4- Results and Discussion

4-1- MORPHOLOGICAL CHARACTERIZATION OF THE STUDIED SOILS:-

The morphological description of soil profiles could be taken, in most cases, as an indicator of the physical and chemical processes that might have taken place. They could also indicate the type or types of parent materials, the mode of deposition and the nature of soil forming factors that prevailed during the period of profile development.

Morphological description of the studied soil profiles was carried out as outlined by the guidelines for soils description, (1990).

The morphological description of the representative soil profiles is shown in appendix (1) . The description leads to a brief knowledge about these soil characteristics field morphological features reveal that the soil sites under consideration give a good models to define the relation between the soil fertility aspects and the nature of soil type, as well as, the environmental conditions that are predominating in El- Kaluobia Governarate. In general, the soils under consideration are varied in their morphological features from one profile to another as it could be clearly seen from the morphological field sheets. The differences among horizons within each soil profile with respect to soil colour, texture, structure and distribution of secondary formations. The soils constitute sediments from clay, coarse Sand and Sandy loam . Soil colour has the range between yellow (10YR8/6) to dark grayish brow (10YR4/2) when dry and brownish yellow (10YR 6/6) and very dark brown (10YR2/3) when moist. Soil structure is single gravis to angular blocky. The representative soil profiles are morphological described as given in appendix (1).

4-2 SOIL CHARACTERISTICS

4-2-1: Physical properties

4-2-1-1: Particle size distribution

Data presented in Table (1) show that of tested soils texture varies considerably from one soil profile to another and even within the subsequent layers of the same profile. For instance, the cultivated soils of Abu El Ghait which is represented by profile No. 1 is of clay loam texture in the surface layer underlain by light clay textured layer while the soils rpresented by profiles 2 and 5 are of clay loam Texture throughout the entire profile. With regard to the soils of Kafr El- Ragalat, Kafr Saad and Kafr El- Gemal which are represented by profiles 3, 4 and 7, most of them are of medium texture in the surface layers underlain with coarse- textured materials in the deepest layers. On the other hand, an almost uniform medium texture (sandy clay loam) characterizes the soil represented by profile 6 (Sandanhor).

Likewise, the soils of Qaha, Sindiyun, Qalyub, Nawa, Kafr Shibin and Abu Zabal which are reprented by profiles 8, 9, 10, 11, 12 and 14 are of fine- texture (clay) throughout the entire profile except for the surface layer of profile 8 which is of a sandy clay loam texture. Soil profiles of the eastern side of the studied area (Abu Zabal, El- Khanka, El- Gabal El- Asfar and El- Qalag) which are represented by profiles 13, 15, 16 and 17 are entirely dominated with coarse- texture .

4-2-1-2: Qrganic matter content :

Data depicted in Table (1) reveal that organic matter content of all the studied soil profiles is generally low, not exceeding 2.3% . The highest content characterizes the soils of Kafr Saad and Kafr Shibin, while the lowest is associated with the coarse – textured soils of Kafr El- Ragalat .

Depthwis distribution indicates that the uppermost surface of the studied soils conatains higher levels of organic matter. This is expected as a result of organic manuring of the cultivated soils which contribute markedly to organic matter increase in the top layer. Noteworthy to mention that the low content of the organic matter is a common feature in the arid regions due to the high rate of decomposition of the organic matter under the arid climatic conditions prevailing the area of study.

4-2-1-3 : Calcium Carbonate Content

Examination of data presented in Table (1) reveals that the highest $CaCO_3$ content (6.1 %) is associated with the soils of Qaha (Profile 8), while the lowest content (0.10 %) characterizes the coarse textured soils of El- Qalag (profile 17). Generally, the low $CaCO_3$ content of the studied soils is rendered to the nature of parent material (alluvial and sand) from which soils are derived . The vertical distribution of $CaCO_3$ within the studied soil profiles indicates that $CaCO_3$ content does not obey any specific pattern that could be considered characteristic for Kalubia sediments .

Table (1) : Particle size distribution, orgranic matter and $CaCO_3$ contents of the studied soils.

Profile No.	Location	Depth (cm)	Particle size distribution				Textural class	O.M %	$CaCO_3$ %
			C. Sand%	F. Sand %	Silt %	Clay %			
(1)	Abu El Ghait	0 – 25	2.3	42.4	36.5	18.8	C. L.	1.7	2.1
		25 – 75	0.7	35.7	38.3	25.3	L. C.	0.9	2.8
		75 - 125	1.6	23.9	41.6	32.9	L. C.	0.9	3.6
(2)	El- Munira	0-20	1.1	35.5	34.5	28.9	C. L.	1.7	1.2
		20-50	0.5	47.4	32.2	19.9	C. L.	0.9	2.6
		50-100	0.3	39.8	40.3	19.6	C. L.	1.4	2.3
		100-150	0.4	40.9	37.9	20.8	C. L.	1.2	2.9
(3)	Kafr El-Ragalat	0-30	38.5	30.5	15.5	15.5	S. C. L.	1.7	0.95
		30-70	79.1	9.7	3.2	8.0	L S.	0.9	0.21
		70-120	86.6	6.3	2.3	4.8	S	0.3	0.32
(4)	Kafr Saad	0-20	2.6	62.6	18.9	15.9	S.C.L.	2.3	2.6
		20-50	32.3	37.5	14.9	15.3	S.C.L.	0.6	2.1
		50-90	8.4	67.6	12.5	11.5	S.L.	1.2	0.43
		90-120	1.1	89.3	4.7	4.9	S.	0.6	2.3
(5)	Shiblanga	0-20	4.1	55	24.1	16.8	C. L	1.8	3.3
		20-60	4.2	54.5	20.5	20.8	C. L.	1.7	2.9
		60-110	5.2	43.5	19.6	31.7	C. L.	1.7	1.2

.C. L. = Clay Loam L. S. = Loamy Sand L.C. = Light Clay
S. = Sand S.C.L. = Sandy Clay Loam S.L. = Sandy Loam.

Table (1) Cont.

Profile No.	Location	Depth (cm)	Particle size distribution				Textural class	O.M %	$CaCO_3$ %
			C. Sand%	F. Sand %	Silt %	Clay %			
(6)	Sandanhoor	0-20	4.6	59.8	17	18.6	S. C. L	1.9	3.2
		20-50	3.5	61.7	16.4	18.4	S. C. L	1.7	3.3
		50-100	4.3	59.9	16	19.8	S. C. L	1.7	3.1
		100-150	2.6	61.1	17.2	19.1	S. C. L	1.4	3.1
(7)	Kafr El-Gemal	0-20	1.9	69.7	3.7	24.7	S. C. L	1.9	2.2
		20-60	0.9	73.8	17.9	7.4	S, L.	1.9	2.5
		60-90	0.5	85.2	9.6	4.7	L.S.	1.7	0.5
		90-120	0.9	64.9	16.4	17.8	S. C. L	1.7	1.6
(8)	Qaha	0-25	6.4	62.4	15.7	15.5	S. C. L	2.2	6.1
		25-60	3.1	29.5	15.1	52.3	H. C.	1.2	2.5
		60 – 90	3.7	33.7	16.8	45.8	H. C.	1.2	4.5
		90 - 120	1.8	36.2	19.3	42.7	H. C.	1.2	2.3
(9)	Sindiyun	0-25	2.1	28.6	24.7	44.6	H. C.	1.4	2.4
		25- 75	1.4	29.4	21.8	47.4	H. C.	0.9	2.9
		75 - 110	1.9	30.6	22.9	44.6	H. C.	1.2	2.8
(10)	Qalyub	0-25	2.9	42.9	29	25.2	L. C.	2.2	3.1
		25-50	3.5	36.5	21.3	38.7	H. C.	1.2	3.3
		50 – 90	4.3	39.3	20.4	36	H. C.	1.2	2.3
		90 - 120	2.9	35.5	17.2	44.4	L. C.	0.9	2.2
(11)	Nawa	0-30	5.3	29.6	21.5	43.6	H. C.	1.9	3.7
		30-60	5.8	24.5	17.9	51.8	H. C.	1.7	3.5
		60 – 90	5.2	31.1	16.7	47	H. C.	1.4	3.2
		90 - 120	5.7	29.6	24.7	40	H. C.	1.4	3.3

S.C.L. = Sandy Clay Loam L.C. = Light Clay H.C. = Heavy Clay
L. S. = Loamy Sand S.L. = Sandy Loam

Table (1) Cont.

Profile No.	Location	Depth (cm)	Particle size distribution C. Sand%	F. Sand %	Silt %	Clay %	Textural class	O.M %	$CaCO_3$ %
(12)	Kafr Shibin	0-20	4.5	34.7	32.7	28.1	C.	2.3	4.3
		20-60	2.5	38.9	28.7	29.9	L.C.	0.9	2.9
		60 - 90	1.9	44.1	26.4	27.6	L.C.	0.9	2.8
		90 - 120	1.8	41.7	25.2	31.6	L.C.	1.1	2.3
(13)	Abu Zaabal I	0-25	68	18.3	4.7	9	L.S.	0.9	1.1
		25-50	76.3	11.4	6.2	6.1	L.S.	0.6	2.2
		50 - 75	88.4	5.1	2.4	4.1	S.	0.6	1.1
(14)	Abu Zaabal II	0-25	21.2	26.5	23.3	29	L. C.	1.7	2.6
		25-60	21.5	20.2	23.4	34.9	L. C.	1.4	3.6
		60 - 90	8.9	22.9	26.6	41.6	H. C.	1.2	3.4
		90 - 120	4.7	30.6	25.8	38.9	L. C.	1.4	3.7
(15)	El- Khanka	0-20	62.5	27.8	4.3	5.4	L.S.	1.7	4.3
		20-75	74.4	10.2	6.8	8.6	S. L.	0.9	1.4
		75 - 150	96.3	0.5	1.3	1.9	S.	0.9	0.3
(16)	El- Gabal ElAsfer	0-20	45.5	41.7	8.6	4.2	L.S	1.9	0.40
		20-60	78.4	14.2	2.4	5	L.S.	1.2	0.30
		60 - 100	91.2	4.3	0.2	4.3	S.	0.9	0.2
(17)	El- Qalag	0-25	67.1	11.9	5.7	15.3	S. C. L.	1.7	1.6
		25-60	84.6	5.9	0.3	9.2	L. S.	1.2	0.30
		60 - 90	81.6	11.7	1.4	5.3	L.S.	0.6	0.10

L.C. = Light Clay H.C. = Heavy Clay L.S. = Loamy Sand
S. = Sand S. L. = Sandy Loam C. = Clay
S.C.L. = Sandy Clay Loam

4-2-2 : *Chemical Properties:*

4-2-2-1 : Soil reaction

Table (2) shows that pH values of the studied soils are neutral to moderately alkaline as they ranged between 7.1 and 8.3 . The lowest pH value (7.1) was recorded in the middle layer of Abu El-Ghait (profile No.1) and in the upper most parts of profiles (16 and 17) representing El Gabal El Asfer and El Kalag. values were recorded for the uppermost surface layers of profiles 1, 16 and 17, while the highest value (8.3) was detected in the deepest layer of profile 8 (Qaha) . Soils of El- Munira, Kafr El- Ragalat, Kafr Saad, Shiblanga, Sandanhor, Kafr El- Gemal, Qaha, Sindiyun, Qalyub, Kafr Shibin, Abu Zabal, and El- Khanka, represented by profiles (2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14, 15), are characterized by mildly alkaline reaction except for profile (8) which is moderately alkaline downwards .

4-2-2-2: Total Salinity

Data presented in Table (2) indicate that the different studied soils are generally, non saline as their EC values are below 4ds m^{-1}., except for the surface layer of profile (15) (El Khanka) which is slightly saline (EC 5.8dSm^{-1}) . It is noticed that the distribution of total soluble salts content, as expressed by the EC values, is relatively similar through the different profile layers in majority of the studied soils. At few locations, however, it was relatively higher in sub- soil layers than in the surface ones, as indicated by profiles 5, 6, 7, 11, and 14. This may be due to keeping downwards movement of water carrying salts as a result of the sucessive irrigations.

Table : (2) Chemical properties of the studied soils.

Profile No.	Location	Depth (cm)	pH	E.C dSm-1	Soluble cations (meqIL)				Soluble Anions (meq)				C.E.C (meq/ 100g soil)
					Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	Cl^{-}	HCO_3	CO_3	SO_4	
(1)	Abu El Ghait	0 - 25	7.3	0.97	3.5	3.7	4.7	0.7	4.0	4	-	4.6	32
		25 - 75	7.1	0.94	3.5	1.6	3.4	0.2	3.1	5	-	0.6	38.4
		75 - 125	7.3	0.98	3.5	2.7	4.8	0.2	4	3.6	-	3.6	40
(2)	El- Munira	0-20	7.5	0.65	4.6	0.5	2.9	0.2	3.2	4.6	-	0.4	39.2
		20-50	7.2	0.84	3.5	2.7	4.5	0.2	4	4	-	2.9	35.2
		50-100	7.5	0.64	4.6	0.5	3.4	0.1	3.2	3.2	-	2.2	33.6
		100-150	7.5	0.70	3.5	1.6	3.9	0.2	3.2	3.8	-	2.2	39.2
(3)	Kafr El-Ragalat	0-30	7.4	0.76	3.5	2.7	30	1	3.1	5.8	-	1.3	23.2
		30-70	7.4	0.61	1.2	2.9	2.4	0.6	2.3	3.2	-	1.6	13
		70-120	7.5	0.34	1.2	1.9	2.9	0.4	2.3	3	-	1.1	8.4
(4)	Kafr Saad	0-20	7.4	1.6	4.6	5.6	7.6	0.5	6	5.6	-	6.7	32.8
		20-50	7.6	0.98	1.2	2.9	5.6	0.2	6	3.4	-	0.5	24.8
		50-90	7.6	0.67	2.3	2.8	4.8	0.2	5	2.8	-	2.3	18.4
		90-120	7.6	0.65	1.2	3.0	3.9	0.2	4	3	-	1.3	27.2
(5)	Shiblanga	0-20	7.9	1.3	3.5	2.6	10	0.2	9	5.2	-	2.1	47
		20-60	7.8	1.8	2.3	3.8	12.3	0.1	10	3.8	-	4.7	47
		60-110	7.8	2.2	2.3	3.3	19.5	0.1	18	5	-	2.2	49
(6)	Sandanhor	0-20	7.6	0.76	2.3	4.3	3.9	0.4	3.3	5	-	2.6	36
		20-50	7.6	0.91	4.6	2.5	5.0	0.2	4.1	7	-	1.2	39.2
		50-100	7.5	1.1	4.6	2.5	7.2	0.2	8	3.8	-	2.7	36.2
		100-150	7.5	1.4	2.3	3.3	9.4	0.2	8	3.8	-	3.4	52.1

Table (2) Cont.

Profile No.	Location	Depth (cm)	pH	E.C dSm-1	Soluble cations (meqIL)				Soluble Anions (meq)				C.E.C (meq/ 100g soil)
					Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	Cl^{-}	HCO_3	CO_3	SO_4	
(7)	Kafr El-Gemal	0-20	7.5	0.66	2.3	4.3	2.0	0.6	2.1	5	-	2.1	46.3
		20-60	7.5	0.66	2.3	2.2	2.7	0.3	2.3	4	-	1.2	28
		60-90	7.5	0.62	2.3	2.3	2.8	0.1	2.3	3.2	-	2	35.2
		90-120	7.5	1.5	4.6	3.5	10	0.4	8	4.2	-	6.3	38.4
(8)	Qaha	0-25	7.6	0.69	2.3	2.8	3.9	0.1	3.3	3.3	-	2.6	38.4
		25-60	7.5	2.1	5.7	5.4	13.8	0.3	11	4	-	10.2	50.2
		60 – 90	8.0	1.2	1.2	1.9	12	0.1	11	3	-	1.2	50.2
		90 - 120	8.3	1.2	1.2	1.9	11.3	0.1	10	4	-	0.5	40
(9)	Sindiyun	0-25	7.5	0.59	2.9	2.2	2.8	0.2	3	3	-	2.1	50.9
		25- 75	7.6	0.69	2.9	2.7	3.5	0.1	3	2.6	-	3.6	38.4
		75 - 110	7.4	0.96	2.3	3.8	6.8	0.1	6	2.2	-	4.8	36
(10)	Qalyub	0-25	7.4	1.1	5.2	4.5	4.7	0.5	4	4.8	-	6.1	37.6
		25-50	7.5	0.65	3.5	1.6	2.9	0.3	3	2.4	-	1.9	45
		50 – 90	7.4	0.84	4.0	2.1	3.8	0.3	3	2.8	-	4.4	36
		90 - 120	7.4	0.70	3.5	2.7	3.6	0.2	3	2.9	-	4.2	37.6
(11)	Nawa	0-30	7.6	1.2	2.3	2.8	9.2	0.3	8	4.4	-	2.2	39.2
		30-60	7.9	1.5	1.7	1.8	14	0.2	12	5	-	0.7	35.2
		60 – 90	8.1	1.6	1.2	0.9	17.3	0.2	16	3	-	0.6	37.6
		90 - 120	7.8	1.9	1.2	1.9	19	0.2	18	3.4	-	0.9	27.2

Table (2) Cont.

Profile No.	Location	Depth (cm)	pH	E.C dSm-1	Soluble cations (meqIL)				Soluble Anions (meq)				C.E.C (meq/ 100g soil)
					Ca^{+2}	Mg^{+2}	Na^{+}	K^{+}	Cl^{-}	HCO_3	CO_3	SO_4	
(12)	Kafr Shibin	0-20	7.7	1.4	3.5	3.7	9.4	0.6	8	5	-	4.2	24
		20-60	7.8	1.1	2.3	1.8	7.4	0.3	7	4	-	0.8	24.4
		60 - 90	7.7	1.1	2.3	1.8	8.8	0.2	8	2.8	-	2.3	24.8
		90 - 120	7.7	1.3	2.9	2.7	9.0	0.2	9	3.8	-	2	32.4
(13)	Abu Zaabal I	0-25	7.2	1.2	3.5	5.7	4.8	0.4	4	3	-	7.4	17.2
		25-50	7.3	0.9	3.5	4.7	2.8	0.3	3	3	-	5.3	9.2
		50 - 75	7.4	0.7	2.3	2.8	2.5	0.3	2	2.2	-	3.7	4.8
(14)	Abu Zaabal II	0-25	7.4	1.1	3.5	3.7	6.0	0.3	6	4.4	-	3.11	25.6
		25-60	7.4	1.9	3.5	8.8	11.3	0.2	10.4	3.2	-	0.2	34
		60 - 90	7.5	1.8	2.3	3.8	15.6	0.1	14	3	-	4.8	23.4
		90 - 120	7.5	1.8	1.2	3.9	16.4	0.1	16	3.6	-	2	16.8
(15)	El- Khanka	0-20	7.4	5.8	6.9	16.5	43.5	1.1	43	6.4	-	18.6	37
		20-75	7.6	3.4	6.9	4.3	27.5	1	25	3.4	-	11.3	15.6
		75-150	7.8	2.00	2.9	3.3	12.3	0.5	12	2	-	5	1.2
(16)	El- Gabal El Asfar	0-20	7.1	0.93	3.5	2.2	4.8	0.75	4	4	-	3.25	23.4
		20-60	7.3	0.71	2.3	2.3	3.9	0.5	3	2.2	-	3.8	8.6
		60-100	7.3	0.75	2.3	2.8	3.9	0.5	3	2.4	-	4.1	3.2
(17)	El- Qalag	0-25	7.1	0.96	3.5	3.7	3.7	0.73	3	6	-	2.63	20
		25-60	7.1	0.51	2.3	1.8	2.6	0.22	3	2	-	0.92	12.8
		60 - 90	7.3	0.96	4.6	2	4.6	0.22	3	2.8	-	5.62	8.4

4-2-2-3 : Soluble cations and anions :-

Table (2) also shows that, regardless of salinity level, the soluble catians were oftenly dominated with Na^+. In most cases, soluble Ca^{++} and / or Mg^{++} was the . second predominant cation, while K^+ constitued the least abundant soluble cotion . Nevertheless, soluble Ca^{++} exceeds soluble Na^+ in the middle layers of profile 1 which represents Abu El- Ghait soils, as well as the uppermost surface layers of profiles 2, 9 and 10 (Kafr El- Ragalat, Sindiyun and Qalyub). Brifly, the common cationic composition of most profiles follows the order: $Na^+ > Ca^{++} > Mg^{++} > K^+$, while the exceptional cases follows the order, $Ca^{2+} > Na^+ > Mg^{++} > K^+$, such as some layers within profiles 1, 2, 9 and 10 of Abu El Ghait, Kafr El- Raglat, Sindiyun and Qalyub.

The anionic composition is usually dominated with Cl^- and / or HCO^-_3. In most cases, soluble HCO^-_3 is the second predominant anion, followed by soluble SO^{2-}_4 with an entire absence of CO_3^- ions, consequently The anionic composition in most profiles follows the order; $Cl \geq HCO_3^- > SO^{2-}_4$. Generally , the wide variations in distribution of soluble cations and anions may be due to the differences of land use, management, practices rotation and irrigation regime. Moreover, these variations may reflect the special character of soluble ions vertical movement throughout the profile layers, due to the active evaporation which contributes to salts upward movement or the downward movement due to leaching processes .

4-2-2-4 : Cation exchange capacity (C.E.C.)

Regarding the cation exchange capacity of the studied soil profiles, data in Table (2), indicate that values of cation exchange capacity range between 1.2 and 50.9 me/ 100g soil . The lowest value is detected in the deepest layer of profile 15 which represents the lighter texture sand that attains relatively low content of clay, while the highest value of CEC characterizes the surface layer of profile 9 which is of clay - textural class and attains a relatively high content of clay. From these data, it is evidant that the wide range of C.E.C. is related to soil texture, particularly with respect to soil clay content .

4-3: STATUS OF MICRONUTRIENTS

4-3-1- Iron

4-3-1-1: Total Iron:

Data illustrated in Table (3) show that total Fe content of the studied soils ranges widely between 10200 and 66000 ppm. The lowest values characterize the deepest and 20- 60 cm layers of profiles 3 and 5, respectively due to their high content of sands which are very poor in their iron content. On the other hand, the highest content of total Fe was found in the surface layer of profile 12 (Kafr Shibin).

The wide range of Fe content is apparently associated with soil texture and is probably dependent on type of parent materials from which the soil was formed. It is worthy to note that soils of El- Munira, Qaha, Qalyub, Kafr Shibin and Abu Zabal contained amounts of total Fe exceeding 5000ppm. These soils are characterized by their low content of $CaCO_3$ and fairly high content of clay. The lowest values of total iron .

Table (3) Total and available (DTPA – extractable) Fe of the studied soil profiles.

Profile (No)	Location	Depth (cm)	Fe (ppm)	
			Total Fe	Available Fe
(1)	Abu EL Ghait	0-25	21120	11.2
		25-75	38210	10.0
		75-125	41150	10.7
		Mean	33493	10.63
(2)	EL-Munira	0-20	55600	13.4
		20-50	51200	8.9
		50-100	54200	11.2
		100-150	41300	15.6
		Mean	50575	12.28
(3)	Kafr EL- Ragalat	0-30	43200	12.5
		30-70	12300	11.1
		70-120	10200	4.4
		Mean	21900	9.33
(4)	Kafr Saad	0-20	44500	12.5
		20-50	41300	8.9
		50-90	12200	5.6
		90-120	11500	8.9
		Mean	27375	8.98
(5)	Shiblanga	0-20	12500	13.5
		20-60	10200	10.2
		60-110	15300	12.3
		Mean	12666.67	12

Table (3) Cont.

Profile (No)	Location	Depth (cm)	Fe (ppm)	
			Total Fe	Available Fe
(6)	Sandanhur	0-20	21500	9.2
		20-50	19000	8.9
		50-100	19500	10.2
		100-150	19500	10.2
		Mean	19875	9.63
(7)	Kafr El- Gemal	0-20	54300	12.3
		20-60	16500	9.5
		60-90	15100	4.5
		90-120	21200	8.2
		Mean	15557.5	8.63
(8)	Qaha	0-25	55600	10.8
		25-60	51200	11.2
		60 – 90	54500	13.4
		90 - 120	54300	9.4
		Mean	53900	11.2
(9)	Sindiyun	0-25	20500	11.7
		25- 75	55000	8.5
		75 - 110	41500	8.9
		Mean	39000	9.7
(10)	Qalyub	0-25	59200	9.8
		25-50	54000	11.2
		50 – 90	55000	10.7
		90 - 120	52000	11.2
		Mean	55050	10.73

Table (3) Cont.

Profile (No)	Location	Depth (cm)	Fe (ppm)	
			Total Fe	Available Fe
(11)	Nawa	0-30	54200	13.4
		30-60	50500	13.3
		60 – 90	50200	11.9
		90 - 120	44500	10.3
		Mean	49850	12.23
(12)	Kafr Shibin	0-20	66000	15.6
		20-60	58200	12.3
		60 – 90	55000	11.2
		90 - 120	55000	7.9
		Mean	58550	11.8
(13)	Abu Zaabal I	0-25	1950	8.5
		25-50	1220	10.1
		50 – 75	1150	4.5
		Mean	14400	7.7
(14)	Abu Zaabal II	0-25	63500	11.2
		25-60	62500	12.2
		60 – 90	58200	15.5
		90 - 120	59100	7.9
		Mean	60825	11.7
(15)	El- Khanka	0-20	21500	11.2
		20-75	19200	10.3
		75 – 150	12300	5.5
		Mean	17666	9

Table (3) Cont.

Profile (No)	Location	Depth (cm)	Fe (ppm)	
			Total Fe	Available Fe
(16)	El- Gabal El Asfar	0-20	42300	18.5
		20-60	28900	10.2
		60 – 100	17500	12.5
		Mean	29566	13.73
(17)	El- Qalag	0-25	512	10.2
		25-60	210	10.2
		60 – 90	135	7.6
		Mean	28566	9.33

(<20000 ppm) are found in the coarse textured soils represented by profiles 5, 6, 7, 13, and 17, while the medium textured soils represented by profiles 1,3, 4, 9, 11, 16 and 17 have moderate amounts of total Fe.

To illustrate the effect of some soil constituents on total Fe content, in soils the correlation coefficient between total iron and each of tested soil constituents were tested, Table (4) .

The obtained correlation coefficients imply that soil total Fe is positively and high significantly correlated with $CaCO_3$ %, silt % and clay % but negatively and high or hishly significant conlated footnete significantly correlated with sand % which stands in accordance with results of El- Falky (1981) and Hssona et al . (1996).

Table (4) Correlation coefficients between soil total and DTPA-extractable iron and some soil variables .

Soil variable	Total iron	DTPA – extractable iron
EC	0.001	0.115
pH	0.141	0.031
$CaCO_3$%	0.499**	0.331*
OM %	0.198	0.422*
CEC	0.234	0.322*
Sand %	-0.697**	-0.373**
Silt %	0.559**	0.340**
Clay %	0.652**	0.319**

** Highly Significant at 1% = 0.340

* Significant at 5% = 0.262

Multiple regression was also computed to determine the relationship between some soil variables and total Fe in the studied soil profiles The derived multiple regression equation is as follows . .

Total Fe = 133665.79_ 9640.63 pH + 3487.403 $CaCO_3$ + 8108. 64 OM.- 769. 568CEC - 909.85 Sand + 393.84 silt.

Furthermore; the direct and joint relation of sand, CEC, OM and $CaCO_3$ with total Fe are 75.23, 11.76, 6.19 and 3.57, respectively, Table (5) .

In short , the contribution of the studied soil variables to total Fe in these soils can be arranged in the order :

Sand > CEC > OM > $CaCO_3$.

Table (5) : Direct and joint effects of soil variables on total Fe in the studied soil profiles

Soil Variable	Contribution %
Sand %	75.23
CEC	11.76
OM %	6.19
CaCO3 %	3.57
Residual Factors	3.25

4-3-1-2 : DTPA - extractable iron

Date presented in Table (4) Show that the values of chemically available (DTPA - extractable) Fe range between 4.4 and 18.5 ppm. The highest value of DTPA extractable Fe is found in the surface layer of profile 18 that represents the soils of EL- Gabal El- Asfar, while the lowest one belongs to the coarse-textured soils of Kafr El Ragalate, profile (3)

Considering the critical level of DTPA - extractable Fe which has been proposed by Soltanpour and Schwab (1977), the index values of DTPA- extractable Fe are as fallows:

Low, 0 -2 ppm , Marginal, 2.1- 4.0 ppm , Adequate, > 4 ppm. The values of the studied soil profiles indicate that the studied soils belong to the adequate level .

The vertical distribution of DTPA - extractable Fe reveals a tendency to accumulation of available Fe in the surface layers., this behaviour may be due to continuous addition of fertilizers and manures, Which is in a good agreement with EL- Saadani et al (1987).

The correlation coefficients between some soil constituents and DTPA- extractable Fe were computed and presented in Table (5). Results imply that chemically available Fe is significantly, positively correlated with $CaCO_3$, OM % and CEC and positively highly significantly correlated with silt % and clay %, In contrast, available Fe is negatively highly significantly correlated with sand%. Similar results were obtained by Kisnk et al (1980) and Hafez et al (1992).

Multiple regression analysis was also carried out to develop the relationship between some soil variables and DTPA - extractable Fe . The calculated multiple regression equation is as follows:

$$\text{DTPA- extractable. Fe} = 21.66 + 0.322\,(\text{EC}) - 1.55\,(\text{pH}) + 2.01\,(\text{OM\%}) - 0.04\,(\text{sand\%})\ .$$

The direct and joint effects of soil variables (OM and sand %) on DTPA- extractable Fe are 61.81 and 30.56 %, respectively, Table (6).

The contribution of the studied soil variables to DTPA- extractable Fe in these soils can be arranged in the order.

OM % > sand % .

Table (6) : Direct and joint effect of soil variables on DTPA-extractable Fe in the studied soil profiles

Soil Variable	Contribution %
OM %	61.81
Sand %	30.56
Residual Factors	7.63

4-3-1-3 : Depthwise distribution of total iron :

Table (7) shows that the weighted mean (W) for total Fe in the studied profiles varies widely between 12936.36 and 60716 ppm.

The lowest values of (W) for total Fe are associated with the light- textured soil which are the soils of Kafr El- Ragalat, Shiblanga, Sandanhor, Abu Zabal and El- Khanka. The highest values of (W) range between 41916.67 and 60716 ppm and characterize the soils derived from fine textured Nile sediments . The soils of profiles 1, 4, 7, 16 and 17 have moderate values of (W) ranging between 2.3625% to 3.5968 % Fe.

The wide variations of weighted mean in the studied soil profiles may be attributed to geogenic factors rather than pedogenic ones, i.e., may be ascribed to the change in the nature of parent material rather than to soil formation processes or local conditions prevailing in each profile site.

Table (7) Weighted mean (W) trend (T) and specific range (R) of total Fe in the studied soil profiles.

Profile (No)	Location	Weighted mean (W)	Trend (T)	Specific range (R)
(1)	Abu El- Ghait	35968	0.41	0.56
(2)	El- Munira	49486	-0.11	0.29
(3)	Kafr El- Ragalat	19150	-0.56	1.72
(4)	Kafr Saad	24683	-0.45	1.34
(5)	Shiblanga	12936	0.034	0.39
(6)	Sandanhor	19666	-0.09	0.13
(7)	Kafr El- Gemal	23625	-0.56	1.66
(8)	Qaha	53716	-0.04	0.08
(9)	Sindiyun	42863	0.52	0.80
(10)	Qalyub	41916	-0.29	0.17
(11)	Nawa	49850	-0.08	0.19
(12)	Kafr Shibin	57900	-0.12	0.19
(13)	Abu Zaabal I	14400	-0.26	0.56
(14)	Abu Zaabal II	60716	-0.04	0.09
(15)	El- Khanka	16056	-0.25	0.57
(16)	El- Gabal El Aasfer	27020	-0.36	0.92
(17)	El- Qalag	26888	-0.47	1.4

Notes:- W= (? (cxd) - p, where C= concentration of element in layer and "d" = thickness of layers, P = depth of profile.

T = (W- S) - W for cases of W> S or = (W- S) - S for cases of S>W.

S = content of uppermost surface layer W = weighted mean.

R = (H-L) - W

H = highest concentration. L= lowest concentration.

Considering the trend (T), data indicate that the soils represented by profiles 6, 8, 11 and 14 display the highest symmetrical values of total Fe among the studied profiles. The results also show that Fe in most of the studied profiles is usually higher in the surface layers than the deeper ones as indicated by the negative value for the trend.

Specific range (R) for total Fe is generally larger than 0.08 and less than 1.72 which may suggest that these profiles are derived from of a uniform parent material , or to the mild effect of pedgenic processes. In other words, the specific range of total Fe indicates that the soil materials of profiles 6, 8, 10, 11, 12 and 4 are homogeneous, whereas the other profiles are probably formed from heterogeneous soil materials .

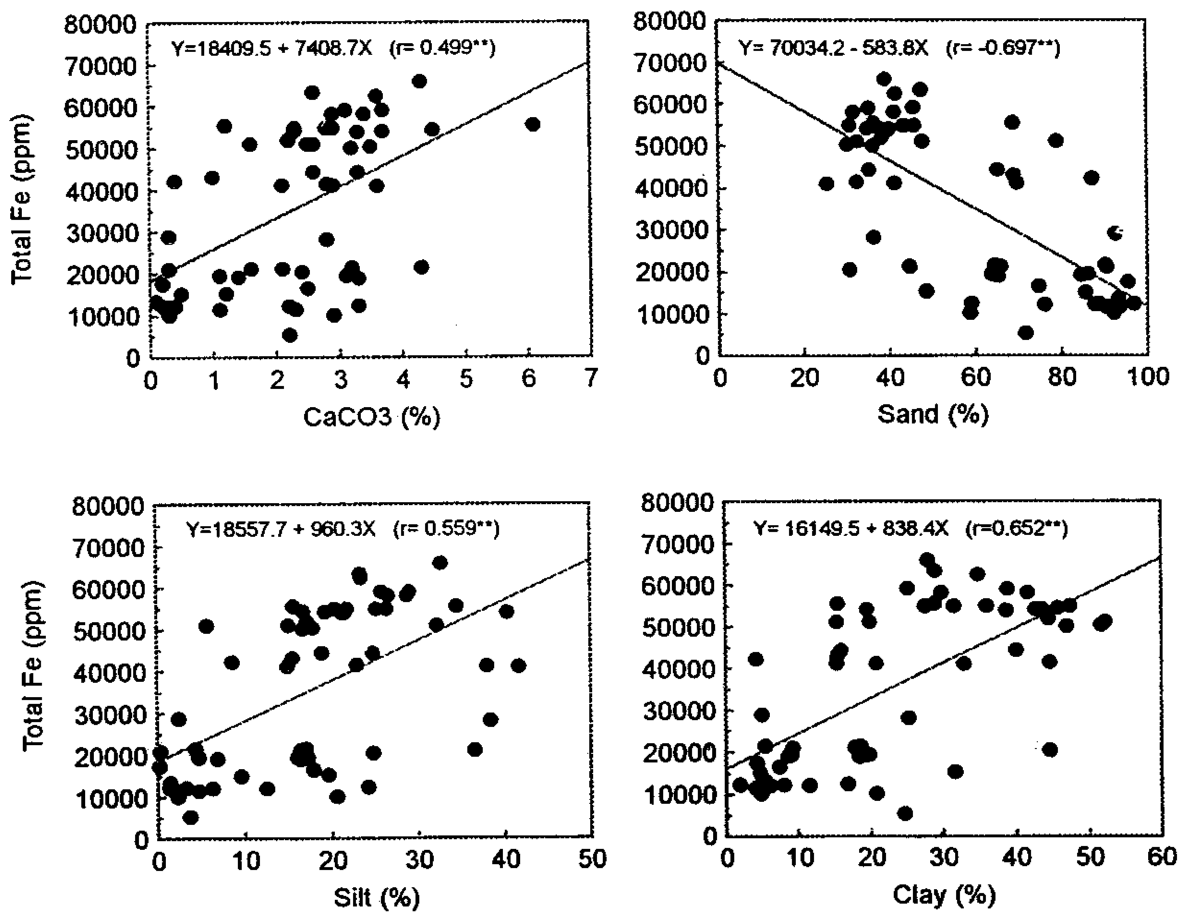

Fig. (1) : Relationship between soils content of total iron and some soil variables.

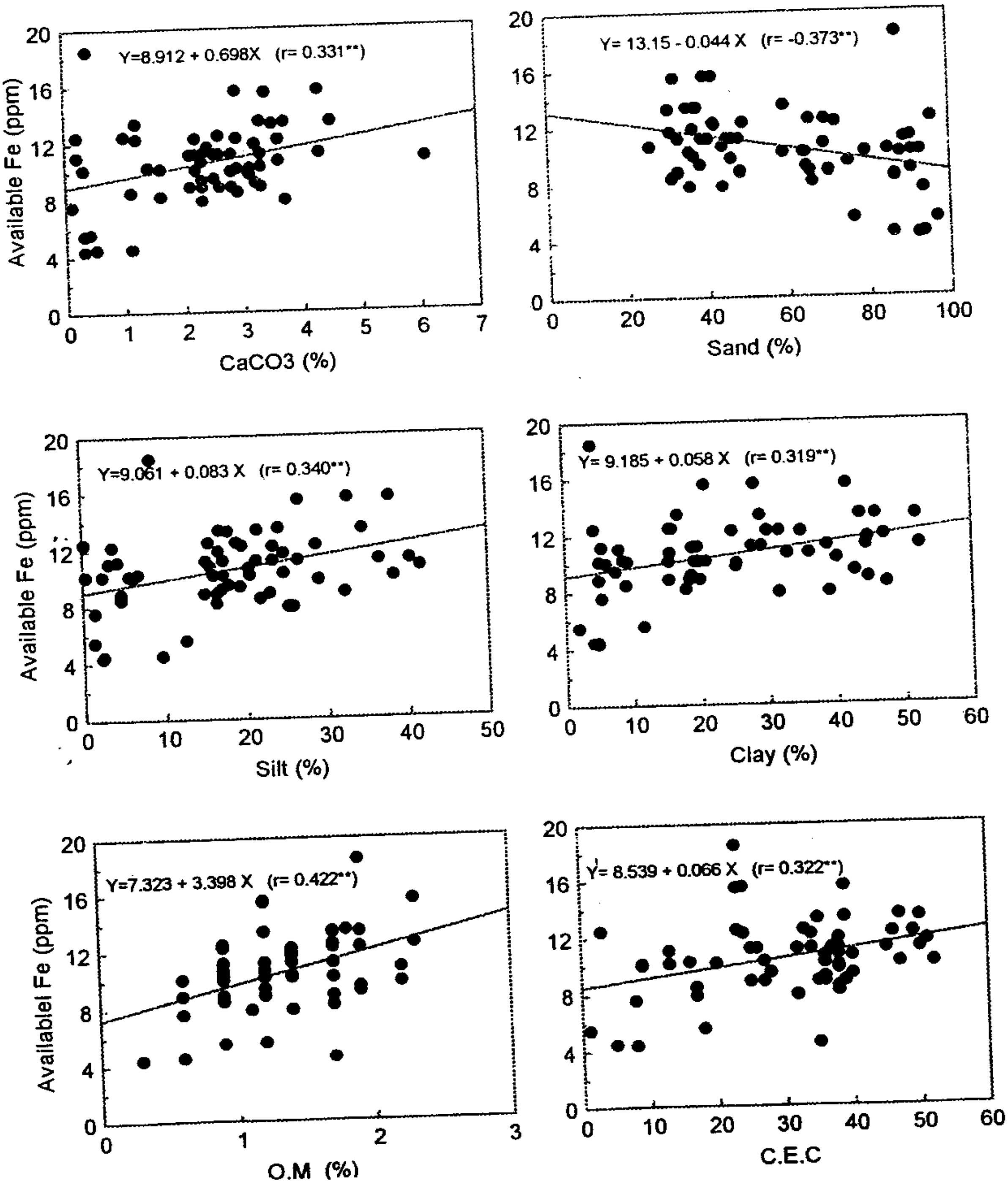

Fig. (2) : Relationship between soils content of available iron and some soil variables.

4-3-4-: Manganese :

4-3-4-1-: Total Manganese :-

Table (8) represents values of total manganese contents of the studied soils. The data show that total manganese ranges from 0.5 to 985 ppm. The highest total Mn value is that recorded for the surface layer of profile 14 (Abu Zabal), while the lowest is that of the 75- 150 cm layer of profile 15 (El- Khanka).

Generally, the wide range of total Mn in the studied soils can be attributed to the difference in the type and nature of soil materials. The sandy soils, (Profiles 3, 4, 13, 15, 16 and 17), are characterized by the lowest contents of Mn, while the heavy textured ones (profiles 1,2 ,5, 6, 7, 8, 9, 10, 11, 12 and 14) have a fairly high content of Mn. These results could be ascribed to the parent materials of these soils are content of Mn- bearing minerals .

The above mentioned discussion reveals that some soil variables are involved in controlling total Mn distribution . To verify such relationship, computation of the correlation coefficients between total Mn and some soil constituents was carried out.

The coefficients show that total Mn is positively and highly significantly correlated with $CaCO_3$, OM%, CEC, silt % and clay% (Table, 9) Similar results were reported by Ghanem et al., (1971) for OM and clay% and Abdel- Razik (1994) and Abdel Karim for clay, clay + silt and organic matter.

Table (8) Total and DTPA extractable Mn of the studied soils .

Profile (No)	Location	Depth (cm)	Mn (ppm)	
			Total	Available
(1)	Abu EL Ghait	0-25	720.0	5.4
		25-75	890.0	3.5
		75-125	790.0	6.8
		Mean	800	5.23
(2)	EL-Munira	0-20	820.0	4.5
		20-50	650.0	3.4
		50-100	540.0	3.9
		100-150	619.0	2.9
		Mean	657.25	4.9
(3)	Kafr EL- Ragalat	0-30	650.0	9.5
		30-70	190.0	7.2
		70-120	145.5	1.5
		Mean	328.5	6.16
(4)	Kafr Saad	0-20	550.0	4.3
		20-50	559.0	7.5
		50-90	220.0	2.4
		90-120	180.0	1.5
		Mean	377.25	3.91
(5)	Shiblanga	0-20	820.0	2.3
		20-60	710.0	1.6
		60-110	720.0	2.4
		Mean	750	2.1

Table (8) Cont.

Profile (No)	Location	Depth (cm)	Mn (ppm)	
			Total	Available
(6)	Sandanhor	0-20	560.0	3.7
		20-50	650.0	2.5
		50-100	520.0	8.4
		100-150	770.0	4.9
		Mean	625	4.81
(7)	Kafr El- Gemal	0-20	775.0	5.2
		20-60	250.5	6.2
		60-90	190.0	4.6
		90-120	790.0	8.2
		Mean	501.45	6.05
(8)	Qaha	0-25	755.0	3.7
		25-60	890.0	4.0
		60 – 90	870.0	0.5
		90 - 120	820.0	0.4
		Mean	833.75	2.15
(9)	Sindiyun	0-25	790.0	5.4
		25- 75	725.0	8.1
		75 - 110	720.0	6.3
		Mean	745	6.6
(10)	Qalyub	0-25	980.0	7.2
		25-50	890.0	6.5
		50-90	810.0	3.7
		90-120	850.0	5.6
		Mean	882.5	5.75

Table (8) Cont.

Profile (No)	Location	Depth (cm)	Mn (ppm)	
			Total	Available
(11)	Nawa	0-30	940.0	7.1
		30-60	824.0	5.6
		60 - 90	820.0	5.4
		90 - 120	790.0	5.6
		Mean	843.5	5.91
(12)	Kafr Shibin	0-20	960.0	4.9
		20-60	750.0	2.0
		60 – 90	780.0	2.8
		90 – 120	770.0	9.4
		Mean	815	4.85
(13)	Abu Zaabal I	0-25	250.0	6.2
		25-50	175.0	3.7
		50 – 75	87.5	1.2
		Mean	170.83	3.7
(14)	Abu Zaabal II	0-25	985.0	6.2
		25-60	840.0	3.0
		60 – 90	840.0	3.3
		90 - 120	870.0	3.5
		Mean	883.75	4
(15)	El- Khanka	0-20	189.0	6.0
		20-75	145.5	1.9
		75 – 150	105.0	2.6
		Mean	146.5	3.5

Table (8) Cont.

Profile (No)	Location	Depth (cm)	Mn (ppm)	
			Total	Available
(16)	El- Gabal Elasfer	0-20	440.0	7.3
		20-60	395.0	5.3
		60 – 100	385.0	5.2
		Mean	406.76	5.93
(17)	El- Qalag	0-25	750.4	9.3
		25-60	179.3	4.8
		60 – 90	175.5	5.5
		Mean	368.4	6.53

Table (9) Correlation coefficients between each of total and DTPA extractable manganese and some soil variables .

Soil variable	Total manganese	DIPA – extractable manganese
EC	-0.045	-0.069
pH	-0.262*	-0.379**
$CaCO_3$%	0.620**	-0.069
OM %	0.411**	0.252
CEC	0.661**	0.016
Sand %	-0.857**	-0.025
Silt %	0.687**	-0.001
Clay %	0.802**	0.041

On the other hand, total Mn is negatively and highly significantly correlated with sand content and negatively significantly correlated with pH.

Multiple regression analysis was carried out to determine the relationship between these soil variables and total Mn in soils, The nultiple regression equation is,

$$\text{Total Mn} = 1214.707 - 33.619\,(EC) - 80.766\,(pH) + 24.46\,(CaCO_3\%) + 151.208\,(OM\%) - 5.881\,(sand\%) + 5.632\,(clay\%).$$

Also, the contribution of sand and organic matter were calculated from the regression and correlation analysis, Table (10) and have been found 89.48% and 7.69 %, respectively, while the contribution of the other factors was 2.83 %.

Table (10) : Direct and joint effects of soil variables on total Mn content of the studied soil profiles.

Soil Variables	Contribution %
Sand %	89.48
OM %	7.69
Residual Factors	2.83

4-3-4-2- : DTPA - extractable Mn : -

Data presented in Table (8) show that the values of chemically available (DTPA extractable) Mn range between 0.4 and 9.5 ppm. The highest value of DTPA extractable Mn is found in the surface layer of profile 3 (Kafr El- Ragalat), while the lowest one belongs to the deepest layer of profile 8 (Qaha).

Regarding, the influence of depth on the available Mn, higher values are found in the surface layers than the subsurface ones in most of the studied soil profiles, this is ascribed to the surface applications of both fertilizers and manures.

According to Soltanpour and Schwab (1977), the critical values of the DTPA extractable Mn are as follows: low, 0-1.8 ppm, of Mn; adequate >1.8 ppm of Mn. The results of the studied soil profiles indicate that the soil samples are beloning to either the low or the dequate level. groups are 9.9 and 90.1 %, respectively. The relation between some soil constituents and DTPA extractable Mn was also evaluated, Table (9). Results imply that chemically available Mn is highly significantly but negatively correlated with soil pH. no significantly correlation cold budetected with all the other factors tested.

Multiple regression analysis was also corried out to determine the relationship between soil variable and available Mn, the calculated multiple regression equation is :

$$\text{Available Mn} = -492.54 - 4.549\ (\text{pH}) - 0.3003\ (CaCO_3\ \%) + 1.446\ (\text{OM}\%) + 5.296\ (\text{Sand}\%) + 5.265\ (\text{silt}\ \%) + 5.347\ (\text{clay}\%).$$

Furthermore, the direct and joint effects of pH, OM%, clay % and silt% on available Mn are 40.98% , 23.64 % , 10.86% and 13.95 , respectively , Table (10) .

Table (11) : Direct and joint effect of soil variables on DTPA extractable Mn content of the studied soil profiles .

Soil Variables	Contribution %
pH	40.98
OM %	23.64
Clay %	10.86
Silt %	13.95
Residual Factors	10.57

4-3-4-3 Depthwise distribution of total manganese

To search for evidence characterizing the distribution of total Mn of the studied soil profiles, the three measures given by Qertel and Giles (1963) have been computed and listed in Table (12) . The table shows that weighted mean of total Mn ranges between 126.2 and 877.4 ppm. It shows also the similarity of values of weighted mean (W) for total Mn within some of the studied profiles, For instance, the weighted means of Sandanhor and Qaha soils (profiles 6 and 8) Qalyub and Abu Zaabal soils (profiles 10 and 14) and Shiblanga and Sindiyun soils (profiles 5 and 9) On the other hand, the rest of the studied soil profiles show a wide range of the considered weighted mean within the studied area .

Table (12) : Weighted mean (W) trend (T) and specific range (R) of Mn of the studied soils.

Profile (No)	Location	Weighted mean (W)	Trend (T)	Specific range (R)
(1)	Abu El- Ghait	816	0.12	0.21
(2)	El- Munira	625.76	-0.24	0.45
(3)	Kafr El- Ragalat	286.56	-0.56	1.76
(4)	Kafr Saad	315.8	-0.43	1.20
(5)	Shiblanga	734.51	-0.10	0.15
(6)	Sandanhor	634.76	0.12	0.41
(7)	Kafr El- Gamal	457.76	-0.41	1.31
(8)	Qaha	634.45	-0.19	0.21
(9)	Sindiyun	738.18	-0.76	0.14
(10)	Qalyub	872.13	-0.11	0.19
(11)	Nawa	843.5	-0.10	0.18
(12)	Kafr Shibin	797.5	-0.17	0.33
(13)	Abu Zaabal I	170.83	-0.32	0.95
(14)	Abu Zaabal II	877.4	-0.11	0.25
(15)	El- Khanka	126.2	-0.33	0.67
(16)	El- Gabal El-Asfer	400	-0.10	0.14
(17)	El- Qalag	336.71	-0.55	1.71

The values of trend (T) show that the soils of Abu El- Ghait, Shiblanga, Sandanhor , Qalyub, Nawa, Abu Zaabal and El- Gabal El- Asfar (profiles 1,5 6,10, 11, 14 and 16) are of highly symmetrical Mn values as the T- values range between -0.10 and -0.12. In addition, the values of the specific range (R) for the studied profiles show that soil materials of profiles 1,5, 8, 9, 10, 11, and 15 are homogeneous whereas those of the other profiles are heterogeneous, Table (12) .

4-3-5: Copper

4-3-5-1-: Total Copper :-

The distribution and levels of total Cu content in the studied soils are guided by the data presented in Table (13) .

These data reveal that total Cu content varies widely ranejing from 17.7 to 97.5 ppm. The highest value is found in the surface layer of profile 11 representing Nawa soils, while the lowest value is detected in the deepest layer of profile 15 representing El- Khanka soils .

From the above - mentioned presentation , one can conclude that the alluvial soils (fine textured) are relatively higher in total Cu content compared with the sandy soils (coarse textured) .

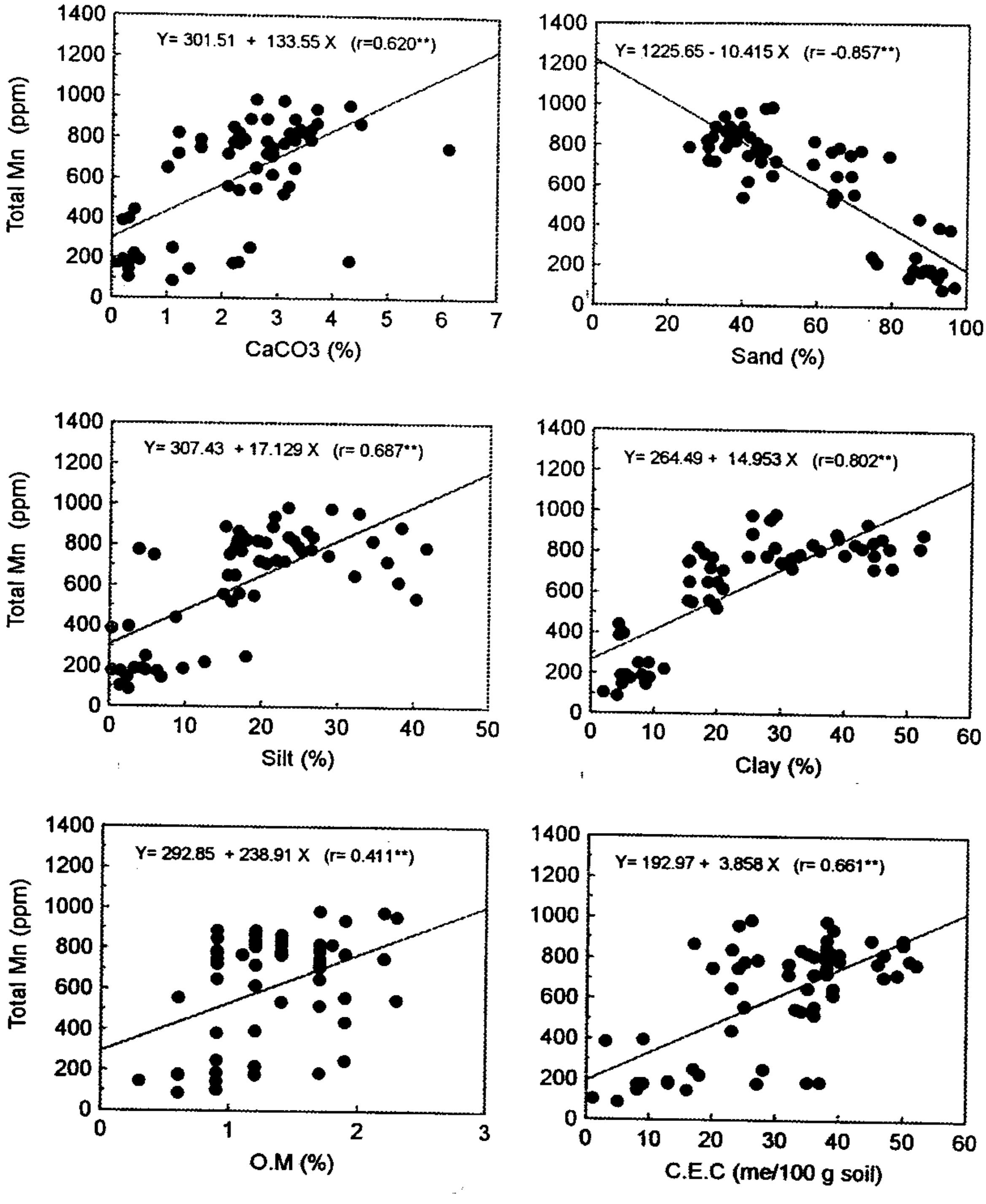

Fig. (3): Relationship between total manganese and some soil variables.

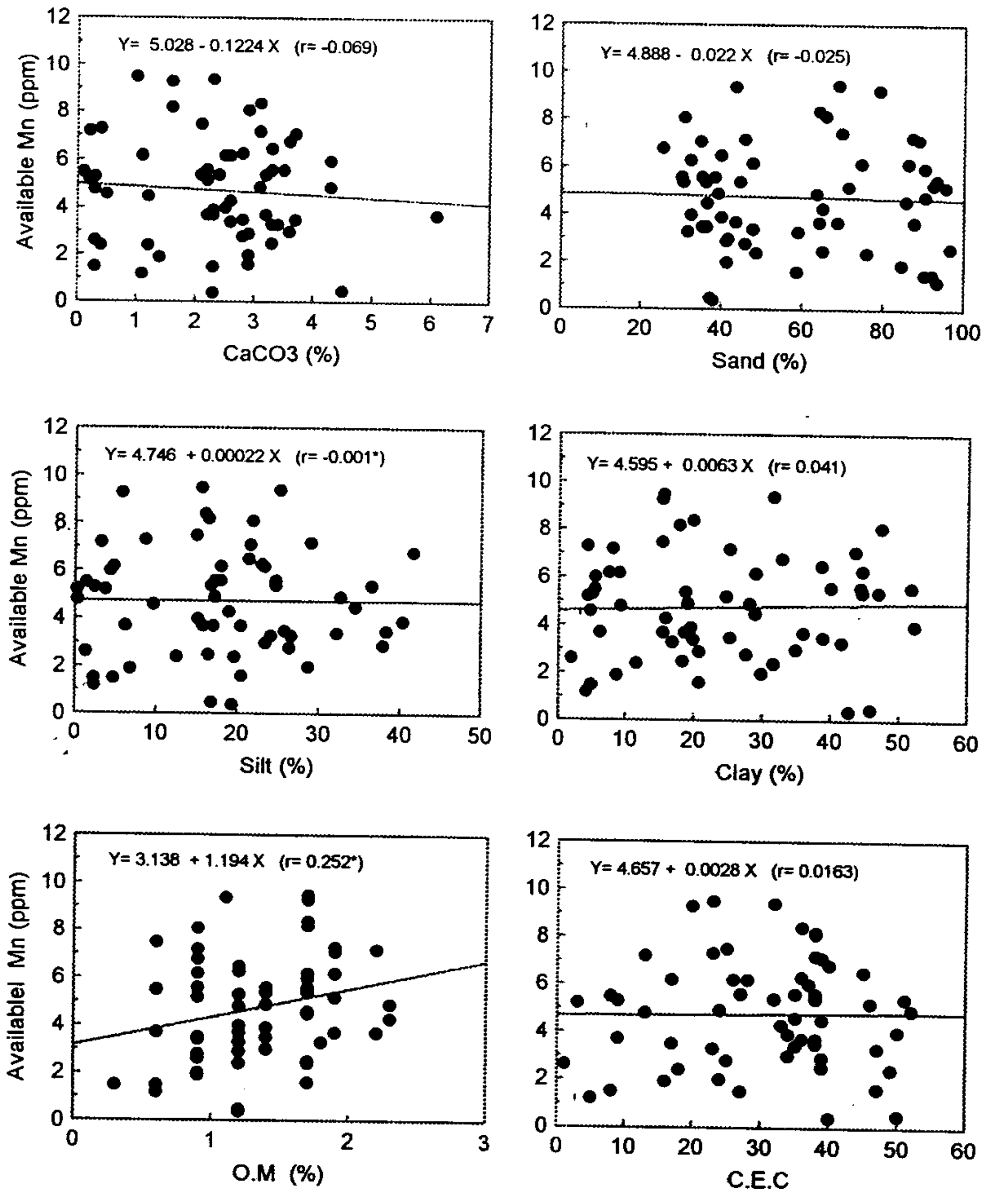

Fig. (4): Relationship between available manganese and some soil variables.

Table (13) Total and DTPA extractable Cu of the studies soils .

Profile No	Location	Depth (cm)	Cu (ppm)	
			Total	Available
(1)	Abu EL Ghait	0-25	68.6	8.2
		25-75	81.5	7.3
		75-125	85.4	5.4
		Mean	78.5	6.96
(2)	EL-Munira	0-20	59.9	6.9
		20-50	67.7	4.8
		50-100	70.2	4.5
		100-150	65.8	5.2
		Mean	65.9	5.32
(3)	Kafr EL- Ragalat	0-30	49.6	9.2
		30-70	29.8	5.8
		70-120	30.9	2.8
		Mean	36.76	5.93
(4)	Kafr Saad	0-20	52.3	9.3
		20-50	58.5	4.4
		50-90	29.4	5.5
		90-120	29.5	6.2
		Mean	42.4	4.85
(5)	Shiblanga	0-20	33.6	8.9
		20-60	24.5	8.8
		60-110	24.6	7.5
		Mean	27.56	8.5

Table (13) Cont.

Profile No	Location	Depth (cm)	Cu (ppm)	
			Total	Available
(6)	Sandanhor	0-20	32.4	7.9
		20-50	35.9	8.6
		50-100	38.9	7.5
		100-150	24.8	8.9
		Mean	33	8.22
(7)	Kafr El- Gemal	0-20	53.3	9.1
		20-60	22.4	8.3
		60-90	21.5	7.9
		90-120	53.9	8.7
		Mean	37.7	8.5
(8)	Qaha	0-25	54.7	8.1
		25-60	89.6	7.5
		60 – 90	82.7	9.04
		90 - 120	91.5	8.9
		Mean	79.62	33.54
(9)	Sindiyun	0-25	23.9	8.8
		25- 75	85.4	8.6
		75 - 110	74.1	7.2
		Mean	61.13	8.2
(10)	Qalyub	0-25	91.1	6.5
		25-50	69.8	6.3
		50 – 90	74.9	5.5
		90 - 120	65.1	5.1
		Mean	75.22	58.5

Table (13) Cont.

Profile No	Location	Depth (cm)	Cu (ppm)	
			Total	Available
(11)	Nawa	0-30	97.5	7.2
		30-60	66.4	5.4
		60 – 90	60.1	5.1
		90 - 120	66.4	4.4
		Mean	72.6	5.52
(12)	Kafr Shibin	0-20	78.3	7.5
		20-60	63.7	4.3
		60 – 90	72.6	4.1
		90 - 120	71.6	3.2
		Mean	71.55	4.77
(13)	Abu Zaabal I	0-25	46.1	1.2
		25-50	23.7	1.5
		50 – 75	27.4	1.4
		Mean	32.4	1.36
(14)	Abu Zaabal II	0-25	79.4	5.8
		25-60	58.4	5.8
		60 – 90	56.9	4.1
		90 - 120	63.1	4.1
		Mean	64.45	4.95
(15)	El- Khanka	0-20	24.3	4.9
		20-75	22.3	1.2
		75 – 150	17.7	1.1
		Mean	21.43	2.4

Table (13) Cont.

Profile No	Location	Depth (cm)	Cu (ppm)	
			Total	Available
(16)	El- Gabal El Asfer	0-20	51.5	9.9
		20-60	28.4	4.1
		60 - 100	20.4	2.7
		Mean	33.43	5.56
(17)	El- Qalag	0-25	58.3	2.9
		25-60	22.6	1.2
		60 - 90	24.1	1.9
		Mean	35	2

The vertical distribution of total Cu content in the soils under consideration indicates no specific pattern that could be used to distinguish one soil type from another except for profiles 15 and 16 in which Cu decreased with depth. In other words, total Cu distribution with depth does not follow any specific pattern pertaining to soil type. Computed correlation coefficients between total Cu content and soil variables reveals a positive and highly significant correlations between soil total Cu and each of $CaCO_3$ % , CEC, silt % and clay % . The data, on the other hand, reveal a highly significant but negative correlation between soil total Cu and sand % . The multiple regression equation reads :

Total Cu = 72.318 - 2.754 (ECe) - 14.390pH + 3.028 ($CaCO_3$ %) - 0.348 (CEC) - 0.988 (sand%) + 2.719 (silt %) .

The direct and joint effects of sand and pH on total Cu, Table (15), are 91.8 and 2.7% , respectively .

Table (14) Correlation coefficients between each of total and DTPA extractable copper and some soil variables .

Soil variables	Total Copper	DTPA – extractable Copper
EC	-0.104	-0.110
pH	0.132	0.229
$CaCO_3$%	0.486**	0.362**
OM %	0.130	0.629**
CEC	0.394**	0.736**
Sand %	-0.775**	-0.356**
Silt %	0.641**	0.334*
Clay %	0.709**	0.297*

Table (15) : Direct and joint effects of Soil Variables on total Cu content of the studied soils .

Soil Variable	Contribution %
Sand %	91.8
pH%	2.7
Residual Factors	5.5

4-3-8 : DTPA – extractable Copper (available):

Data illustrated in Table (13) show that available Cu content varies from 1.1 to 9.9 ppm .

These data indicate that the highest voluet extractable Cu is associated with the soils of El- Gabl El- Asfar (profile No. 16) which are irrigated with sewage water, while the lowest DTPA- extractable Cu content characterized the soils of El- Khanka (profile No 15) .

Depthwise distribution of available Cu indicates that, in most cases, extractable Cu increases in the surface layers and tends to decrease with depth .

According to Soltanpour and Schwab (1977), the index values used for Cu extracted by DTPA are as follows: low, 0-0.5 ppm, high> 0.5 ppm Cu. The results of the studied soil profiles indicate that the studied soils are high in their content of available copper .

Statistical evaluation of available Cu in relation to soil variables indicates that extractable Cu is positively and high significantly correlated with each of $CaCO_3$ %, OM% and CEC, and positively, significantly by correlated with silt % and clay %. On the other hand, available Cu correlated negatively and highly significantly with sand content (Fig, 6) .

The multiple regression equation between available Cu and the soil constituents is :

$$\text{Available Cu} = -7.986 - 0.735\,(\text{ECe}) + 0.956\,(\text{pH}) - 0.143\,(CaCO_3\,\%) + 2.156\,(\text{OM\%}) + 0.132\,\text{CEC} + 0.017\,(\text{sand }\%)\ .$$

The direct and joint effects of CEC, OM% and EC on available Cu are 74.36% , 15.56 % and 6.76%, respectively. (Table , 16).

Table (16) : Direct and joint effects of soil variables on available Cu content of the studied soils .

Soil Variables	Contribution %
CEC	74.36
OM %	15.56
ECe	6.76
Residual Factors	3.32

4-3-9 Depthwise distribution of total Cu :

Table (17) shows that the weighted mean (W) for total Cu in the studied soil profiles varies widely between 12.09 and 66.96 ppm . The lowest values of (W) are associated with the low percent of silt and clay fractions . The highest values of (W) characterized the soils derived from fine textured Nile sediments. The wide variations encountered within or between profiles may reflect the variations in partent materials as affected by both geogenic or pedogenic processes.

Considering the trend (T) and specific range (R), data reveal that the computed trends indicate more symmetrical Cu distribution in profiles 1,2 and 9 as indicated by the smallest values of (T) . The specific range indicates that the soils of profiles 1, 2, 3, 5, 6, 8, 11, 13, and 15 are formed of homogeneous soil materials, while the other profiles are constituted from heterogeneous soil materials .

Table (17) : Weighted mean (W) trend (T) and specific range (R) of Cu of the studied soils.

Profile (No)	Location	Weighted mean (W)	Trend (T)	Specific range (R)
(1)	Abu El- Ghait	66.96	-0.02	0.25
(2)	El- Munira	43.46	-0.27	0.23
(3)	Kafr El- ragalat	25.3	-0.48	0.043
(4)	Kafr Saad	16.1	-0.69	1.80
(5)	Shiblanga	17.3	-0.48	0.52
(6)	Sandanhor	12.6	-0.61	1.11
(7)	Kafr El- Gemal	13.6	-0.74	2.38
(8)	Qaha	34.3	-0.37	1.07
(9)	Sandiyun	29.0	0.17	2.12
(10)	Qalyub	35.3	-0.61	0.74
(11)	Nawa	40.9	-0.58	0.91
(12)	Kafr Shibin	30.95	-0.60	0.47
(13)	Abu Zaabal I	24.5	-0.46	0.91
(14)	Abu Zaabal II	33.5	-0.57	0.67
(15)	El- Khanka	12.09	-0.50	0.54
(16)	El- Gabal Elasfar	18.46	-0.64	1.68
(17)	El- Qalag	24.2	-0.58	1.47

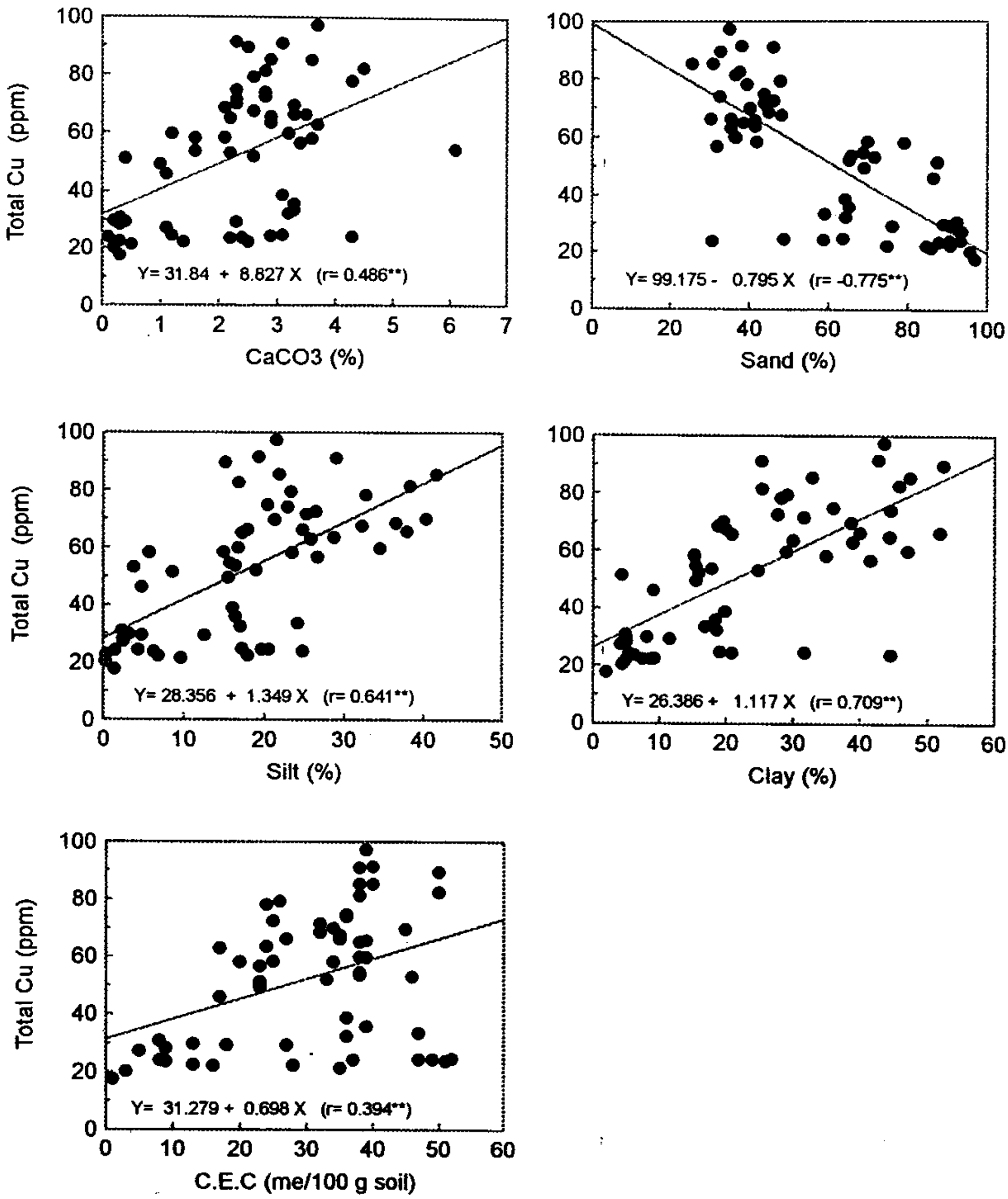

Fig. (5): Relationship between total copper and some soil variables.

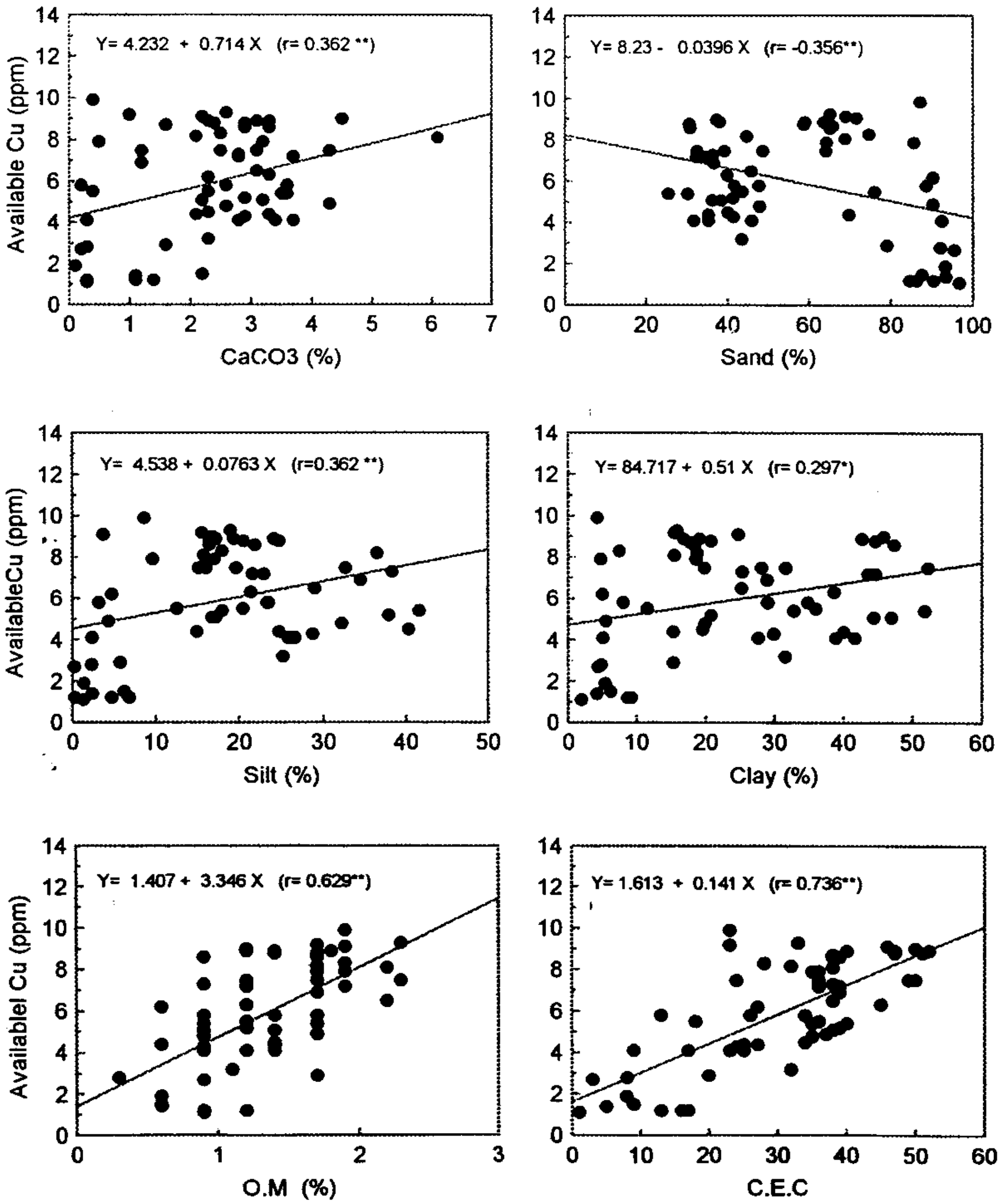

Fig. (6) : Relationship between available copper and some soil variables.

4-3-5 : *Zinc*

4-3-5-1- Total Zinc :

Table (18) represents the total zinc contents of the studied soils. The data show that total zinc ranges from 32.0 to 159.0 ppm. The highest value characterizes the surface layer of profile 14 (Abu Zaabal), while the lowest value characterizes the deepest layer of profile 15 (El- Khankha).

From these data, it seems that the wide range of total Zn is correlated with some soil constituents particularly soil texture, for instance, the highest total Zn is found in the heavy textured soils, while the lowest values are detected in the sandy textured soils.

According to Chapman (1965), the levels of total Zn content below 50 ppm could be considercl low and those above 100 ppm could be considered high.

The results indicated that the soils belonging to medium and high Zn levels groups represent 43.3 % and 43.4 %, respectively, whereas 13.3 % only belongs to the low level one.

Distribution of total Zn through the studied soils may be influenced by some factors, relationships between total Zn and some of these factors were computed (Table 19 and Fig 7) .

The obtained correlation coefficients indicate that total Zn positively and highly significantly correlated with $CaCO_3$ % , O.M.%, Table (18) Total and DTPA extractable Zn of the studied soils.

Profile (No)	Location	Depth (cm)	Zn (ppm)	
			Total	Available
(1)	Abu EL Ghait	0-25	105	3.6
		25-75	124	1.8
		75-125	130	3.6
		Mean	119.67	3
(2)	EL-Munira	0-20	80	2.5
		20-50	71	2.2
		50-100	55	2.9
		100-150	60	1.4
		Mean	66.5	2.25
(3)	Kafr EL- Ragalat	0-30	100	1.9
		30-70	60	1.9
		70-120	25	0.4
		Mean	61.67	1.4
(4)	Kafr Saad	0-20	155	2.3
		20-50	105.2	2.2
		50-90	40	0.5
		90-120	59	1.4
		Mean	89.8	1.6
(5)	Shiblanga	0-20	140	2.6
		20-60	158	2.3
		60-110	150	2.3
		Mean	149.33	2.4

Table (18) Cont.

Profile (No)	Location	Depth (cm)	Zn (ppm)	
			Total	Available
(6)	Sandanhor	0-20	102.5	3.0
		20-50	92.3	2.6
		50-100	97.1	1.3
		100-150	93.7	1.2
		Mean	96.4	2.03
(7)	Kafr El- Gemal	0-20	175	3.2
		20-60	80.5	1.5
		60-90	45.1	0.5
		90-120	58.9	1.4
		Mean	89.98	1.65
(8)	Qaha	0-25	91	4.0
		25-60	142	3.6
		60 – 90	115	3.8
		90 - 120	98	2.9
		Mean	111.5	3.68
(9)	Sindiyun	0-25	102	3.8
		25- 75	97.5	2.5
		75 - 110	85.7	1.9
		Mean	95.17	2.73
(10)	Qalyub	0-25	140.1	4.2
		25-50	125	1.9
		50 – 90	120.1	2.2
		90 - 120	97.9	2.8
		Mean	120.88	2.88

Table (18) Cont.

Profile (No)	Location	Depth (cm)	Zn (ppm)	
			Total	Available
(11)	Nawa	0-30	146.9	3.8
		30-60	65.3	2.9
		60 – 90	80.2	1.4
		90 - 120	88.5	2.2
		Mean	95.23	2.68
(12)	Kafr Shibin	0-20	115	4.1
		20-60	102	3.3
		60 – 90	102	3.9
		90 - 120	100	1.2
		Mean	104.75	3.13
(13)	Abu Zaabal I	0-25	75	3.5
		25-50	54	1.5
		50 – 75	30	0.5
		Mean	53	1.83
(14)	Abu Zaabal II	0-25	159	3.9
		25-60	135	3.2
		60 – 90	130	2.7
		90 - 120	140	2.4
		Mean	141	3.05
(15)	El- Khanka	0-20	55	1.5
		20-75	42	0.9
		75 – 150	32	0.3
		Mean	43	0.9

Table (18) Cont.

Profile (No)	Location	Depth (cm)	Zn (ppm)	
			Total	Available
(16)	El- Gabal El-Asfar	0-20	52.1	1.6
		20-60	45.0	0.7
		60 – 100	48.9	0.7
		Mean	48.67	1
(17)	El- Qalag	0-25	152	3.7
		25-60	55.5	0.4
		60 – 90	51.9	0.4
		Mean	86.57	1.5

Table (19) Correlation coefficients between total and DTPA extractable Zinc and some soil variables.

Soil variables	Total Zinc	DIPA – extractable Zinc
ECe	0.052	-0.032
pH	0.102	0.128
CaCO3%	0.505**	0.614**
OM %	0.452**	0.398**
CEC	0.565**	0.497**
Sand %	-0.563**	-0.627**
Silt %	0.428**	0.521**
Clay %	0.544**	0.574**

CEC, silt % and clay %, while it is showing a highly significant but negative correlation with sand %. These findings are in agreement with those of Metwally et al (1977) and Kamh (1981).

The multiple regression analysis was carried out to determine the relationship between the important soil constituents and total Zn in the studied profiles. The multiple regression equation desired is .

$$\text{Total Zn} = 253.446 - 32.126\,(\text{pH}) + 0.501\,(\text{CEC}) + 3.94\,(\text{CaCO3\%}) + 23.9\,(\text{OM\%}) - 0.001\,(\text{Sand \%}) + 1.094\,(\text{clay\%})\,.$$

The direct and joint effects of CEC, sand, O.M. and clay % on total Zn are 63.24, 13.56, 13.52 and 4.9% , respedively (Table,20)

Table (20) Direct and Joint effect of soil variables on soil variable on total Zn content of the studied soils .

Soil Variables	Contribution %
CEC	63.24
Sand %	13.56
OM %	13.52
Clay %	4.9
Residual Factors	4.78

4-3-5-2-: DTPA- extractable zinc

Data in Table (18) show that the amounts of DTPA- extractable Zn in the soils under consideration vary between 0.3 to 4.2 ppm. The highest value is presented in the surface layer of profile 10 (Qalyub), while the lowest one is that of the deepest layer of profile 15 (El-Khanka).

Regarding the influence of depth on soil content of available zinc, it could be noticed that the highest values are found in the surface soil layers while the lowest ones are generally, detected in the deepest layers , this is true in all the studied profiles except in the 75- 125 cm and 50- 100 cm layers of profiles 1 and 2, respectively.

The tendency of Zn to accumulate in the surface layers may be due to the presence of the organic matter in these layers in relatively higher amounts besides of the added fertilizers and manuers.

According to Soltanpour and Schwab (1977), the index values used for Zn extracted from soils by DTPA method are as fallows: low 0-0.9 ppm, abstained marginal, 1-1.5 ppm, adequate , > 1.5 ppm.

The alrtained results indicate that the tested soils are belonging to adequate and marginal level groups represent 66.7 % and 16.6,% of tested ramples respectively, whereas 16.7% of the studied soils belong to the low level .

Relating the values of DTPA extractable Zn to the different soil properties, it could be seen from Table (21) and Fig (8), that DTPA-extractable Zn correlated positively and high significantly with the percentages of $CaCO_3$, OM, silt, clay and CEC, and negatively high significantly correlated with sand content.

Multiple regression analysis was computed to determine the relation between $CaCO_3$, sand, developed OM, EC and DTPA extractable Zn . The multiple regression equation is:

DTPA- extractable Zn = 8.841 - 0.198 (EC) - 0.766 (pH) + 0.334 ($CaCO_3$ % + 0.551 (OM%).

The contribution of these effective factors on DTPA-extractable Zn are 70.25 % for sand%, 15.39% for $CaCO_3$, 6-7% for OM and 3.28 % for EC, while the contribution of the other non determined factors is 4.38% , Table (21)

Table (21) Direct and joint effects of soil variables on DTPA extractable Zn in the studied soils

Soil Variables	Contribution %
Sand %	70.25
$CaCO_3$ %	15.39
OM %	6.7
CEC	3.28
Residual Factors	4.38

4-3-5-3- Depthwis distribution of total Zinc.

Data in Table (21) reveal that the majority of the studied profiles have an irregular vertical distribution of soil total Zn with depth, which is, probably associated with the changes in soil texture.

The values of weighted mean (W) of total Zn vary between 38.7 and 151.1 ppm. The lowest values of the weighted mean characterize the sandy and light textured soils, while the rest of the studied soil profiles are characterized by high weighted mean values of total Zn .

Considering the trend (T) , the values presented in Table (22) show that the computed trend of the soils of profiles 1, 2, 5, 6, 8, 9, 10, 12, 14 and 16 are of more symmetrical Zn distribution than the other profiles. The specific range (R) of Zn shows that the soil materials of profiles 2, 3, 6, 12 and 16 are homogenous, whereas, the soil materials of the other profiles are heterogenous . Also the relative values of the trend (T) show that in most of the studied profiles, total Zn is usually higher in the surface layers than in the deeper ones .

4-3-6: Molybdenum

4-3-6-1: Total molybdenum

The distribution and levels of total Mo content in the studied soils are guided by the data presented in Table (23) . These data reveal that total soil Mo varies widely, renging from 2.9 to 21.4 ppm. The lowest value is detected in the deepest layer of profile 17 representing the soils of El- Qalag, while the highest value characterizes the surface layer of profile 16 representing the soils of El- Gabal El- Asfar . The studied area can be decribed as follows.

Table (22) : (Weighted mean (W) trend (T) and specific range (R) of Mo the studied soils.

Profile (No)	Location	Weighted mean (W)	Trend (T)	Specific range (R)
(1)	Abu EL Ghait	15.9	-0.04	0.60
(2)	EL-Munira	10.4	-0.35	0.82
(3)	Kafr EL- Ragalat	8.8	-0.57	1.93
(4)	Kafr Saad	13.9	0.39	1.08
(5)	Shiblanga	18.2	0.56	0.71
(6)	Sandanhor	10.9	0.10	1.28
(7)	Kafr El- Gemal	6.9	-0.54	1.45
(8)	Qaha	15.0	-0.03	0.14
(9)	Sindiyun	10.5	0.33	0.48
(10)	Qalyub	13.5	-0.12	0.48
(11)	Nawa	11.2	-0.36	1.21
(12)	Kafr Shibin	11.9	-0.21	1.01
(13)	Abu Zaabal I	8.3	-0.25	0.72
(14)	Abu Zaabal II	15.5	-0.09	0.18
(15)	El- Khanka	5.4	-0.30	0.62
(16)	El- Gabal El Asfar	15.5	-0.28	0.61
(17)	El- Qalag	6.3	-0.30	0.97

Table (23) Weighted mean (W) Trend (T) and specific range (R) of Zn of the studied soils.

Profile (No)	Location	Weighted mean (W)	Trend (T)	Specific range (R)
(1)	Abu EL Ghait	122.6	0.14	0.20
(2)	EL-Munira	63.2	-0.21	0.40
(3)	Kafr EL- Ragalat	55.4	-0.45	1.4
(4)	Kafr Saad	76.7	-0.51	1.5
(5)	Shiblanga	151.1	0.14	0.12
(6)	Sandanhor	96.3	-0.10	0.11
(7)	Kafr El- Gemal	82	-0.53	1.94
(8)	Qaha	114.3	0.20	0.5
(9)	Sindiyun	95.7	-0.11	0.17
(10)	Qalyub	119.7	-0.15	0.42
(11)	Nawa	95.2	-0.35	0.86
(12)	Kafr Shibin	103.7	-0.18	0.11
(13)	Abu Zaabal	53	-0.33	0.85
(14)	Abu Zaabal	140	-0.12	0.21
(15)	El- Khanka	38.7	-0.36	0.59
(16)	El- Gabal El Asfar	48.8	-0.13	0.11
(17)	El- Qalag	81.1	-0.57	1.2

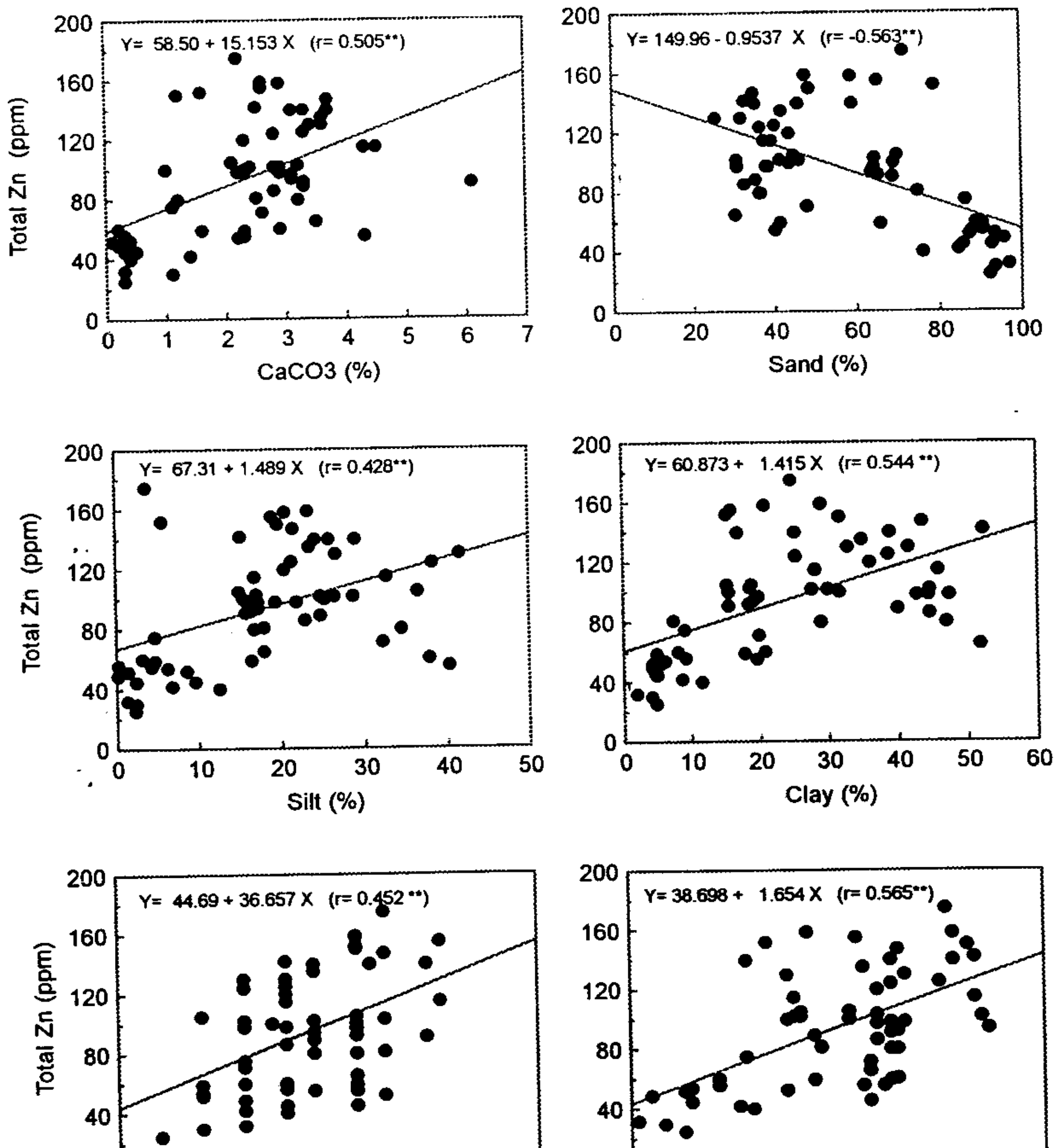

Fig. (7) : Relationship between total zinc and some soil variables.

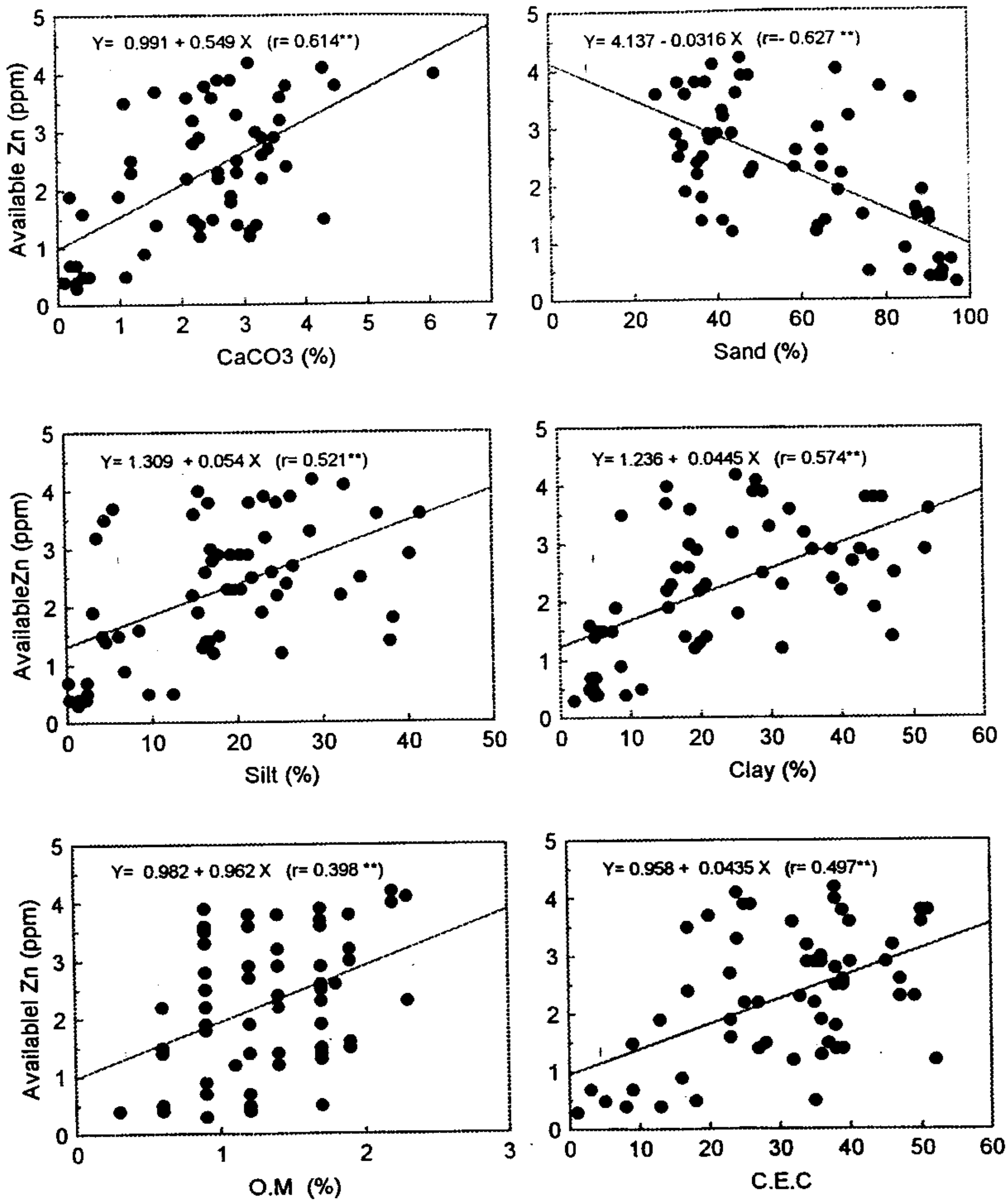

Fig. (8) : Relationship between available zinc and some soil variables.

Table (24) Total and DTPA extractable molybdenum of the studied soils.

Profile (No)	Location	Depth (cm)	Mo (ppm)	
			Total	Available
(1)	Abu EL Ghait	0-25	16.5	0.84
		25-75	11.0	0.30
		75-125	20.5	1.04
		Mean	16.0	0.73
(2)	EL-Munira	0-20	16.0	0.80
		20-50	9.5	0.83
		50-100	11.5	0.38
		100-150	7.5	0.54
		Mean	11.13	0.64
(3)	Kafr EL- Ragalat	0-30	20.5	0.78
		30-70	6.5	0.34
		70-120	3.5	0.36
		Mean	17.0	0.49
(4)	Kafr Saad	0-20	8.5	0.62
		20-50	5.5	0.16
		50-90	20.5	0.30
		90-120	17.0	0.80
		Mean	12.9	0.47
(5)	Shiblanga	0-20	8.0	0.66
		20-60	21.0	0.16
		60-110	20.0	0.76
		Mean	16.3	0.53

Table (24) Cont.

Profile (No)	Location	Depth (cm)	Mo (ppm)	
			Total	Available
(6)	Sandanhor	0-20	9.78	0.22
		20-50	18.0	0.91
		50-100	4.0	0.36
		100-150	14.0	0.26
		Mean	11.4	0.44
(7)	Kafr El- Gemal	0-20	15.0	0.9
		20-60	5.0	1.26
		60-90	5.0	0.42
		90-120	6.0	0.14
		Mean	7.75	0.91
(8)	Qaha	0-25	15.5	0.32
		25-60	13.45	0.32
		60 – 90	14.4	0.32
		90 - 120	17.0	0.02
		Mean	15.1	0.25
(9)	Sindiyun	0-25	7.0	0.54
		25- 75	12.0	0.30
		75 - 110	11.0	0.34
		Mean	10.0	0.39
(10)	Qalyub	0-25	15.35	0.59
		25-50	15.42	0.66
		50 – 90	14.4	0.88
		90 - 120	9.0	0.75
		Mean	13.5	0.72

Table (24) Cont.

Profile (No)	Location	Depth (cm)	Mo (ppm)	
			Total	Available
(11)	Nawa	0-30	17.5	0.91
		30-60	15.4	0.56
		60 – 90	8.0	0.30
		90 - 120	4.0	0.36
		Mean	11.2	0.53
(12)	Kafr Shibin	0-20	15.0	0.08
		20-60	5.0	0.12
		60 – 90	14.0	0.90
		90 - 120	17.0	0.08
		Mean	12.75	0.30
(13)	Abu Zaabal I	0-25	11.0	0.12
		25-50	9.0	0.31
		50 – 75	5.0	0.76
		Mean	8.3	0.40
(14)	Abu Zaabal II	0-25	17.0	0.24
		25-60	15.0	0.38
		60 – 90	14.2	0.24
		90 - 120	16.0	0.16
		Mean	15.6	0.26
(15)	El- Khanka	0-20	7.7	0.08
		20-75	4.34	0.07
		75 – 150	5.52	0.62
		Mean	5.9	0.26

Table (24) Cont.

Profile (No)	Location	Depth (cm)	Mo (ppm)	
			Total	Available
(16)	El- Gabal El Aasfar	0-20	21.4	0.72
		20-60	16.0	0.18
		60 - 100	12.0	0.34
		Mean	16.5	0.41
(17)	El- Qalag	0-25	9.0	0.56
		25-60	7.3	0.47
		60 - 90	2.9	0.47
		Mean	6.4	0.50

1- The highest values are found in the profiles represnting the soils of Abu El- Ghait, Kafr El- Ragalat, Shiblanga, Qaha, Abu Zabal and El- Gabal El-Asfar (Table). The average values of Zn in this soils ranged between 15-20 ppm.

2- The medium values are found in the profiles representing the soils of El- Munira, Kafr Saad, Sandanhor, Sindiyun, Qalyub, Nawa and Kafr Shibin . The average values of total Zn range from 8 to 15 ppm .

3- The lowest values are found in the profiles representing the soils of Kafr El-Gemal, Abu Zaabal, El- Khanka and El- Qalag. The values obtained averaged between 5.9 – 8.3 ppm.

From the above mentioned presentation, one can conclude that the amounts of total molybdenum reported in the studied soils agree with Mo contents found in the soils as moticed by Anderson (1955), Swaine and Mitchell (1960) and Massey, et al (1967).

The highest molybdenum content in th soil profiles of Abu El- Ghait, Kafr El Ragalt , Shiblanga, Qaha, Abu Zaabal and El- Gabal El- Asfar were probably due to the presence of either colloidal particales in the clay fraction of the soil or high content of organic matter.

The vertical distribution of total Mo content in the soils under consideration indicates no specific pattern that could be used to distinguish one soil type from another, except for the soils of Kafr El- Ragalat, Nawa, Abu Zabal El- Gabal El- Asfar and El Qalag in which total Zn tended to decrease with depth .

Computed correlation coefficients between total Mo content and soil variables, Table (24), and Fig, (9) indicate that total Mo is positively significantly correlated with OM %, CEC , silt % and clay %. On the other hand , sand content is negatively significantly correlated with total Mo. The multiple regression equation has been computed to read .

Total Mo = 12.151 – 0.683 ECe + 3.079 (OM%) – 0.061 (Sand %) .

The direct and joint effects of sand, OM and EC on total Mo, Table (25), are 56.95, 36.96 and 6.09 % , respectively .

Table (25) Correlation coefficients between total and DTPA - extractable Mo and each of some soil variables

Soil variables	Total Mo	DTPA - extractable Mo
ECe	-0.070	-0.327*
pH	0.061	-0.199
$CaCO_3$%	0.196	-0.062
OM %	0.311*	0.132
CEC	0.305 *	0.142
Sand %	-0.316 *	-0.042
Silt %	0.279*	0.127
Clay %	0.277 *	-0.029

Table (26) Direct and joint effects of soil variables on total Mo content of the studied soils .

Soil Variables	Contribution %
Sand %	56.95
OM %	36.96
ECe	0.09
Residual Factor	6.00

4-3-14 DTPA Extractable molybdenum

It was found convenient to use DTPA reagent recommended by Lindsay and Norvell (1978) for determining what could be considered available Mo.

Extractable amounts of soil Mo using this reagent are presented in Table (23) . Data presented in this Table show that amounts of extractable soil Mo ranges from 0.02 to 1.24 ppm. The lowest value is found in the deepest layer of profile (8) representing the soils of Qaha, while the highest value is detected in the subsurface layer of profile (7) representing the soils of Kafr El-Gemal .

The vertical distribution of extractable Mo indicates a relative increase of Mo in the top surface layer or the subsurface ones with a tendency to decrease downwards in the soil profiles. This could be explained on the premise of favourable soil variables governing extractable Mo in the uppermost surface layers of each soil profile.

To substantiate the relationship between the extractable Mo and some soil variables that possibly control its behaviour in the studied soils, correlation coefficients were computed. The obtained coefficients indicate that DTPA extractable Mo is negatively, significantly correlated with EC. In contrast, DTPA- extractable Mo is insignificantly correlated with the other investigated factors. (Table 24 and Fig 10) The multiple regression equation is found to be :

DTPA extractable Mo = 2.312 – 0.116 EC – 0.256 pH + 0.076 (OM%) + 0.004 (CEC) .

The direct and joint effects of EC, OM % , pH and CEC on DTPA - extractable Mo, Table ( ) are 56.46% , 17.41 % , 12.51 % and 13.62 , respectively .

Table (27) Direct and joint effect of soil variables on DTPA extractable Mo content of the studied soils.

Soil Variable	Contribution %
EC	56.46
OM%	17.41
pH	12.51
CEC	13.62

4-3-15 *Depthwise distribution of total molybdenum*

To search for an evidence relating the distribution of Mo to the different properties of soil profiles , the three measures given by Oertel and Giles (1963) have been computed and recorded in Table (27) .

Considering the weighted mean (W) of total Mo, data show that it varies widely between 5.4 and 18.2 ppm. The lowest values (5.4 8.8ppm) characterized the soils of Kafr El- Ragalate, Kafr El- Gemal, Abu Zabal, El- khanka and El- Qalag which have coarse textures , while the highest values (10.4 - 18.2 ppm) are those of the alluvial soils. The wide variation in the values of (W) within each of these profiles are either attributed to the depositional regime or to the variation within the parent materials from which the soils were derived .

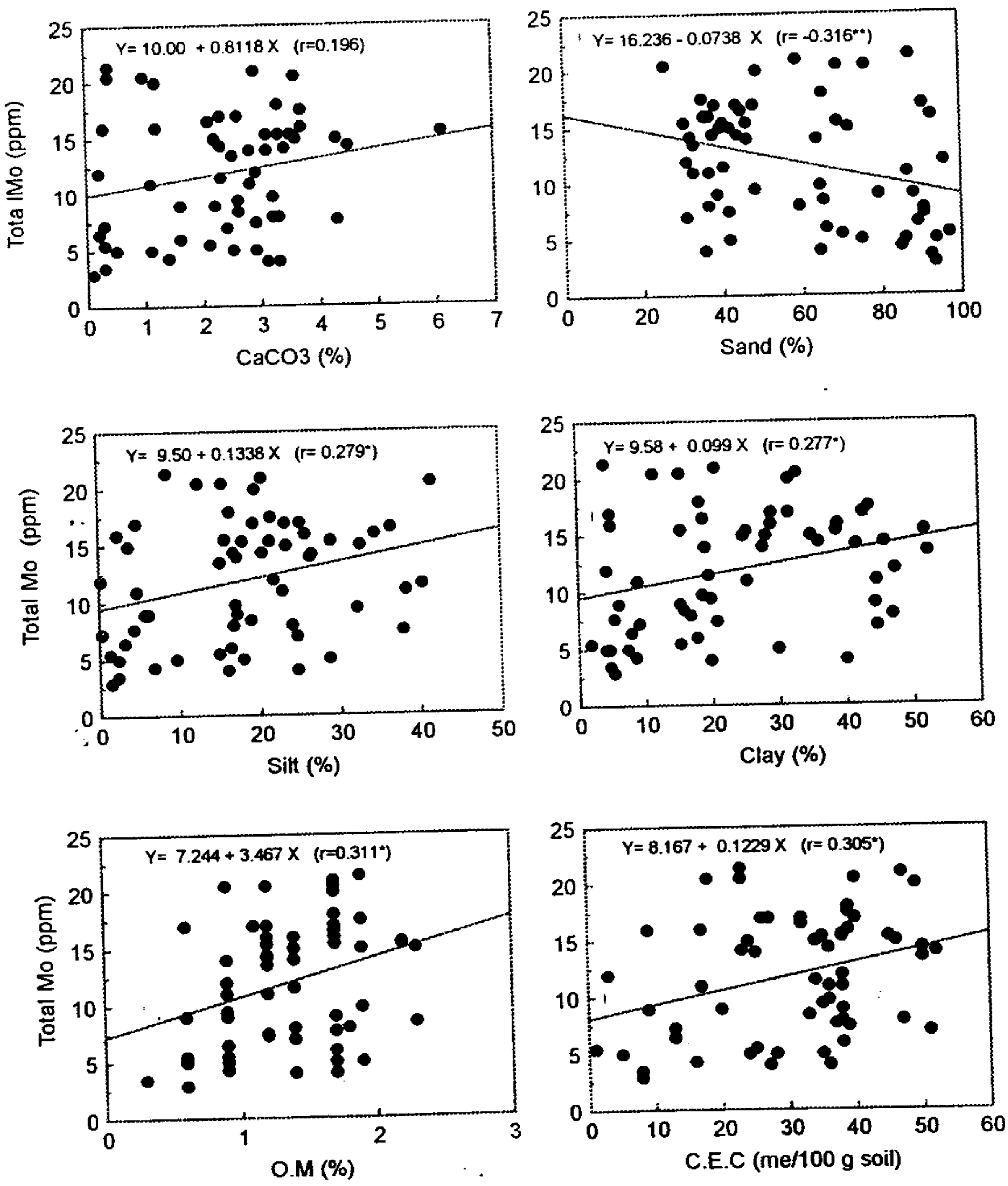

Fig. (9) : Relationship between total molebdinium and some soil variables.

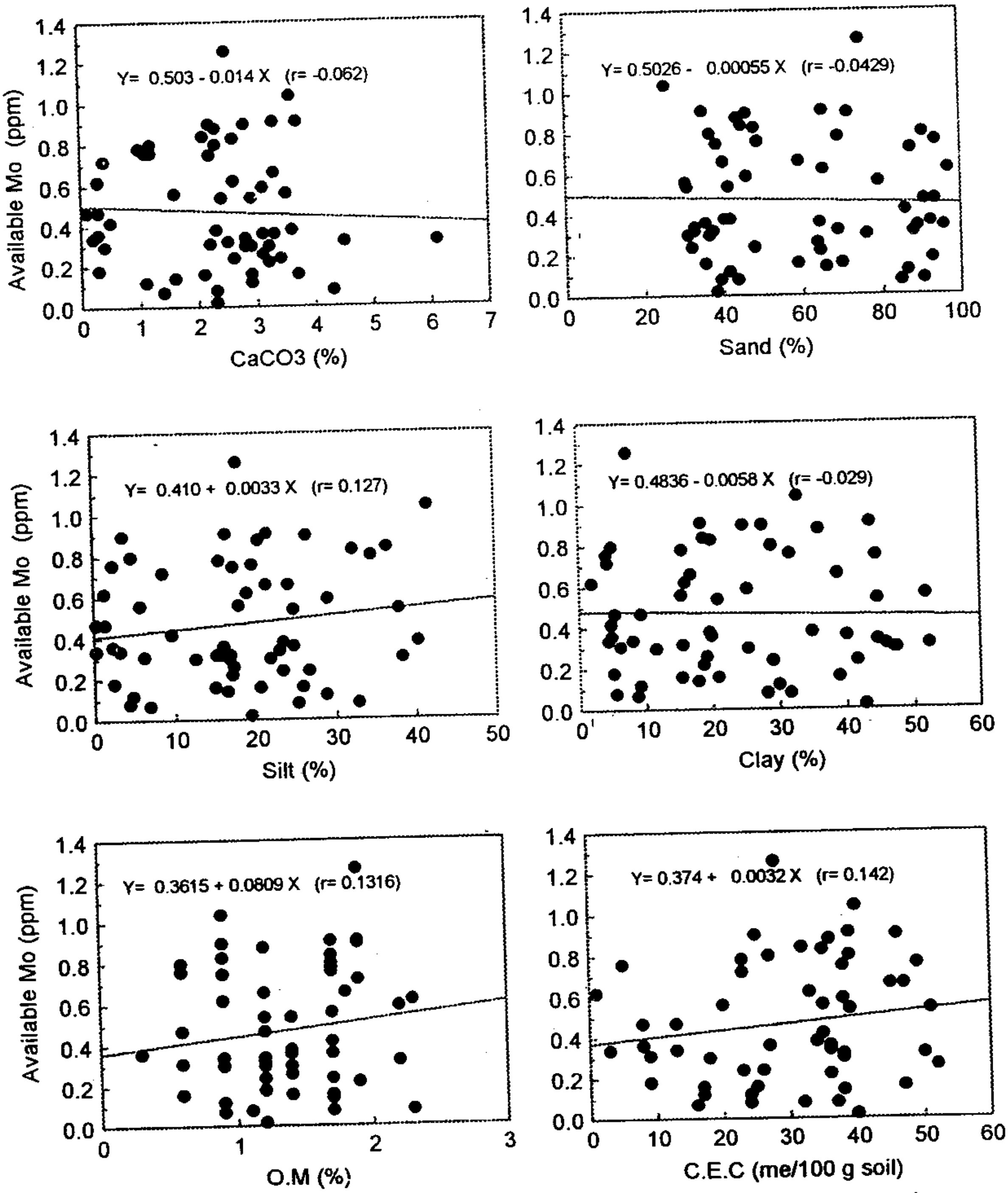

Fig. (10) : Relationship between available molebdinium and some soil variables.

The values of trend (T) in Table (27) show that the soils of Abu El- Ghait, Sandanhor Qaha, Qalyub, Kafr Shibin and Abu Zabal are highly symmetric , as the T- values range between -0.03 and 0.01 . The reset soils are less symmetric as T- values range from -0.25 to 0.57. The values of specific range (R) of total Mo in the studied soils range between 0.14 and 1.93 . The low values are associated with the soils of Qaha (profile 8) having highly symmetrical distribution of Mo, while those of high R values belong to the soils of Kafr El-Ragalat .

The statistical measures could be taken as indications of the possible variations in parent sediments, depositional regime as well as the pedogenic processes prevailing during soil formation .

SUMMARY

This work aims at studying and evaluating the physical and chemical properties of the different soil types of Kaluobia govenorate and define the relation between the fertility status of total and DTPA extractable Fe, Mn, Zn, Cu, Pb, Mo, and Cd and some soil variables

So, seventeen soil profiles were selected to represent the main soil types of El- Kaluobia goverenorate . These soil profiles were morphologically described and their physical , chemical and fertility status were evaluated . The obtained data could be summarized in the following .

1- Physical properties :

A- SOIL TEXTURE :-

Soil texture varies widely from one profile to another and even in the subsequent layers of the same profile. Data reveal that soil texture . ranges from sand to clay. Soil of Abu El- Ghait, El- Munira, Shiblanga, Qaha, Sindiyun, Qalyub , Nawa, Kafr Shibin , Abu Zabal (profile 14) are of fine texture (clay or clay loam) throughout their entire depth. Soils of Sandanhor (profile 6) and Kafr Saad (profile 4) are of medium texture (sandy clay loam) , while the other profiles are coarse- textured (sand, sandy loam and / or loamy sand . The wide variation in the textural grades in fact reflect variation in the mode of sedimentation pattern by which these soils have been formed .

B- ORGANIC MATTER CONTENT :

Organic matter content is very low, not exceeding 2.3 %. The low content of organic matter is common feature in the arid regions due to the high oxidation potential sustaining arid climatic conditions.

C- CALCIUM CARBONATE CONTENT

Calcium carbonate content is very low and ranges from 0.1 % to 6.1 %. The vertical distribution of $CaCO_3$ content does not obey any specific pattern with depth.

2- Chemical properties

A- SOIL REACTION (pH).

Soil reaction is quite variable from one profile to another. pH values ranges from 7.1 to 8.3 , i. e, neutral to mildly alkaline . Soil reaction are true reflection of the prevailing aridity and soil chemical composition .

B- TOTAL SALINITY

The soils are non saline as their ECe value are below 4 dSm^{-1} except for the surface layer of profiles 15 which is slightly saline (ECe 5.8 dSm^{-1}) .

C- SOLUBLE CATIONS AND ANIONS

Soluble cations are usually dominated with Na^+ followed by Ca^{++} and / or Mg^{++} , while K^+ constitutes the lest abundant soluble cations. The anionic composition is dominated with Cl^- and / or HCO'_3 followed by soluble SO'_4 with an entire absence of CO'_3 ions ,

E- CATION EXCHANGE CAPACITY

Cation exchange capacity values range from 1.2 and 50.9me/100g soil, depending on soil texture and clay content .

MICRO NUTIENTS STATUS IN THE STUDIED SOILS :-

1- Iron

Total iron content ranged from 10200 and 66000 ppm. The corresponding computed weighted mean (W) of total Fe varies widely between 12936.36 and 60716 ppm. Trend (T) indicate that the soils of profiles 6, 8, 11 and 14 display the highest symmetry . Specific range (R) of total Fe indicate that the soil materials of profiles 6, 8, 10, 11, 12 and 14 are homageneous whereas other profiles are heterogeneous. Highly significant positive correlations were found between total Fe and each of silt % , $CaCO_3$ and clay % and negatively highly significantly correlation were found with sand%. DTPA extractable Fe ranged from 4.4 to 18.5 ppm. The studied soil profiles display adequate quantities of available Fe. DTPA extractable Fe was positively highly significantly correlated with silt % and clay % and negatively highly significantly correlated with sand % .

2- Manganese

Total manganese content ranges from 0.5 to 985 ppm. The wide range of total Mn in the studied soils can be attributed to the difference in the type and nature of soil materials . Weighted mean of total Mn ranges between 126.2 and 877.4 ppm. Trend (T) indicates that the soils of profiles 1, 5, 6, 10, 11, 14, and 16 are highly symmetrical ones. Specific range indicates that the soil materials of profiles 1, 5, 8, 9, 10, 11 and 15 are homogeneous where as the other profiles are heterogeneous. Total Mn was positively highly significantly correlated with $CaCO_3$, O.M.%, CEC, silt % and clay % and negatively highly significantly correlated with sand % and negatively significantly correlated with pH.

The DTPA extractable Mn ranged from 0.4 to 9.5 ppm. According to the critical levels of available Mn by Soltanpour and Schwab (1977) , the results indicate that samples beloning to low and adequate level groups 9.9 % and 90.1 % , respectively . Negatively highly significant positive correlations were established between DTPA extractable Mn and pH.

3- Zinc

Total Zinc content ranged from 32.0 to 159.0 ppm. Weighted mean (W) of Zn ranges between 38.7 and 151.1 ppm. Trend, (T) of the soils of profiles 1, 2, 3, 6, 8, 9, 10, 12, 14 and 16 are more symmetrical than the other profiles. Specific range (R) shows that the soil materials of profiles 2, 3, 6, 12 and 16 are homogeneous whereas, the soil materials of the other profiles are heterogeneous. The abtained correlation coefficients indicate that total Zn has positively highly significantly correlated with $CaCO_3$ % , O. M.% , EC, silt % and clay % , and has a highly significant negative correlation with sand % .

DTPA- extractable Zn varies between 0.3 to 4.2 ppm depending on soil texture. The results indicate that the soils belonging to adequate and marginaly Zn groups. DTPA extractable Zn was positively highly significantly correlated with $CaCo_3$ % , O.M%, silt % , caly % and C.E.C and negarively highly significantly correlated with sand % .

COPPER

Total copper content in the studied soils ranges between 17.7 and 97.5 ppm. Weighted mean of total Cu ranges from 12.09 to 66.96