30	0.5	0.6	3.20	0.5	-
	65-85	89	8.30	1.50	0.95	8.10	43.50	1.10	0.60	0.8	2.40	0.4	0.6	3.2	0.4	-
	75-110	90	8.40	1.30	0.80	8.20	47.30	12.30	0.50	0.80	3.1	0.3	0.8	3.3	0.6	-
19	0-15	91	7.6	2.1	2.4	8.1	40.3	10.3	0.9	0.6	2.1	0.4	0.7	1.4	1.9	-
	15-35	92	8.3	1.8	1.9	8.9	42.1	11.8	0.6	0.9	2.4	0.3	0.5	2.9	0.8	-
	35-60	93	8.3	1.6	1.1	9.2	46.3	13.1	0.5	0.9	2.9	0.2	0.4	2.9	1.2	-
	60-80	94	8.6	1.9	0.95	8.3	49.8	13.9	0.3	0.9	3.5	0.2	0.5	3.9	0.7	-
	80-95	95	8.1	2.1	0.65	7.8	50.3	15.1	0.4	0.7	6.3	0.1	1.2	4.9	1.4	-
23	0-25	96	7.8	1.49	20.30	17.30	1.80	15.80	3.10	6.75	15.75	1.25	14.10	9.50	3.75	-
	25-55	97	8.3	1.20	17.40	15.80	1.20	11.40	3.25	7.55	17.95	1.90	9.80	18.25	2.55	-
	55-80	98	8.4	2.50	23.50	15.30	0.8	8.30	3.55	7.75	15.55	0.75	15.85	10.00	1.75	-
	80-130	99	8.6	2.80	19.30	16.40	0.5	13.80	3.10	6.25	13.50	0.95	9.95	12.35	1.50	-
24	0-15	100	8.13	2.15	18.81	30.30	1.30	3.57	1.01	8.25	9.10	0.30	10.55	3.00	5.11	-
	15-25	101	8.36	1.30	4.35	23.80	0.90	4.10	1.25	8.50	8.75	0.20	11.44	2.25	5.01	-
	25-50	102	8.59	1.90	5.53	28.90	0.70	3.57	1.01	4.25	10.10	0.40	6.14	2.13	7.50	-
	50-75	103	8.34	1.80	5.23	26.30	0.40	2.77	1.25	5.50	11.30	0.30	10.97	2.38	5.00	-

Table (19) Practical size distribution of Typic Haplotorrerts soils.

Profile No.	Depth cm	Sand (%)		Silt (%)	Clay (%)	Texture
		Coarse	Fine			
16	0-20	5.30	20.10	21.00	53.60	Clay
	20-55	4.20	22.50	26.30	47.0	C
	55-75	2.30	19.10	28.10	50.5	C
	75-90	2.80	14.30	28.90	54.00	C
	90-110	2.10	15.20	3.10	52.60	C
17	0-30	4.80	18.80	32.90	43.50	C
	30-55	4.10	18.70	28.10	49.10	C
	55-75	3.20	18.00	23.50	55.30	C
	75-110	3.60	16.70	23.50	56.20	C
	110-120	4.30	23.30	21.30	51.10	C
18	0-30	8.40	24.30	17.20	49.10	C
	30-60	5.80	26.10	14.90	53.20	C
	60-90	4.30	24.10	15.80	55.80	C
	90-120	4.10	22.90	16.30	56.70	C
19	0-15	9.30	20.50	21.30	48.90	C
	15-35	7.30	20.50	19.50	52.70	C
	35-60	6.70	20.90	17.30	55.10	C
	60-80	7.30	21.50	18.10	53.10	C
	80-95	6.20	24.20	16.30	53.30	C
20	0-30	7.30	22.10	32.70	37.90	CL
	30-70	3.90	15.10	29.80	51.20	C
	70-100	5.90	19.30	30.80	44.00	C
	100-130	7.30	10.10	35.10	47.50	C
21	0-30	7.80	22.30	21.10	48.80	C
	30-70	6.20	21.10	21.80	50.90	C
	70-95	5.30	22.10	18.60	54.00	C
	95-130	5.80	19.80	19.10	55.30	C
22	0-30	6.20	21.50	20.10	52.20	C
	30-65	5.30	20.80	22.30	51.60	C
	65-85	3.80	20.10	16.70	59.40	C
	85-110	3.50	19.30	17.30	59.90	C
23	0-25	22.80	20.90	15.80	40.50	C
	25-55	17.90	20.50	18.10	43.50	C
	55-80	15.40	24.10	14.40	46.10	C
	80-130	12.70	23.30	10.80	53.2	C
24	0-15	39.80	31.20	6.80	22.20	SCL
	15-25	12.10	11.30	13.70	62.90	C
	25-50	6.90	14.80	22.80	55.50	C
	50-75	7.80	16.70	25.30	50.20	C

varies widely. The soils represented by profiles No. (16, 18, 19 and 22) are slightly alkaline soils (9.7 to 15.1%), while profiles 17, 20 and 21, the ESP ranged between 17.15 and 33.10%. The CEC values ranged between 7.77 to 50.3 meq/100 gm except profile No. 16 its ranges between 7.77 to 10.60 meq/10 gm.

These soils are clayey texture. The $CaCO_3$ content did not exceed than 9.2 (profile No. 19), where in profiles No. 10, 17 and 18 ranged between 2.77% to 6.3% while in profiles No. 19, 20, 21 and 22 it ranged between 6.3% to 9.2% Na^+ is the dominant soluble cation follows by Mg^{2+} while Cl^- is the dominant anion followed by $SO_4^=$. The water table depth is more than 110-130 cm except profile No. 24 and 19) it is between 75-95 cm. Generally water table level is deep. These soils are well drainage and nearly level. These soils are very suitable for agricultural production because the good drainage, deep water table and low alkaline. These soils are classified as Typic Hoplotorrirts, while profile No. (23) is Calcitorrerts.

5.2. LAND CAPABILITY CLASSIFICATION :

The U.S.D.A. Capability System (Klingebiel and Montgomery, 1961), was used to classify El-Fayoum depression soils according to their capability and for the certain crops. The limiting factors which had been used in this system are wetness, salinity, alkalinity, soil depth, slope, texture, erosion, $CaCO_3$ content and climate. The soils are grouped into classes according to the capability index values.

Table (20) Limiting factors of land capability.

1- Wetness

Soil drainage condition	Rating value
Well drained	100
Moderately drained	95-85
Excessive drained	80-60
Imperfectly drained	70-60
Poorly drained	60-40

2- Salinity

Salinity level in mmhos/cm	Rating value
< 2	100
2-4	100-95
4-8	95-85
8-16	85-60
> 16	60-30

3- Alkalinity

ESP	Rating value
< 10	100
10-20	95-86
20-30	85-70
30-50	70-50
> 50	< 50

4- Slope

Slope	Rating value
Nearly level (0-2)	100
Gently undulating (0-2)	95-85
Gently slopping (3-8)	95-85
Moderately slopping (9-15)	85-80
Strongly slopping (16-30)	80-70
Hilly (16-30)	80-70
Steep (30-45)	50-30

5- Soil depth

Soil depth	Rating value
> 150	100
150-100	100-95
99-80	95-85
79-60	85-70
59-30	70-40
< 30	< 40

6- Texture

Texture	Rating value
FSL, L, SiL, SCL, Si	100
SL, Cl	95-90
CL-LS, V.F.S.	85-80
SiC, C, Medium sand	75-60
Coarse sand	55-40

7- Erosion

Erosion type	Rating value
Non to slight erosion	100
Moderate sheet erosion	95-80
Occasional shallow gullies	90-70
M. sheet with shallow gullies	80-60
M. sheet with deep gullies	60-10
Severe sheet erosion	80-50
Severe sheet erosion with shallow gullies	50-40
Very Severe erosion	40-10

8- $CaCO_3$ %

$CaCO_3$ %	Rating value
0-2	100
2-4	100-95
4-8	95-90
8-15	90-85
15-30	85-80
> 30	80-75

Land capability index

Capability class	Grade	Capability index value
I	Very good	100-80
II	Good	79-60
III	Fair	59-40
IV	Poor	39-20
V	Very poor	19-10
VI	Non agriculture land	< 10

The result obtained show that the soils under investigation belong to Classes II, III, IV and V, this based on the limitations of the land characteristics (climate and soils). The rating values for each limiting factor are presented in Table (21).

The capability classification for the different soil units in El Fayoum depression is as folows :

5.2.1. Class II; represented by profiles Nos. (4, 5, 6, 7, 9, 14, 16, 20 and 22). Most of these profiles are located in the middle part and northern side of depression. These soils are suitable for most crops and the soils need a careful management. The soils are free to slight saline. No limitation with slope and drainage. In profiles Nos. (4, 5, 6, 7 and 9) the main limiting factor is the increase on $CaCO_3$ content while in profiles No. 14, 20 and 22 the limiting factors is the high alkalinity. This area of the class is about 512.1 km^2 (122904 feddan) represents 30.05% of the total area of the depression.

5.2.2. Class III, represented by 9 profiles Nos. (1, 2, 8, 12, 18, 19, 21, 23 and 24). Profiles No. (1, 2, 8, 12 and 23) are high in $CaCO_3$ content while Nos. (18, 19, 21 and 24) have high alkalinity.

The soils are located in the western, eastern and northwest parts and are poorly to moderately drained. The soils give moderate yields and need a careful management such as good drainage system and to decrease or improve high alkalinity and all factors which limit the agriculture production. The total area of this class is 494.5 km^2 (118 feddan) represents 29.01% of the total area of the depression.

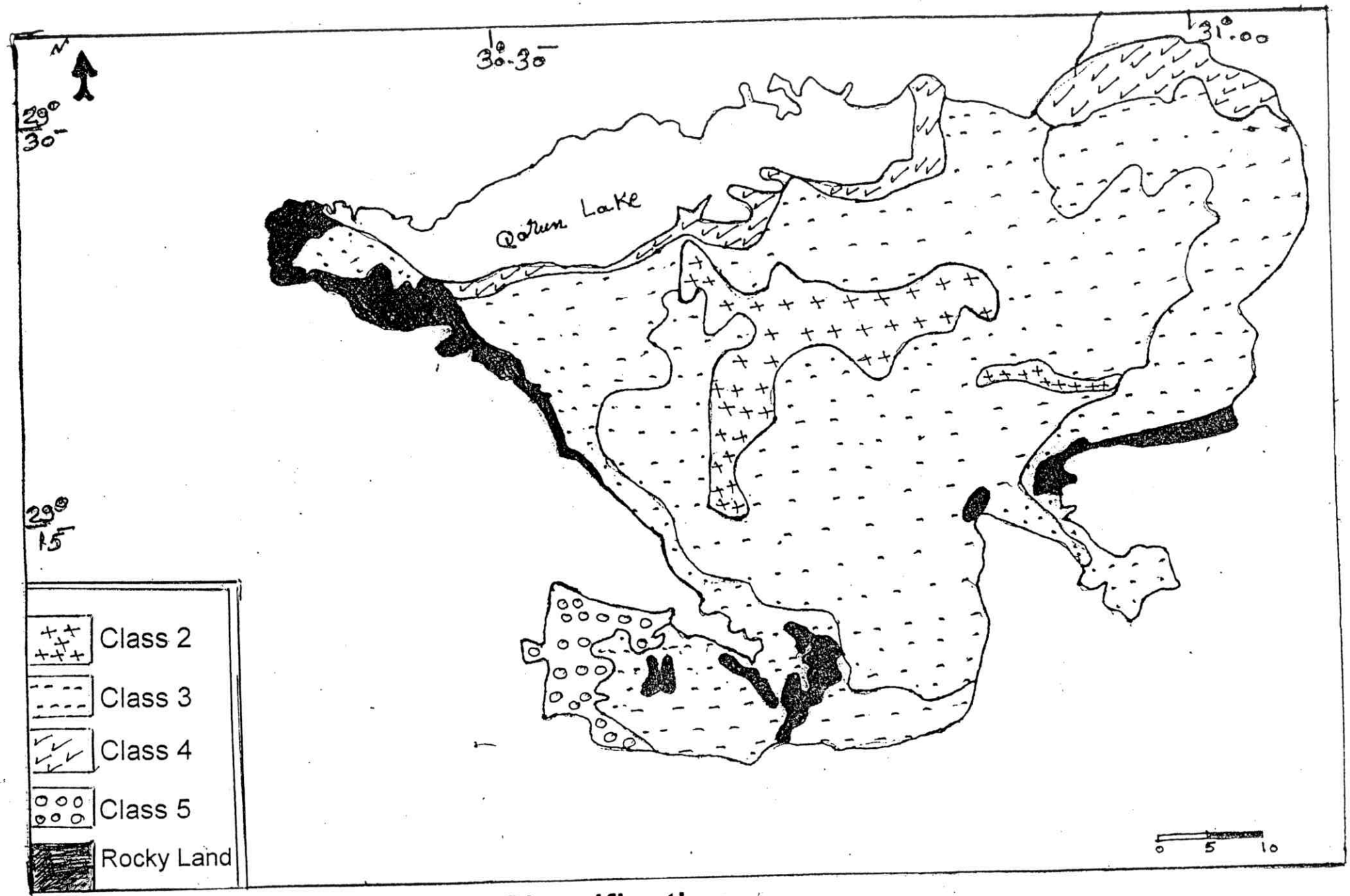

Fig. (10): Land Capability Classification.

Table (21) Land capability classification of El Fayoum depression (limiting factor).

Profile No.	Capability class	Limiting factors
1	III	$CaCO_3$ and drainage
2	III	$CaCO_3$
3	IV	Drainage and alkalinity
4	II	$CaCO_3$
5	II	$CaCO_3$ and drainage
6	II	$CaCO_3$
7	II	$CaCO_3$ and alkalinity
8	III	$CaCO_3$ and drainage
9	II	$CaCO_3$
10	IV	Salinity, alkalinity and drainage
11	IV	Salinity and drainage
12	III	Alkalinity, slope and $CaCO_3$
13	IV	Alkalinity, slope and $CaCO_3$
14	II	Alkalinity
15	V	Drainage, texture, depth and slope
16	IV	Texture
17	IV	Drainage, alkalinity and texture
18	III	Slope and texture
19	III	Alkalinity and texture
20	II	Alkalinity and texture
21	III	Alkalinity and texture
22	II	Texture
23	IV	$CaCO_3$, texture and drainage
24	IV	Drainage, depth, alkalinity and texture

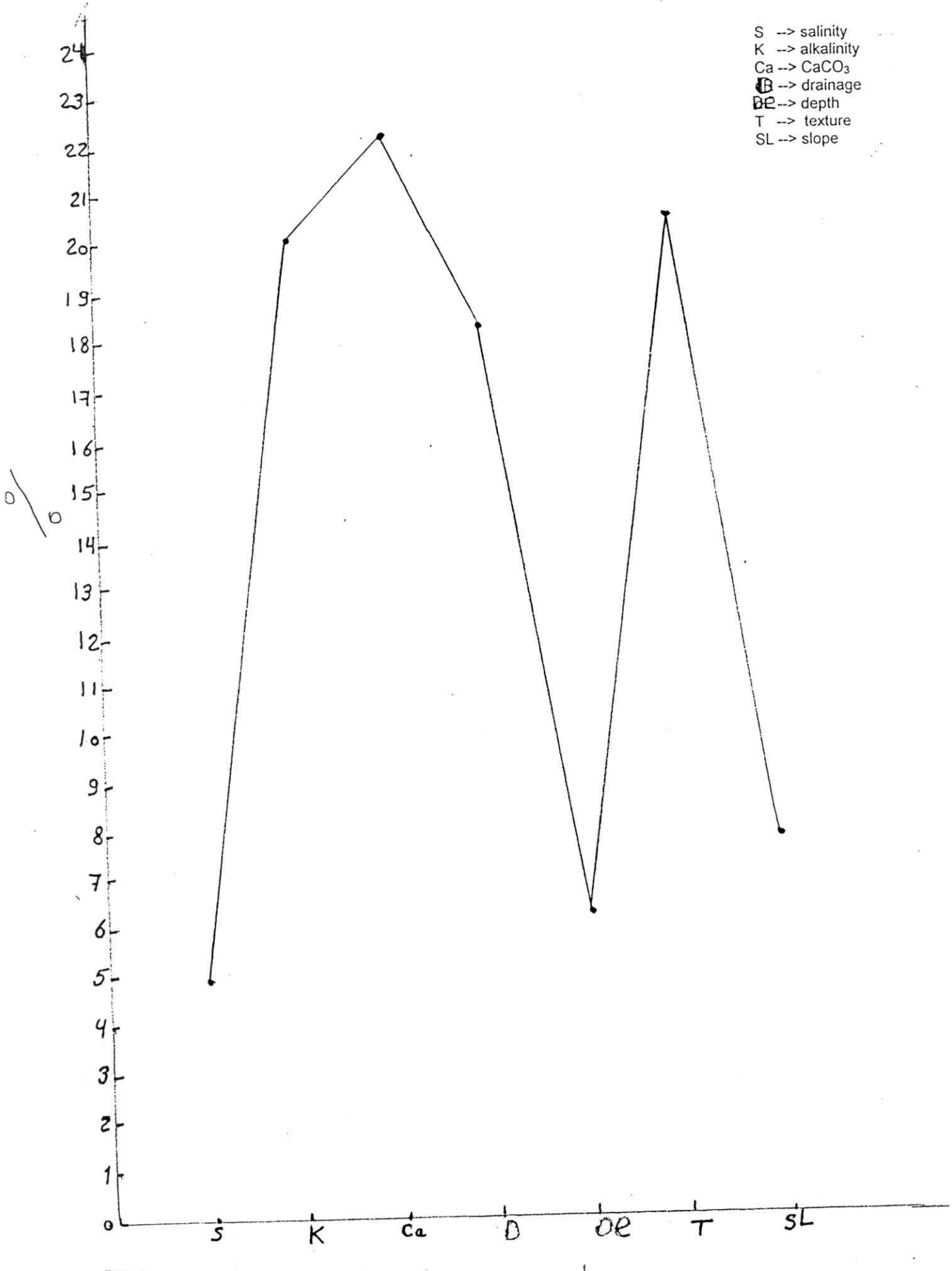

Fig. (11) L.F. for land cabability classes in the studied area.

Table (22) The characteristics ranges of El Fayoum depression.

Profile No. / L.F.	1	2	3	4	5	6	7	8	9	10	11	12
Wetness	85	100	80	95	85	95	95	85	95	60	85	95
Climate	100	100	100	100	100	100	100	100	100	100	95	100
Salinity	95	100	95	100	95	95	100	100	100	80	85	100
Soil depth	95	85	90	90	95	100	100	95	100	95	95	95
Slope	100	100	95	95	95	95	100	85	90	90	90	85
AMHC	85	84	79	97	100	100	85.8	90	90	98	75	93
Erosion	100	100	100	100	100	100	100	100	100	95	80	95
$CaCO_3$	85	85	85	90	85	90	90	85	80	90	90	85
ESP	95	92	70	95	100	90	85	100	100	70	95	70
CI	52.6	55.88	22.9	67.4	61.9	69.4	62.4	52.5	61.6	24	30.1	40.3
Grade	III	III	IV	II	II	II	II	III	II	IV	IV	III

Table (23) cont.

Profile No. / L.F.	13	14	15	16	17	18	19	20	21	22	23	24
Wetness	90	100	60	100	60	95	100	100	95	95	85	65
Climate	100	100	90	100	100	100	100	100	100	100	100	100
Salinity	100	100	95	100	100	100	100	100	100	100	95	100
Soil depth	95	100	85	100	100	100	95	100	100	100	100	85
Slope	85	100	80	100	95	90	100	95	95	95	90	100
AMHC	91	96	75	75	75	75	75	79.6	75	75	75	85
Erosion	90	95	90	100	100	100	100	100	100	100	95	95
$CaCO_3$	86	95	90	95	95	95	90	95	90	95	90	100
ESP	70	75	90	95	85	95	85	85	75	95	90	90
CI	35.4	64.9	19.1	67.7	34.5	57.9	54.5	61.1	54.7	61.1	41.9	40.2
Grade	IV	II	V	II	I	III	III	II	III	II	III	III

AMCH = Available Moisture Holding Capacity CI = Capability Index
LF = Limiting Factores

Table (23) Size of capability classes in the studied area.

Class	Area/km^2	Area/Feddan	(%) of total area
II	512.1	122904	30.05
III	494.5	118680	29.01
IV	499.2	119808	29.29
V	198.6	47664	11.65
Total	170404	409056	100

Table (24) Mean of characteristics ranges in the studied area.

Soil unit	Mean capability index	Class
Calcids	56.3	III
Gypsids	37.9	IV
Salids	27.05	IV
Fluvents	64.9	II
Psamments	19.1	V
Torrerts	52.6	III

5.2.3. Class IV: represents by 5 profiles Nos. (3, 10, 11, 13 and 17) and located in the northern and north eastern part of the depression. In profiles No. (10 and 11) which are adjacent to Qarun lake, these soils are highly saline, alkaline and poorly drained (profiles No. 3, 22). These soils are covered by salt crust. The soils of this class give very low yield and the severe limitations reduce the crop growth. They are need leaching and good drainage system. The total area is 499.2 km^2 (119808 feddan) representing 29.29% of the total area.

5.2.4. Class V : The soils belong to class V are located in the west and south western side of the depression These soils are shallow, poorly drained and of low moisture holding capacity. The soils need a careful management for irrigation and drainage. The total area in this class is 198.6 km^2 (47664 feddan) which represent 11.65% of the total area.

5.3. LAND SUITABILITY CLASSIFICATION :

Land evaluation is the assessment of land performance when used for specific purposes. It provides a rational basis for taking land use decisions based on the analysis of the relations between land use and land, giving the required inputs and project outputs (FAO, 1983). the outomated land evaluation system (ALES) Rossiter and Van Wambeke (1993) was used with matching Sys system (1993) to evaluate the area under investigation for selected land use types (LuTs). In the studied area the agriculture productivity was low due to many problems some of them related to the water management, and also population pressure. This

means that without suitability the environment will deteriorate and farmers will become poorer.

5.3.1. Land Use Types:

A specific type of land use defined in more detailed technical and socio-economic characteristics, it includes attributes the several to differentiate the suitability of land area and limit the land use options and outputs. In the studied area the cropping system was rational (crop rotation). Ten land use types were selected based on the kind of production and management.

Lu_1 - Wheat

Lu_2 - Maize

Lu_3 - Cotton

Lu_4 - Rice

Lu_5 - Olive

Lu_6 - Onion

Lu_7 - Mango

Lu_8 - Date palm

Lu_9 - Tomato

Lu_{10} - Alfa Alfa

These inputs and outputs of the selected LuT were collected from the yearly statistics with the actual data. Table (27) show the detailed inputs and outputs of some of the selected LUTs.

Table (25) Cultivated areas in El Fayoum (season 1996-1997).

Crop	Cultivated/feddan.	Production	Mean/feddan
Wheat	142309	1400693 Ardab	16.86
Maize	721243	1326481 Ardab	19/36
Rice	≃ 6593	110511 Ton	3.02
Tomato	14109	208592 Ton	12.3
Onion	2903	37634 Ton	12.96
Cotton	42951	240526 Ton	5.6
Mango	7373	3509	4.76
Olive	10126	45972	4.54
Alf Alfa	93796	1806741	19.26
Date palm	452	8051k kg	178 kg

Total summer crops 94100 Feddan

Total winter crops 318237 Feddan

Total Nili crops 301086 Feddan

Table (26) Detailed from some LUT (1996-1997).

Specification LuT		Production period	Production	Average yield Ton/Fed.	Price LE/unit	Production vale (LE/Fed)
Cotton	main product	7.5 months	Cotton tissues	7.5 Kentar(1)	520	4010
	other product		Cotton branches	200 bundle(2)	0.55	
Rice	main product	6 months	rice grains	3500 kg	0.750	2914
	other product		hay productions	17 bel	17	
Wheat	main product	6.5 months	wheat grains	15 ardab (3)	110	2070
	other producti		hay productions	14 bale	30	
Onion		5 months	onion	15.000 kg	0.35	5250
Olive (4)		Permenant	Olive	4.000 kg	1.40	5600/year
Mango (4)		Permanent	Mango	4.250 kg		7850/year

(1) Kentar = 52.5 kg

(2) Bundle = 30 kg

(3) Ardab = 140 kg

(4) For olive and mango the date is average of 30 years.

Table (26) Con. Detailed inputs per feddan for the selected land use types (1996-1997).

Input / LuTs		Unit	Cotton			Rice			Wheat			Onion			Olive(2)	Mango(2)
			N(5)	(5)	T(5)	N	C	T	N	C	T	N	C	T	T	T
(A) Agricultural operations																
Pre-cultivation (preportion)		tractor /hour	5	14	70	5	14	70	5	14	70	5.5	14	77		
Cultivation (seedling...		man/day	7	6	42	15	5	75	6	3.5	21	11	6	66		
Irrigation		man/day	6	6	36	9.5	6	57	6	6	36	10	6	60		
Fertilizer distribution		man/day	9	6	54	4	6	24	6.5	6	39	5	6	30		
Other costs														201		-
Weed control	Manual	man/day	15	6	90	13	5	65	-	-	-	5	6	54		
		man/day	8.5	6	51	8	6	48	-	-	-	5	6	30		
	Chemical	mecanic. /day	-	-	-	-	-	-	-	-	-	6	15	90		
Harvesting and transfering and		man/day	9	10	90	22.5	6	135	6.5	6	39	12	6	72		
field preparation		mecanic. /hour	5	30	180	4	15	60	5	19	90	-	-	-		
Total					637			534			295			680	912	890
(B) Crop addition																
Seed, transplants		3	1	52	52	6	10	60	6	10	60	2	150	300		
	Nitrogen	Urea bags	6	22	132	3	22	66	5	22	110	6	20	110		
Fertilizers	Phosphorus	Super-P.bags	4	11.5	46	2	11.5	23	-	-	-	3	11.5	34.5		
	Potassium	K.sulphate	2	48	96	2	48	96	-	-	-	-	-	-		
Organic manure		Shabeet /fed.(4)	140	0.5	70	140	0.5	70	250	0.5	125	200	0.5	100		
Pesticides		Liter	-	-	-	2	20	40	-	-	-	4	50	200		
Total crop additions					396			355			295			7445	986	1070
Total input costs					1033			889			590			14205	1898	1965

1) The units are different from one land use to another (cotton rice and wheat is Killa/feddan and Killa= 12-14 kg) onion is Kirrat = 175 m^2.
2) Shabeet = 30-40 kg 5) No. = Nuimber of operation, c= Cost of each operation, T= Total cost by Egyptian pound or LE (1$=3.41LE)

5.3.2. Land Use Requirements (LUR)

The physical and chemical requirements for each land use types are presented in Tables (27 to 36).

The rating factor was done in four classes to determined the suitability of the land for a specific LUTs;

S_1 = Highly suitable

S_2 = Moderately suitable

S_3 = Marginally suitable

N = Not suitable

The obtained data revealed that, in the first unit (calcids), the best suitable crops are wheat, maize and alfalfa, which are moderately suitable and represent 60% for wheat and maize and 100% for alfa alfa, while rice, onion, mango and date palm are marginally.

The limiting factors for these crops growth are high $CaCO_3$ content, low O.M. and soil alkalinity. After removing these factors for example fertilizers Leaching, remaining gravels. This unit can be suitable for cotton, olive, rice and date palm and the suitability classes for wheat, maize and alfa alfa changed to class I.

The unit requires, fertilization, leaching and removing gravels to increase productivity.

The second unit (Gypsids), the best LuT are wheat, olive, cotton and alfalfa which are the moderately suitable. Rice, onion, tomato are marginally suitable.

Table (27) Land use requirements for LUT (semi mechanized Wheat).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	C,SiC,Si,SiL,SiCL,CL	SCL,L	SL,LS,S	-
Soil depth (cm)	90-50	50-20	20-10	<10
$CaCO_3$ (%)	0-30	30-40	40-60	>60
Soil fertility characteristics				
CEC	24-16	16-12	12-8	<8
pH, H_2O	7-8	8-8.5	8.5-9	>9
O.M. (%)	1.2-0.80	0.8-0.40	<0.40	-
Salinity and alkalinity				
ECe (dS/m)	0-3	3-5	5-10	>10
ESP (%)	0-20	20-35	35-45	>45
Soil drainage class	well-mod	imperf.	poor	V. poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam

SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (28) Land use requirements for LUT(semi mechanized Maize).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	C,SiC,SiCL,CL,SCL,SiL,L	SL,LS	S	-
Soil depth (cm)	100-75	75-50	50-20	<20
$CaCO_3$ (%)	0-15	15-25	25-35	>35
Soil fertility characteristics				
CEC	24-16	16-12	12-8	<8
pH, H_2O	6.6-7.8	7.8-8.2	8.2-8.5	>8.5
O.M. (%)	>0.8	0.8-0.4	<0.4	-
Salinity and alkalinity				
ECe (dS/m)	0-4	4-8	8-12	>12
ESP (%)	0-15	15-20	20-25	>25
Soil drainage class	well-mode	imperf.	poor	very poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam
SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (29) Land use requirements for LUT(semi mechanized Cotton).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	C,SiC,SiCL,SI,SiL,CL	SL,SCL	S,LS	-
Soil depth (cm)	100-75	75-50	50-25	<25
$CaCO_3$ (%)	0-20	20-30	30-40	>40
Soil fertility characteristics				
CEC	24-16	16-12	12-8	<8
pH, H_2O	6.6-7.8	7.8-8.0	8.0-8.5	>8.5
O.M. (%)	1.2-0.8	0.8-0.40	<0.40	-
Salinity and alkalinity				
ECe (dS/m)	0-8	8-12	12-16	>16
ESP (%)	0-20	20-30	30-40	>40
Soil drainage class	well	moderate	imperf	poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam
SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (30) Land use requirements for LUT(semi mechanized Rice).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	C,SiC,SiCL,CL,Si	CL,Si,SiL	SC,L,SCL	-
Soil depth (cm)	90-75	75-50	50-20	<20
$CaCO_3$ (%)	0-6	6-15	15-25	>25
Soil fertility characteristics .				
CEC	2.4-16	16-12	12-8	<8
pH, H_2O	6.5-8	8-8.5	8.5-9	>9
O.M. (%)	2-1	1-0.8	<0.8	-
Salinity and alkalinity				
ECe (dS/m)	0-2	2-4	4-6	<6
ESP (%)	0-20	20-30	30-40	>40
Soil drainage class	well.mod.	poor	very poor	-

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam
SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (31) Land use requirements for LUT(semi mechanized Olive).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	L,SCL,SL,SC,SiL,SiC	SCL,L,SC	S,LS,SL	
Soil depth (cm)	150-120	120-100	100-80	<80
$CaCO_3$ (%)				
Soil fertility characteristics				
CEC	24-16	16-12	12-8	<8
pH, H_2O	7-8	8-8.5	8.5-9	>9
O.M. (%)	1.5-0.8	0.8-0.40	<0.40	-
Salinity and alkalinity				
ECe (dS/m)	0-12	12-16	16-20	>20
ESP (%)	0-25	25-35	35-45	>45
Soil drainage class	well.mod	imperf	poor	very poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam

SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (32) Land use requirements for LUT(semi mechanized Onion)

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	C,SiC,Si,SiL,SiCL,CL	SCL,L,SC	S,LS,SL	
Soil depth (cm)	75-50	50-30	30-20	<20
$CaCO_3$ (%)	0-5	5-10	10-20	>20
Soil fertility characteristics				
CEC	24-16	16-12	12-8	<8
pH, H_2O	7-7.8	7.8-8.2	8.2-8.5	>8.5
O.M. (%)	2-1.2	1.2-0.8	<0.8	
Salinity and alkalinity				
ECe (dS/m)	0-2	2-4	4-8	>8
ESP (%)	0-20	20-35	35-50	>50
Soil drainage class	good.mod.	imperfect	poor	very poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam

SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (33) Land use requirements for LUT(semi mechanized Mango).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	L,SiL,SL,Si,SCL,SiCL	LS-C	S	
Soil depth (cm)	150-100	100-75	75-50	<50
$CaCO_3$ (%)	0-5	5-10	10-25	>25
Soil fertility characteristics				
CEC	>16	16-12	12-8	<8
pH, H_2O	6.6-7.8	7.8-8.2	8.2-8.5	>8.5
O.M. (%)	2-1.2	1.2-0.8	<0.8	
Salinity and alkalinity				
ECe (dS/m)	0-4	4-6	6-8	>8
ESP (%)	0-15	15-20	20-25	>25
Soil drainage class	good	moderate	imperf.	poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam
SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (34) Land use requirements for LUT(semi mechanized Date palm).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	L,SiL,SL,Si,SCL,SiCL	LS-C	S	-
Soil depth (cm)	150-120	120-100	100-75	<75
$CaCO_3$ (%)	0-5	5-10	10-25	>25
Soil fertility characteristics				
CEC	>16	16-12	12-8	<8
pH, H_2O	7-8	8-8.2	8.2-8.5	>8.5
O.M. (%)	2-1.2	1.2-0.8	<0.8	
Salinity and alkalinity				
ECe (dS/m)	0-4	4-6	6-8	>8
ESP (%)	0-15	15-20	20-25	>25
Soil drainage class	good	moderate	poor	very poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam
SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (35) Land use requirements for LUT(semi mechanized Tomato).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	Ci,L,SiCL,Si,SCL	LS,SC	-	-
Soil depth (cm)	150-100	100-75	75-50	<50
$CaCO_3$ (%)	0-5	5-10	10-25	>25
Soil fertility characteristics				
CEC	24-16	16-12	12-8	<8
pH, H_2O	6.6-7.5	7.5-8.0	8.0-8.3	>8.3
O.M. (%)	2-1.2	1.2-0.8	<0.8	
Salinity and alkalinity				
ECe (dS/m)	0-5	5-8	8-10	>10
ESP (%)	0-15	15-25	25-35	>35
Soil drainage class	good.mod.	imperf.	poor	very poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam
SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (36) Land use requirements for LUT(semi mechanized Alfa Alfa).

Land use requirements	Rating factors			
	S_1	S_2	S_3	N
Physical soil characteristics				
Texture	SL,SCL,SC,L,CL,SiCL	CS,SiC	S	-
Soil depth (cm)	100-75	75-50	50-20	<20
$CaCO_3$ (%)	0-15	15-25	25-35	>35
Soil fertility characteristics				
CEC	24-16	16-12	12-8	<8
pH, H_2O	7-8	8-8.8	8.2-8.5	>8.5
O.M. (%)	2-1.2	1.2-0.8	<0.8	
Salinity and alkalinity				
ECe (dS/m)	0-5	5-9	9-12	>12
ESP (%)	0-20	20-35	35-50	>50
Soil drainage class	good	moderate	imperf.	poor

C : Clay
SiC : Silty clay
Si : Silty
SiL : Silty loam
SiCL : Silty clay loam
CL : Clay loam
SCL : Sandy clay loam
L : Loam
SL : Sandy loam
LS : Loamy sand
S : Sand

Table (37) Land suitability for Wheat

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	1	1	1	1	1	1	1	1	1
	2	1	1	1	3	1	1	1	1	3
	3	1	1	1	1	2	1	2	2	2
	4	1	1	1	2	1	1	2	2	2
	5	1	1	1	1	1	1	2	1	2
	6	2	1	1	1	1	1	1	1	1
	7	1	1	1	1	1	1	2	1	2
	8	1	1	1	1	1	1	1	1	1
	9	1	1	1	1	1	1	1	1	1
Salids	10	N	1	1	1	2	1	2	3	N
	11	N	1	1	1	1	1	1	3	N
Gypsids	12	1	1	1	1	2	1	2	1	2
	13	1	1	1	1	2	1	2	2	2
Fluvents	14	1	1	1	1	1	1	2	1	2
Psamments	15	2	1	1	3	2	1	2	2	3
Torrerts	16	1	1	1	3	1	1	1	2	3
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	1	1	1	1	1	1	1
	20	1	1	1	1	2	1	1	1	1
	21	1	1	1	1	2	1	1	1	1
	22	1	1	1	1	1	1	1	1	1
	23	1	1	1	1	1	1	1	1	1
	24	1	1	1	3	2	1	2	2	3

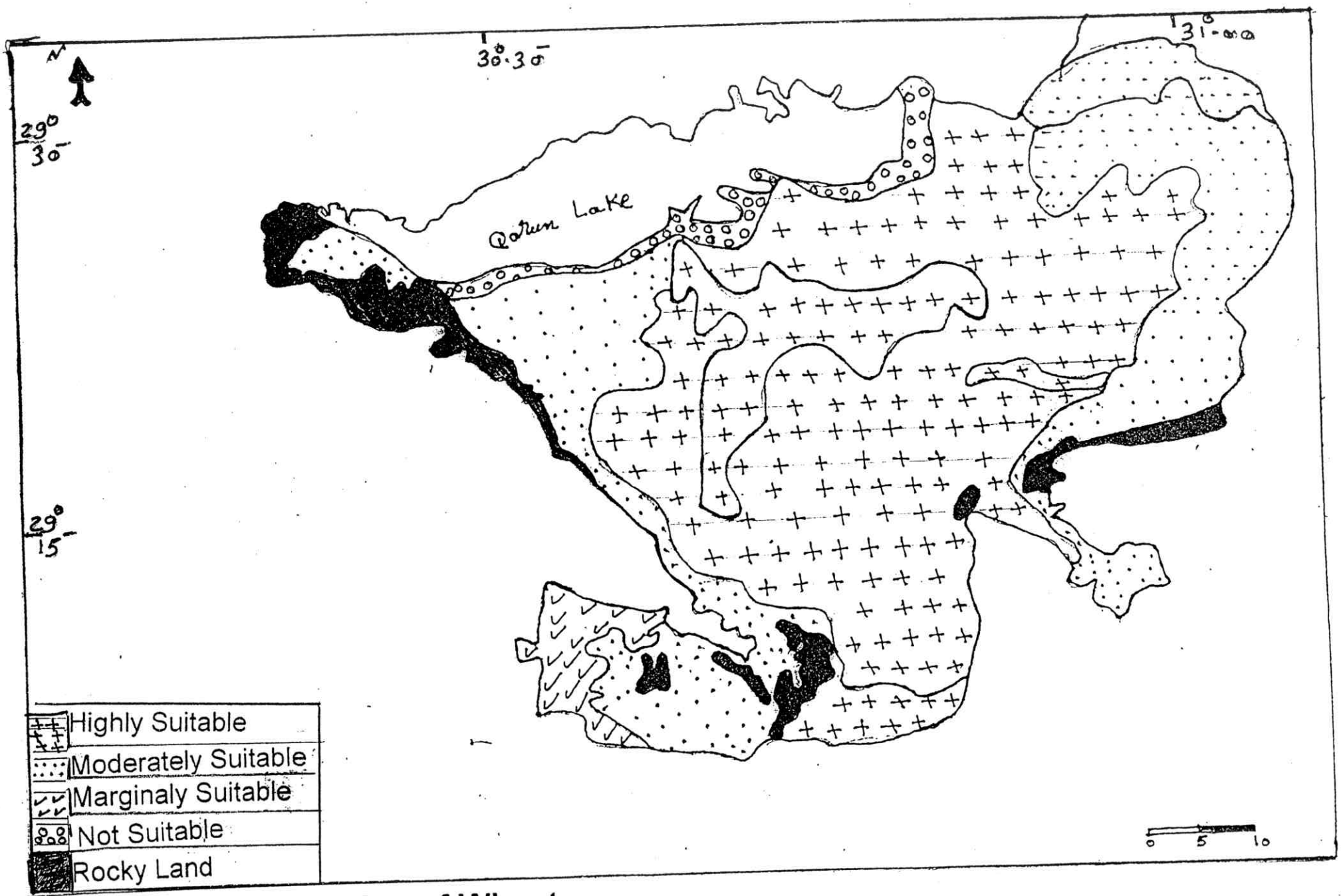

Fig. (12): Suitability Map of Wheat.

Table (38) Land suitability for Maize.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	1	1	2	1	2	1	1	1	2
	2	1	1	2	3	2	1	2	1	3
	3	1	1	2	1	3	1	2	2	3
	4	1	1	1	2	1	1	2	2	2
	5	1	1	2	1	1	1	2	1	2
	6	1	1	2	1	2	1	2	1	2
	7	1	1	1	1	2	1	2	1	2
	8	1	1	1	1	1	1	1	1	1
	9	1	1	2	1	1	1	3	2	3
Salids	10	3	1	1	1	N	1	2	3	N
	11	3	1	1	1	2	1	1	3	3
Gypsids	12	1	1	2	1	3	1	3	1	3
	13	1	1	2	1	3	1	2	2	3
Fluvents	14	1	1	1	1	1	1	1	1	1
Psamments	15	2	1	1	3	2	1	3	2	3
Torrerts	16	1	1	1	3	1	1	1	2	3
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	1	1	1	1	1	1	1
	20	1	1	1	1	3	1	1	1	3
	21	1	1	1	1	3	1	1	1	3
	22	1	1	1	1	1	1	1	1	1
	23	1	1	1	1	1	1	1	1	1
	24	1	1	1	3	N	1	N	2	N

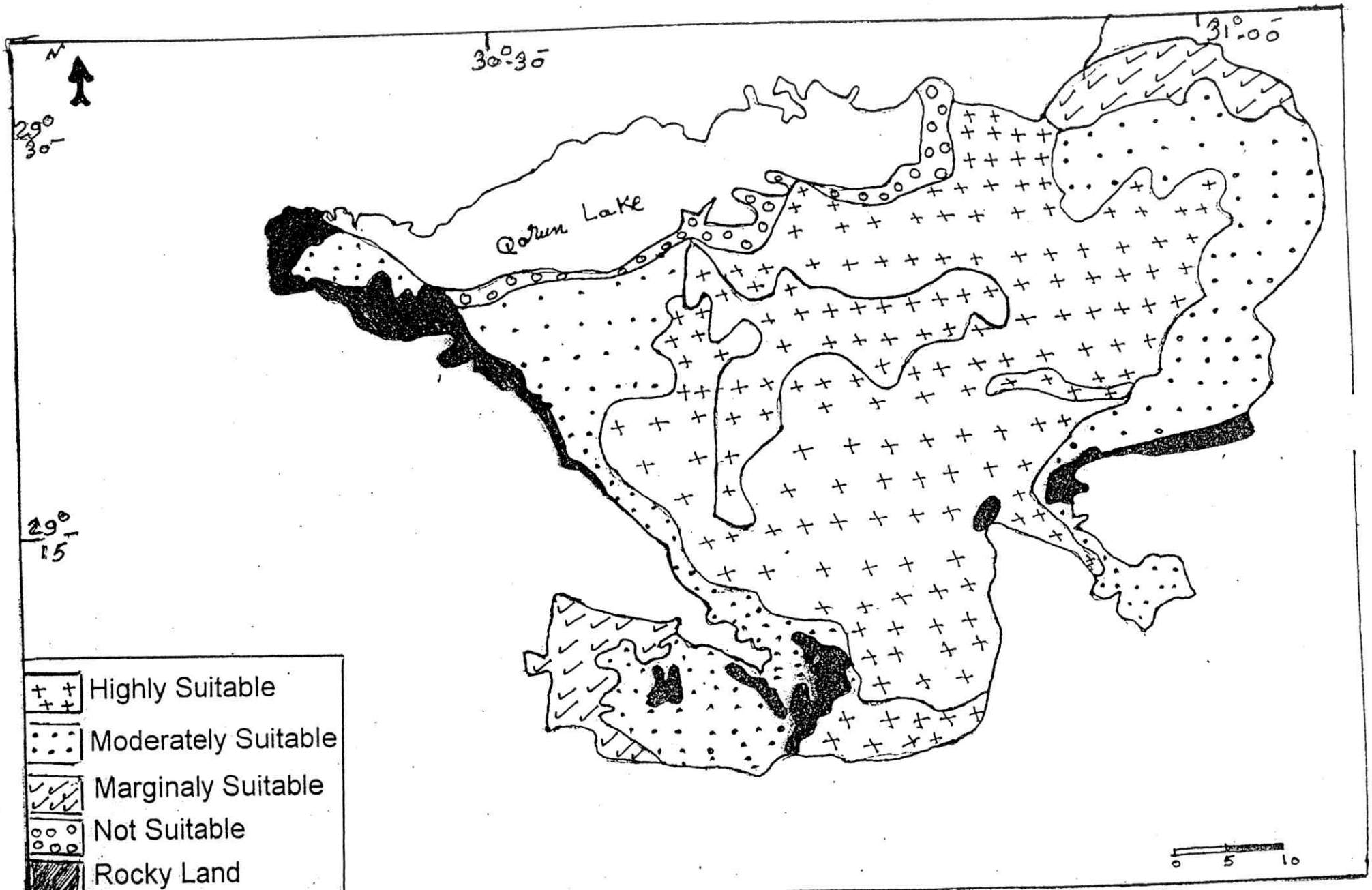

Fig. (13): Suitability Map of Maize.

Table (39) Land suitability for Cotton.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	1	1	1	1	1	1	1	1	1
	2	1	1	1	3	1	1	2	1	3
	3	1	1	1	1	2	1	2	2	2
	4	1	1	1	2	1	1	2	2	2
	5	1	1	2	1	1	1	2	1	2
	6	1	1	2	1	1	1	2	1	2
	7	1	1	1	1	1	1	1	1	1
	8	1	1	1	1	1	1	1	1	1
	9	1	1	2	1	1	1	2	2	2
Salids	10	2	1	1	1	2	1	2	2	2
	11	2	1	1	1	1	1	1	2	2
Gypsids	12	1	1	1	1	2	1	3	1	2
	13	1	1	2	1	2	1	2	2	2
Fluvents	14	1	1	1	1	1	1	3	1	3
Psamments	15	1	1	1	3	1	1	3	2	3
Torrerts	16	1	1	1	3	1	1	1	2	3
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	1	1	1	1	1	1	1
	20	1	1	1	1	2	1	1	1	2
	21	1	1	1	1	2	1	1	1	2
	22	1	1	1	1	1	1	1	1	1
	23	1	1	1	1	1	1	1	1	1
	24	1	1	1	3	2	1	1	2	3

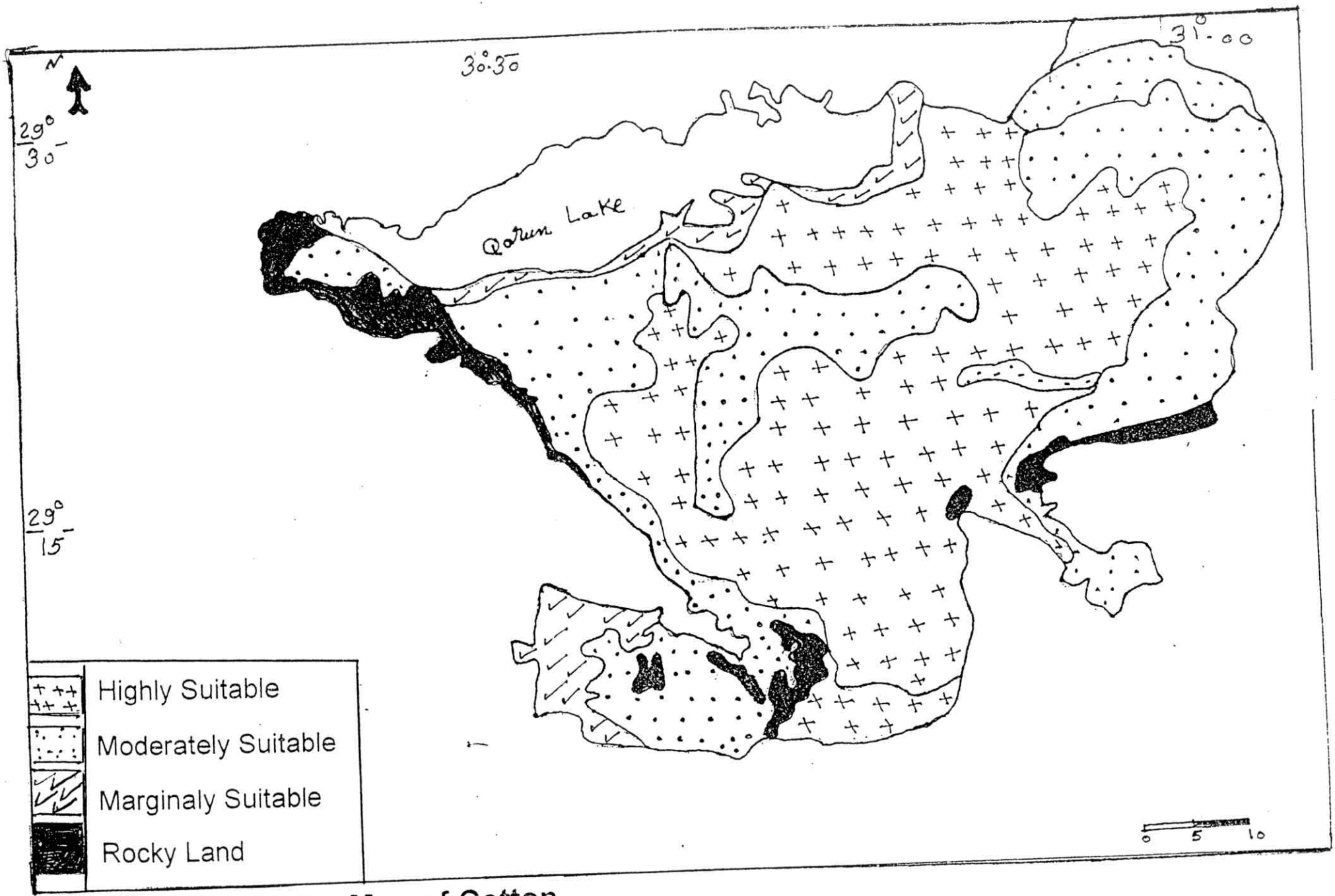

Fig. (14): Suitability Map of Cotton.

Table (40) Land suitability for Rice.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	2	2	3	1	1	1	2	1	3
	2	1	2	3	3	1	1	2	1	3
	3	2	1	3	1	2	1	2	2	3
	4	1	2	2	2	1	1	2	2	2
	5	2	2	3	1	1	1	2	1	3
	6	2	2	3	1	1	1	2	1	3
	7	1	1	2	1	1	1	3	1	3
	8	1	2	2	1	1	1	1	1	2
	9	2	2	3	1	1	1	3	2	3
Salids	10	N	2	2	1	2	1	2	3	N
	11	N	2	2	1	1	1	1	3	N
Gypsids	12	1	2	3	1	2	1	3	1	3
	13	1	2	3	1	2	1	2	2	3
Fluvents	14	2	2	1	1	1	1	2	1	2
Psamments	15	3	2	2	3	1	1	N	2	N
Torrerts	16	1	2	1	3	1	1	1	2	3
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	2	1	1	1	1	1	2
	20	2	1	1	1	2	1	1	1	2
	21	2	1	2	1	2	1	1	1	2
	22	1	1	2	1	1	1	1	1	2
	23	1	1	2	1	1	1	1	1	2
	24	1	2	1	3	2	1	2	2	3

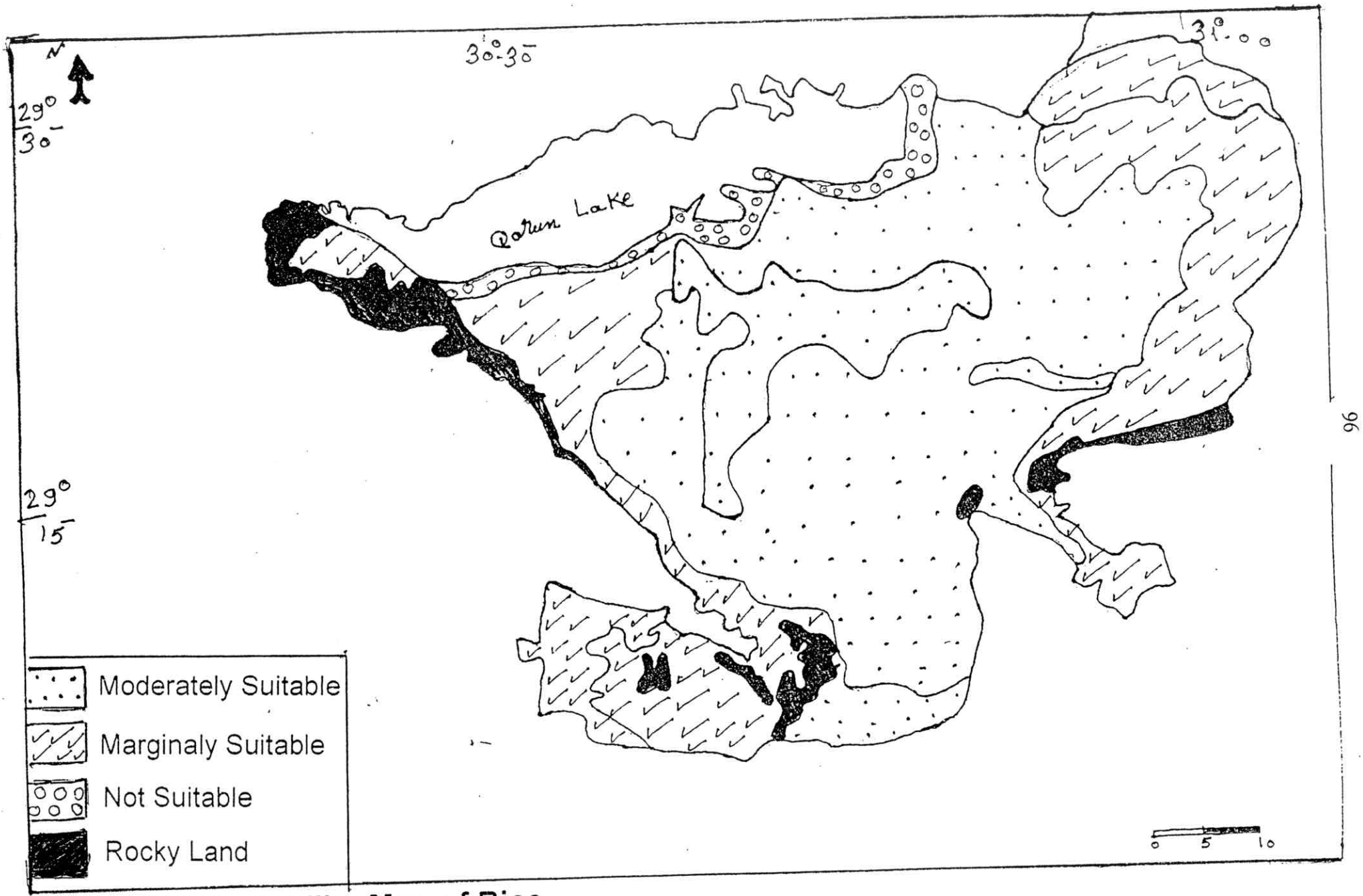

Fig. (15): Suitability Map of Rice.

Table (41) Land suitability for Olive.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	1	1	1	1	1	2	1	1	2
	2	1	1	1	3	1	3	1	1	3
	3	1	1	1	1	2	3	2	2	3
	4	1	1	1	2	1	3	2	2	3
	5	1	1	1	1	1	1	1	1	1
	6	1	1	1	1	1	1	2	1	1
	7	1	1	1	1	1	1	2	1	2
	8	1	1	1	1	1	3	1	1	3
	9	1	1	1	1	1	2	2	2	2
Salids	10	1	1	1	1	2	2	2	2	2
	11	1	1	1	1	1	2	1	2	2
Gypsids	12	1	1	1	1	2	2	2	1	2
	13	1	1	1	1	1	2	2	2	2
Fluvents	14	1	1	1	1	1	1	1	1	1
Psamments	15	1	1	1	3	1	2	2	2	3
Torrerts	16	1	1	1	2	1	2	1	2	2
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	1	1	1	3	1	1	3
	20	1	1	1	1	1	1	1	1	1
	21	1	1	1	1	1	1	1	1	1
	22	1	1	1	1	1	2	1	1	2
	23	1	1	1	1	1	1	1	1	1
	24	1	1	1	3	2	N	2	2	N

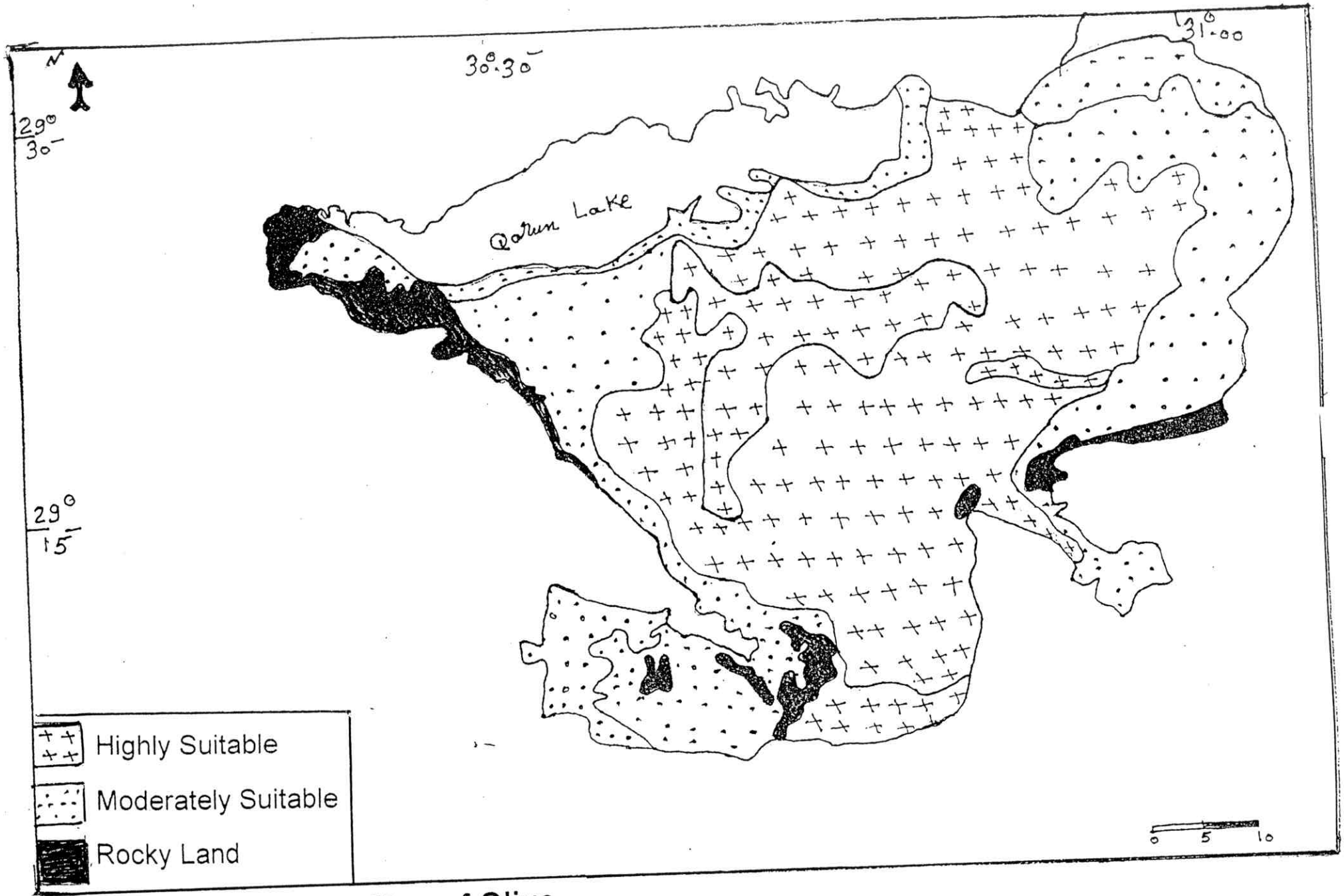

Fig. (16): Suitability Map of Olive.

Table (42) Land suitability for Onion.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	2	2	3	1	1	1	1	1	3
	2	1	2	3	3	1	1	1	1	3
	3	2	2	3	1	2	1	1	2	3
	4	1	2	3	2	1	1	1	2	3
	5	1	2	N	1	1	1	1	1	N
	6	3	2	3	1	1	1	1	1	3
	7	1	1	3	1	1	1	1	1	3
	8	1	2	3	1	1	1	1	1	3
	9	1	2	N	1	1	1	2	2	N
Salids	10	N	2	1	1	2	1	1	3	N
	11	N	2	2	1	1	1	2	3	N
Gypsids	12	1	2	3	1	2	1	1	1	3
	13	1	2	3	1	2	1	1	2	3
Fluvents	14	2	2	2	1	1	1	1	2	2
Psamments	15	3	2	2	3	1	1	1	2	3
Torrerts	16	1	2	1	3	1	1	2	2	3
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	2	1	1	1	2	2	2
	20	2	2	2	1	2	1	1	2	2
	21	2	1	2	1	2	1	1	1	1
	22	1	1	2	1	1	1	2	2	2
	23	1	1	2	1	1	1	2	1	2
	24	1	2	1	3	2	1	1	2	3

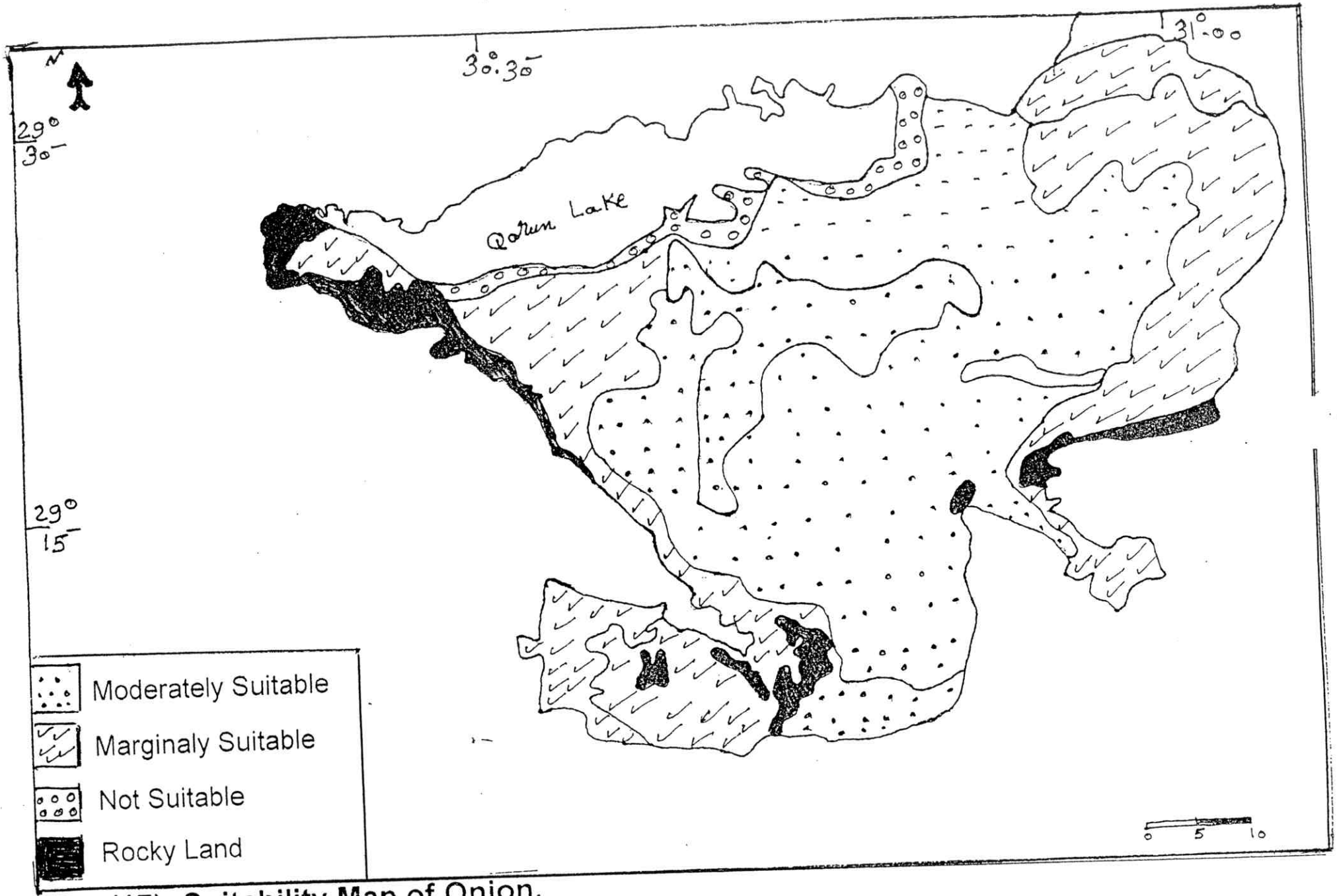

Fig. (17): Suitability Map of Onion.

Table (43) Land suitability for Mango.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	1	2	3	1	2	1	1	1	3
	2	1	2	3	3	1	2	1	1	3
	3	1	2	3	1	N	2	1	2	N
	4	1	2	3	2	1	2	1	2	3
	5	1	2	3	1	1	1	1	1	3
	6	1	2	3	1	2	1	1	1	3
	7	1	2	3	1	2	1	1	1	3
	8	1	2	3	1	2	2	2	1	3
	9	1	2	3	1	1	1	2	2	3
Salids	10	N	2	1	1	3	1	1	3	N
	11	N	2	2	1	2	1	2	3	N
Gypsids	12	1	1	1	1	3	1	1	1	3
	13	1	2	3	1	3	1	1	2	3
Fluvents	14	1	1	1	1	1	1	1	1	1
Psamments	15	2	2	2	2	2	2	1	1	2
Torrerts	16	1	2	1	2	1	1	1	2	2
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	2	1	1	2	1	1	2
	20	1	1	2	1	3	1	1	1	3
	21	1	1	2	1	2	1	1	1	2
	22	1	1	2	1	1	1	1	1	1
	23	1	1	3	1	2	1	2	1	3
	24	1	2	1	3	N	2	1	2	N

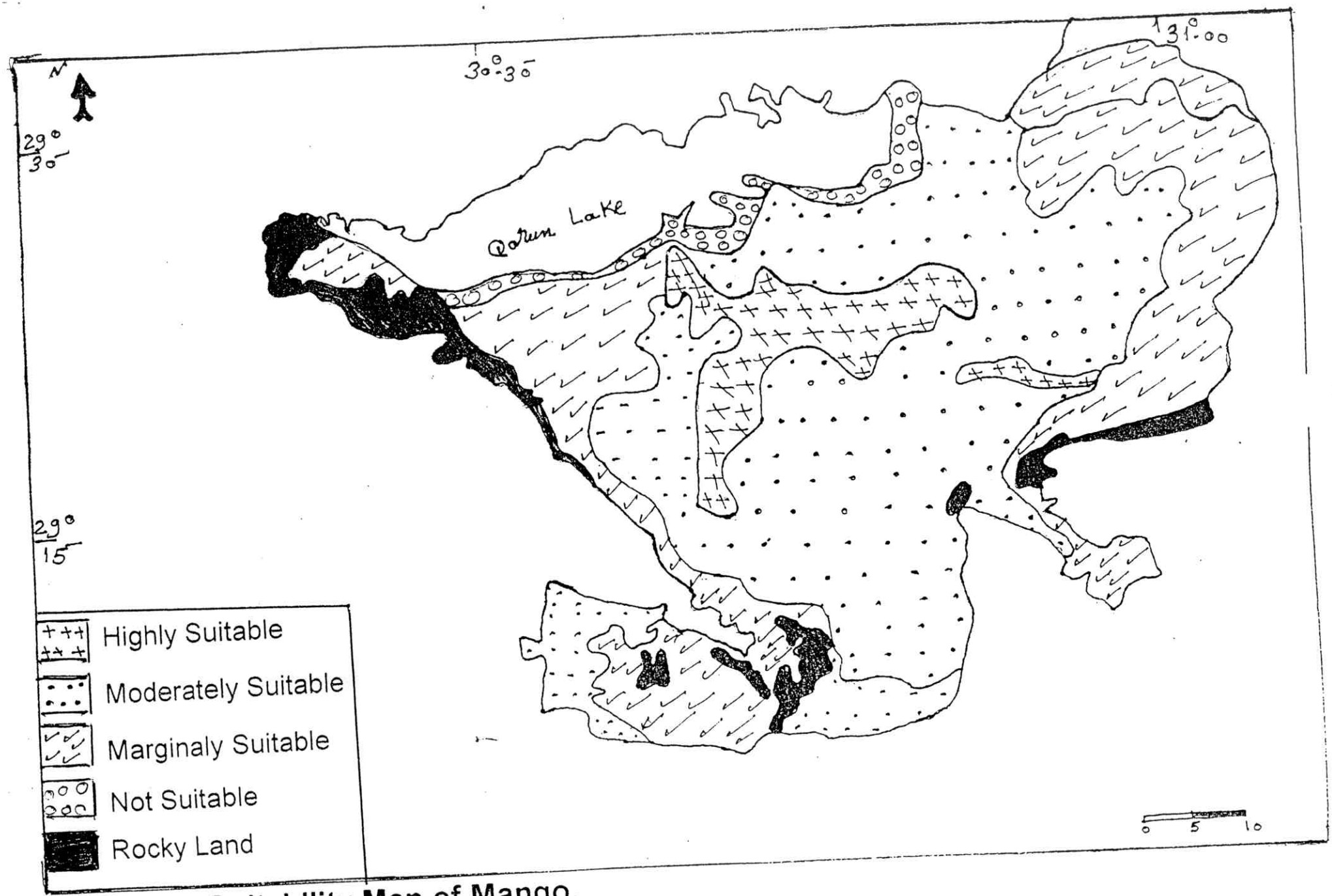

Fig. (18): Suitability Map of Mango.

Table (44) Land suitability for Date palm.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	1	2	2	1	2	1	1	2	2
	2	1	2	2	2	1	2	2	1	3
	3	1	2	3	1	3	2	2	3	3
	4	1	2	2	2	1	2	2	2	2
	5	1	2	3	1	1	1	2	1	3
	6	1	2	3	1	2	1	1	1	3
	7	1	2	36	1	2	1	1	1	3
	8	1	2	3	1	1	2	1	2	3
	9	1	2	3	1	1	1	1	2	3
Salids	10	N	2	1	1	N	1	2	3	N
	11	N	2	2	1	2	1	2	3	N
Gypsids	12	1	2	3	1	3	1	2	3	3
	13	1	2	3	1	3	1	1	2	3
Fluvents	14	1	1	1	1	1	1	1	1	1
Psamments	15	2	2	2	2	2	1	2	2	2
Torrerts	16	1	2	1	2	1	1	2	1	2
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	2	1	1	2	2	1	2
	20	1	1	2	1	3	1	2	1	3
	21	1	1	2	1	2	1	2	1	2
	22	1	1	1	1	1	1	1	1	1
	23	1	1	3	1	2	1	2	1	3
	24	1	2	1	3	N	2	2	2	N

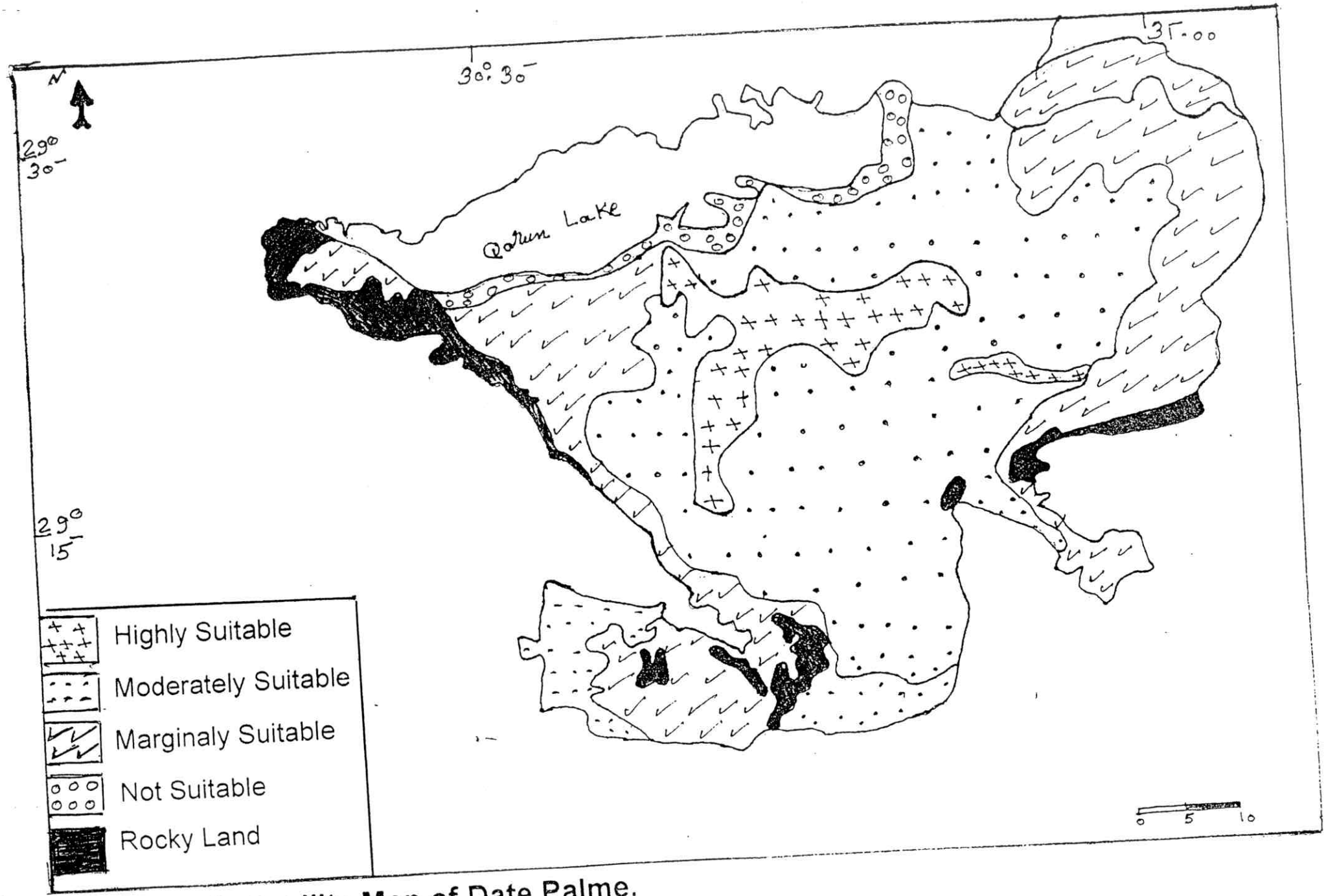

Fig. (19): Suitability Map of Date Palme.

Table (45) Land suitability for Tomato.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	1	2	3	1	2	1	1	3	3
	2	1	2	3	2	2	2	1	1	3
	3	1	2	3	1	3	2	1	3	3
	4	1	2	3	2	1	2	1	2	3
	5	1	2	3	1	1	1	1	1	3
	6	1	2	3	1	2	1	1	1	3
	7	1	2	3	1	2	1	1	1	3
	8	1	2	3	1	1	2	1	2	3
	9	1	2	3	1	1	1	2	2	3
Salids	10	N	2	2	1	3	1	1	3	N
	11	3	2	3	1	2	1	1	3	3
Gypsids	12	1	2	3	1	3	1	1	1	3
	13	1	2	3	1	2	1	1	2	3
Fluvents	14	1	1	1	1	1	1	1	1	1
Psamments	15	1	2	3	2	2	1	2	2	2
Torrerts	16	1	2	1	2	1	1	1	1	2
	17	1	1	1	1	2	1	1	2	2
	18	1	2	1	1	1	1	1	1	1
	19	1	1	2	1	1	2	1	1	2
	20	1	2	2	1	2	1	1	1	2
	21	1	1	2	1	2	1	1	1	2
	22	1	1	2	1	1	1	1	1	2
	23	1	2	3	1	2	1	1	1	2
	24	1	2	1	2	2	2	2	2	2

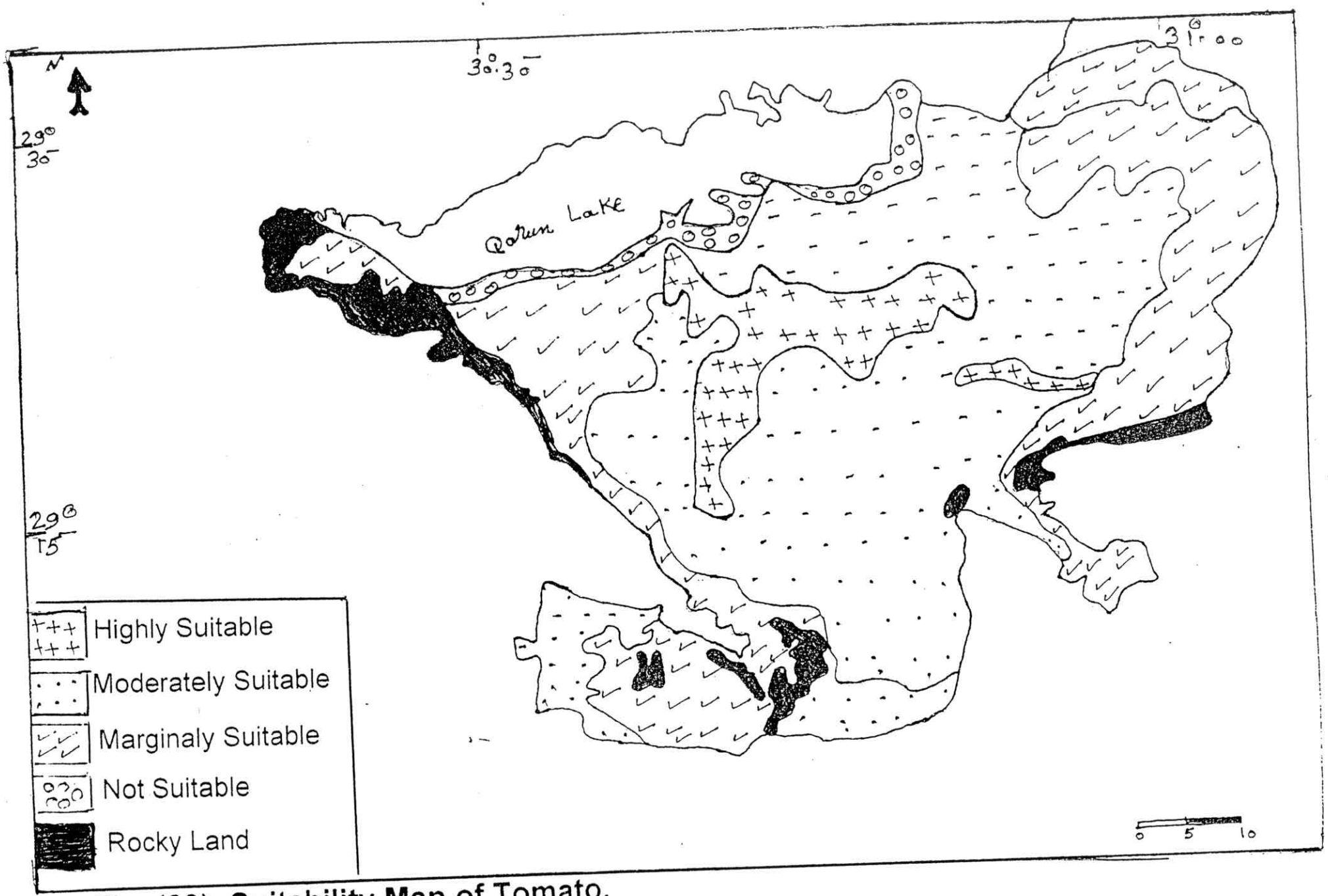

Fig. (20): Suitability Map of Tomato.

Table (46) Land suitability for Alfa Alfa.

Maping unit	Profile No.	EC	O.M.	$CaCO_3$	C.E.C.	ESP	Depth	Texture	Drainage	Class
Calcids	1	1	2	2	1	1	1	1	2	2
	2	1	2	2	2	1	1	1	1	2
	3	1	2	2	1	2	1	1	2	2
	4	1	2	1	2	1	1	1	2	2
	5	1	2	2	1	1	1	1	1	2
	6	1	2	2	1	1	1	1	1	2
	7	1	1	1	1	1	1	1	1	1
	8	1	1	1	1	1	1	1	1	1
	9	1	2	2	1	1	1	1	2	2
Salids	10	3	2	1	1	2	1	1	3	3
	11	3	2	1	1	1	1	2	3	3
Gypsids	12	1	2	2	1	2	1	1	1	2
	13	1	2	2	1	2	1	1	2	2
Fluvents	14	1	1	1	1	1	1	1	1	1
Psamments	15	1	2	1	2	1	1	1	2	2
Torrerts	16	1	2	1	2	1	1	1	1	2
	17	1	1	1	1	1	1	1	1	1
	18	1	1	1	1	1	1	1	1	1
	19	1	1	1	1	1	1	1	1	1
	20	1	1	1	1	2	1	1	1	2
	21	1	1	1	1	1	1	1	1	1
	22	1	1	1	1	1	1	1	1	1
	23	1	2	1	1	1	1	2	1	1
	24	1	2	1	2	2	1	1	2	2

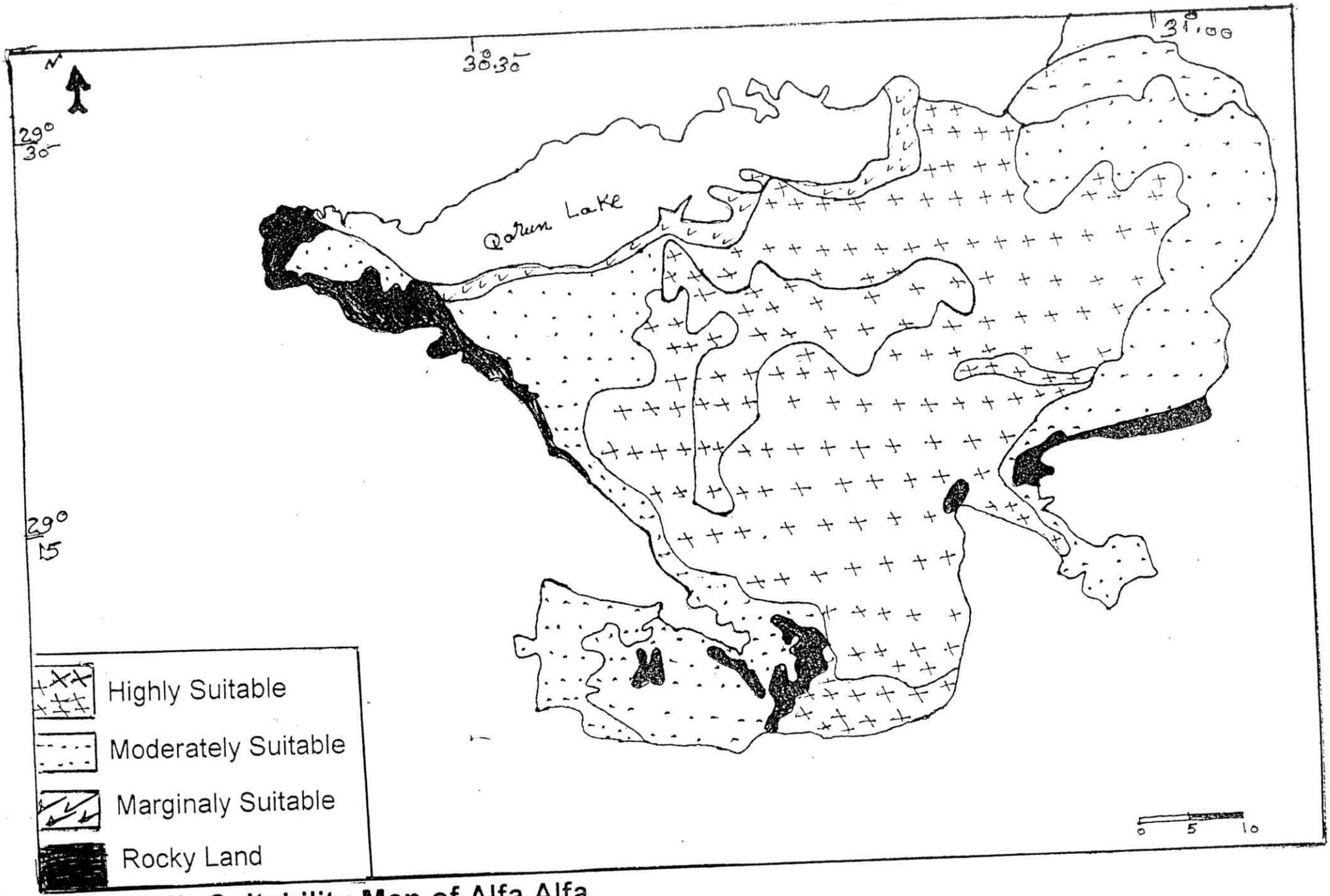

Fig. (21): Suitability Map of Alfa Alfa.

Table (47) Land suitability of the Typic Haplocalcids soils.

Prof. No.	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palm	Tomato	Alfa Alfa
1	1	2	1	3	2	3	3	2	3	2
2	3	3	3	3	3	3	3	2	3	2
3	2	3	2	3	3	3	N	3	3	2
4	2	2	2	2	3	3	3	2	3	2
5	2	2	2	3	1	N	3	3	3	2
6	1	2	2	3	1	3	3	3	3	2
7	2	2	1	1	2	3	3	3	3	1
8	1	1	1	2	2	3	3	3	3	1
9	1	3	2	3	N	N	3	3	3	2

Table (48) Land suitability of Typic Haplogypsids soils.

Prof. No.	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
12	2	3	2	3	2	3	3	3	3	2
13	2	3	2	3	2	3	3	3	3	2
	Land suitability of Haplosalids unit									
10	N	N	2	N	2	N	N	N	N	3
11	N	3	2	N	2	N	N	N	3	3

Table (49) Land suitability of Typic Torrerts soils.

Prof. No.	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
16	2	3	3	3	2	3	2	3	2	2
17	1	1	1	1	1	1	1	1	2	1
18	1	1	1	1	1	1	1	1	1	1
19	1	1	1	2	3	2	2	2	2	1
20	2	3	2	2	1	2	3	2	2	2
21	2	3	2	2	1	1	2	3	2	1
22	1	1	1	2	2	2	1	1	2	1
23	1	1	1	2	1	2	3	3	3	1
24	3	3	2	3	N	3	N	N	3	2

Table (50) Land suitability of the Typic Torrifluvents soils.

Prof. No.	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
14	2	2	3	3	2	2	2	2	3	2
	Land suitability of torripsamments unit									
15	3	3	3	3	2	3	2	2	3	2

Table (51) LUT and their suitability classes.

Cropes / Unit	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
Calcids	$S_2 \rightarrow 60\%$	$S_2 \rightarrow 60\%$	$S_2 \rightarrow 50\%$	$S_3 \rightarrow 80\%$	$S_2 \rightarrow 50\%$	$S_3 \rightarrow 70\%$	$S_3 \rightarrow 80\%$	50% S_2	S_3 100%	S_2 100%
	$S_1 \rightarrow 20\%$	$S_3 \rightarrow 20\%$	$S_1 \rightarrow 30\%$	$S_2 \rightarrow 10\%$	$S_3 \rightarrow 40\%$	$S_2 \rightarrow 10\%$	$S_2 \rightarrow 10\%$			
	$S_3 \rightarrow 20\%$	$S_1 \rightarrow 10\%$	$S_3 \rightarrow 20\%$	$N \rightarrow 10\%$	$S_1 \rightarrow 10\%$	$N \rightarrow 20\%$	$N \rightarrow 10\%$	50% S_3		
Gypsids	S_2 100%	S_3 50%	S_2 50%	S_3 100%	S_2 100%	S_3 100%	S_3 50%	S_3 50%	S_3 100%	S_2 100%
		N 50%	S_3 50%				N 50%	N 50%		
Salids	N 100%	S_3 50%	S_2 100%	N 100%	S_2 100%	N 100%	N 100%	S_3 50%	S_3 50%	S_3 100%
		N 50%						N 50%	N 50%	
Tarrerts	$S_2 \rightarrow 57\%$	$S_1 \rightarrow 57\%$	$S_1 \rightarrow 57\%$	$S_2 \rightarrow 57\%$	$S_1 \rightarrow 57\%$	S_2 85%	S_2 57%	$S_2 \rightarrow 43\%$		$S_2 \rightarrow 43\%$
	$S_2 \rightarrow 29\%$	S_3 43%	$S_2 \rightarrow 29\%$	$S_1 \rightarrow 29\%$	$S_2 \rightarrow 29\%$	S_3 15%	S_3 29%	S_1 28.5%	S_3 85%	S_1 28.5%
	$S_3 \rightarrow 14\%$		$S_3 \rightarrow 14\%$	$S_3 \rightarrow 14\%$	$S_3 \rightarrow 14\%$	$S_3 \rightarrow 14\%$	S_1 14.5%	S_3 28.5%	S_2 15%	S_3 28.5%
Flurents	S_2 50%	S_2 50%	S_3 100%	S_3 100%	S_2 50%	S_2 50%	S_2 50%	S_2 50%	S_3 100%	S_2 100%
	S_3 50%	N 50%			N 50%	S_3 50%	N 50%	N 50%		
Psamments	S_3	S_3	S_3	S_3	S_2	S_3	S_2	S_2	S_3	S_2

Table (52) Land suitability classes in the studied area.

S.class / Unit	S_1 %	S_2 %	S_3 %	N %
Calcids	14.5	31.0	50.0	4.5
Gypsids	10.0	40.0	50.0	60.0
Salids	-	20.0	20.0	60.0
Tarrerts	44.2	33.6	18.8	3.3
Flurents	50.0	40.0	-	10.0
Psamments	-	60.0	30.0	10.0

The main limiting factors in this unit are high $CaCO_3$, low OM and alkalinity and for increasing the suitability classes and soil production fertilization, removing gravels and leaching are essential processes.

The third unit (Salids). not suitable for wheat, onion, mango and rice, while moderately suitable for cotton and olive. Salinity and alkalinity are the main limiting factors for reducing soil suitability, leaching and removing salt crust and gravels are the best management in this unit.

The fourth unit (Typic Haplotorrerts) is the best unit for LuTs due to the high OM, low salinity, deep... etc. The best suitable crops are wheat, maize, olive and cotton which are highly suitable while rice, onion mango and tomato are moderately suitable. Alkalinity, CEC and depth are the limiting factors.

The fifth unit (Torrifluvents) is the best unit for LUTs alfa alfa, wheat, onion, maize, olive, mango and date palm which are highly suitable. Low OM, low CEC and alkalinity are the main limiting factors which decrease the suitability classes and productivity index of such soils.

The Sixth unit (Torripsamment) olive, date palm, alfa alfa and mango are the best LUT which are moderately suitable, shallow soils, alkalinity, low O.M. and salinity are the limiting factors for decreasing the soil productivity.

The government policy show that cotton is the national crop and wheat is the main food crop followed by rice but farmers show that onion, olive, mango and vegetables are the main crops, even it is not physical suitable for land. But after the evaluation studies it can be make

a plane for land use type according to their characteristics and limiting factors for agross margin and needed for each land. Government and farmers show that mango, olive and onion are highly gross margin crops, but recently studies show that physical and chemical properties of land determined the more suitable crops for every kind of land and LuTs or the agricultural plantation.

Finally, land suitability study of El Fayoum depression reveals that salinization, alkalization, $CaCO_3$ and water use are the main problems of area and limit land use type and very special, chemical or careful management improve the productivity classes and land properties.

Table (53) Land suitability results in Typic Haplocalcids soil.

Prof. No.	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
1	-	Ca,K	-	O.M,Ca	D.	O.M,Ca,Ec	K,Ca,O.M	K,Ca	Ca,O.M,K	O.M,Ca
2	CEC	Ca,CEC,K	CEC	O.M,Ca,CEC	D,CEC	O.M,Ca,CEC	D,Ca,O.M	D,O.M,Ca	O.M,Ca,K	O.M,Ca
3	K,tex	K,Ca	K	K,Ca,O.M	D,K	K,Ca	K,O.M,Ca	K,D,Ca	K,O.M,Ca	O.M,Ca
4	CEC	CEC	CEC	O.M,Ca,CEC	D,CEC	O.M,Ca	O.M,Ca	D,O.M	Ca,O.M	O.M
5	tex	Ca	Ca	O.M,Ca	-	O.M,Ca	O.M,Ca	Ca,O.M	K,O.M	O.M,Ca
6	S	K,Ca	Ca,text	O.M,Ca	D	Ca,O.M,Ec	Ca,O.M	K,Ca	O.M,Ca	O.M,Ca
7	text	K	text	text,Ca	D	Ca	K,Ca	Ca,K	O.M,Ca	O.M
8	-	Ca	-	O.M,Ca	D	CaO.M	Ca,O.M,K	O.M,Ca	O.M,Ca	O.M,Ca
9	text	text,Ca	Ca,text	tex,Ca,O.M	D	Ca	Ca,O.M	O.M,Ca	O.M,Ca	O.M,Ca

Table (54) Land suitability results in Typic Haplogypsids soil.

Prof. No.	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
12	K,tex	k,Ca	K,tex	Ca,O.M	D,K	Ca,O.M,K	K,O.M	O.M,K	O.M,K	O.M,Ca
13	K,tex	K,Ca	K,Ca	Ca,O.M	D	Ca,K	K,O.M,Ca	K,O.M	O.M,K	O.M,Ca
	Land suitability results in salids unit									
10	S	S,K	S,K	S	K,D	S,K,O.M	S,K,O.M	S,K	S,K,O.M	S,K
11	S	S,K	S	S	D	S,O.M,Ca	S,K,O.M	S,K	S,K,O.M	S,K

Table (55) Land suitability results in Typic Haplotorrerts soil.

Prof. No.	Wheat	Maize	Çotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
16	CEC	CEC	CEC	O.M,CEC	CEC,D	CEC,O.M	O.M	O.M	O.M,CEC	O.M
17	-	K	-	-	-	tex	K	K	K	O.M
18	-	-	-	-	-	tex,O.M	O.M	-	O.M	-
19	-	-	-	Ca	D	Ca	Ca,D	D	Ca	K
20	K	K	K	S,K	-	K,Ca,S	K,Ca	K	K,O.M	K
21	K	K	K	S,K	-	S,K,Ca	K,Ca	K	K	K
22	-	-	-	Ca	D	tex,Ca	Ca	-	-	-
23	-	k	-	Ca	-	Ca,o.m	K,Ca	T,Ca	Ca,O.M	O.M
24	CEC,K,D	T,CEC,K	CEC,K	CEC,K,O.M	D,K,CEC	CEC,K,O.M	K,O.M	K,O.M	K,O.M	K,O.M

Table (56) Land suitability results in Typic Torrifluvents soil.

Prof. No.	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
14	tex	tex	tex	O.M,S	tex	O.M	S,K	O.M	K,O.M	O.M
	Land suitability of Typic Torripsamments soil									
15	CEC,K	CEC,K	CEC,tex	CEC,K,O.M	CEC,D	CEC,O.M	K,Ca,O.M	S,K,O.M	Ca,K,O.M	O.M,CEC

Table (57) Land suitability class percent of the total area.

Class / Crop	S_1	S_2	S_3	S_4
Wheat	16.2	36.8	29.6	15.8
Maize	11.2	18.6	43.5	26.7
Cotton	14.5	38.2	47.3	-
Rice	4.9	11.2	65.6	18.3
Olive	11.2	71.5	9.00	8.3
Onion	-	24.2	55.8	20
Mango	2.4	36.1	26.5	35.0
Date plame	4.8	40.5	29.7	25.00
Tomato	-	2.5	89.2	8.3
Alfa Alfa	4.8	73.8	21.4	-

Table (58) The best LUT for each unit.

Prof. No.	Wheat	Maize	Cotton	Rice	Olive	Onion	Mango	Date palme	Tomato	Alfa Alfa
P_1 Calcids	1	1	-	-	-	-	-	-	-	1
P_2 Gypsids	2	-	2	-	2	-	-	-	-	2
P_3 Solids	-	-	2	-	2	-	-	-	-	-
P_4 Tarrerts	1	1	1	2	1	1	1	1	2	1
P_5 T.flurents	2,3	1	-	-	1	2	-	1	-	1
P_6 T.psamment	-	-	-	-	2	-	-	2	-	2