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EFFECT OF FYM AND DIFFERENT SOURCES OF P, Zn AND Fe ON SOME MICRONUTRIENTS CONTENT IN SOIL AND PLANT

Fatma S. El-Shafei[(1)], B.Y. El-Koumey[(1)], M.M. Shehata[(1)] and Samiya S. Ekalawey[(2)]

[(1)] Soil Sci., Dept., Fac. of Agric. Menoufia Univ. Egypt
[(2)] Soils, water and Environment Research Inst. A.R.C. Giza

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ABSTRACT: *A pot experiments were performed at the Faculty of Agriculture, Minufiya University, Shibin El-Kom to investigate the effect of different sources and rates, of P, Zn and Fe as well as organic manure on corn plants grown in both alluvial and calcareous soils. Two surface soil samples (0 – 30 cm) were collected from two locations. A) alluvial soil from Experimental Farm of the Faculty of Agriculture, Minufiya University, Shibin El-Kom. B) calcareous soil from Nubaria farm, Beheria Governorate. Each polyethylene pot (15 cm diameter) was filled with 2 kg soils and planted with five grains of corn plant (Zea mays L.). After 14 days from planting the plants thinned to three plants per pot. The pots were irrigated to keep soil moisture at approximately 60% of the water holding capacity. The Farmyard manure (FYM) was added at (0, 1 and 2%) P- was added at (0, 15 and 30 ppm, P_2O_5) of superphosphate and Triplephosphate. The Farmyard manure and phosphatic fertilizers were added before planting. The third part was treated with zinc at rates of 0, 10 and 20 ppm as zinc sulphate and Zn-EDTA. The fourth part was treated with iron at reates of 0, 15 and 30 ppm as iron sulphate and Fe-EDTA from planting the plants were harvested and dried at 70°C weighted, ground and digested for chemical analysis.*

The application of FYM at rates of 1 and 2% to the both alluvial and calcareous soils caused a significant increase on dry matter yield of corn plants. The highest values of dry matter yield was found in alluvial soil. The additions of FYM to both soils increased the Zn and Fe uptake by corn plants and availability of DTPA extrable Zn and Fe. The application of phosphatic fertilizers increased the dry matter yield of corn plants grown in both alluvial and calcareous soils, the dry matter yield of corn plants with triplephosphite applicat on was higher then those with super phosphate in alluvial soil, while the reverse was true in calcareous soil. The Zn and Fe uptake by corn plants were obviously higher on alluvial soil than those on calcareous one with P application. The application of P fertilizers decreased the DTPA-extractable Zn and Fe soils in used. The highest dry matter yield values of corn plants were obtained by Zn addition as Zn-EDTA treatment than $ZnSO_4$ in both alluvial and calcareous soils. The values of micronutrients (Zn and Fe) uptake by corn plants with Zn-EDTA were higher than $ZnSO_4$ in both alluvial and calcareous soil. The corn plants were more responsed by Zn-EDTA in calcareous soils. Application of Zn fertilizers increased the available Zn in both alluvial and calcareous soil. Addition of Zn fertilizers increased the DTPA-extractable Zn. While decreased the DTPA extractable Fe and Cu. The addition of Zn-EDTA recorded higher amounts of available micro elements than those obtained by using $ZnSO_4$ in both alluvial and calcareous soil. The application of Fe at rates of 15 and 30 ppm in both sources resulted a significant increases in the dry matter yield of corn plants grown in both alluvial and calcareous soils. The Fe-EDTA gave higher dry matter yield as compared with $FeSO_4$. The micronutrients uptake was markedly increased with Fe-EDTA addition as compared with $FeSO_4$ in both soils. Addition of Fe increased the DTPA extractable Fe in used soils, while decreased the DTPA extractable Zn in alluvial soil.

Key words: *Alluvial soil, calcareous soil, Farmyard manure (FYM), Phosphorus, Zn and Fe and Corn plant.*

INTRODUCTION

Organic fertilization deficiency limits the proctuction of many crops especially grain legumes in many soils. The application of farmyard manure to soil markedly increased plant growth, availability of nutrients in soil and nutrients uptake by Oat plants.

Phosphorus and nitrogen are playing a fundamental role in large number or enzymatic reactions that depend on phosphorylation. Hence, phosphorus stimulates early growth, strong root formation, nodulation, and fruit setting, hostens maturity and promotes seed and protein yield of legumes (Marschner, 1998). In this connection, El-Koumey *et al.* (1993) found that the addition of phosphate fertilizers increased the dry matter yield of clover tops in the following order Abo-Zabaal triple phosphate (Abo-Zabaal-superphosphate, Kafr El-Zait superphosphate).

Micronutrients are essential for plant growth, and required in quite smaller amounts than those of the primary nutrients, nitrogen, phosphorus of meristematic tissues, stimulate photosynthesis, respiration, energy and nucleotide transfer reactions and fasten the plant maturity (Marschner, 1998). Although micronutrients are needed in relatively very small quantities for adequate plant growth and production, their deficiencies induce a great disturbance in the different physiological and processes inside the plant.

Barsoum *et al.* (1991) and El-Shafei and El-Koumey (1994) who reported that the application of phosphorus depressed zinc concentration in both shoots and roots of board bean plants grown on both alluvial and calcareous soils with increasing of P-applied. In addition, Salem (1996) showed that iron content was decreased by increasing P application at all stages of both in alluvial and calcareous soils.

Maize is one of the most important grain crops grown in Egypt. It plays a fundamental role in human and animal feeding. There is an ever increasing need to increase the agricultural production in Egypt to meet the continuously increasing demands of the growing population. To increase the maize production, it is fundamentally necessary to pay particular attention to the nutrients supply to this crop.

So the main target of the current investigation is to study the effect of FYM and different sources of P, Zn and Fe on some micronutrients in soil and plant. Thereafter, this pot experiment was carried out to study the effect of FYM and different sources and rates of P, Zn and Fe on maize plants grown on alluvial and calcareous soils which varied in their properties and also the contents of available some micronutrients (Zn and Fe) in these soils after plant harvest.

MATERIALS AND METHODS

Two surface soil (0 - 30 cm) were collected separately from two locations a) Alluvial soil from Experimental Farm of the Faculty of Agric., Minufiya university, Shibin El-Kom. B) Calcareous soil From Nubaria farm, Beheira Governorate.

These samples were air dried, ground sieved through a 2 mm sieve and analyzed for some physical and chemical properties of these soils were determined and recorded in Table (1).

Treatments and experimental design.

Polyethylene pots of 15 cm in diameter and 17 cm in depth were used this study. The pots were devided into two main groups. Complete randomized blocks design was employed in this study with three replicates. Two kg of alluvial and calcareous soils were placed in each pot.

Each pot was planted with five seeds of Maize (*Zea mays* L.) and irrigated with tap water at 60 % of water holding capacity of each soil. After 14 days from planting the plants were thinned to three plants for each pot. Each pot was fertilized with ammonium

Table (1): Some physical and chemical properties of the used soil:

(a) Some physical properties

Soil sample	Water holding capacity (W.H.C)	Particle size distribution (%)			Texture grade
		Sand	Silt	Clay	
Alluvial	65	30.61	20.32	49.07	Clayey
Calcareous	34	70.40	20.70	8.90	Sandy loam

(b) Chemical properties

Soil sample	O.M.(%)	$CaCO_3$ (%)	pH 1: 2.5 (soil: water)	Soluble ions (meq/100 gm)										(cmole kg^{-1})	Available nutrients (ppm)					
				EC (dSm^{-1})	Cations				Anions						Macro nutrients		Micro nutrients			
					Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl^{-}	$SO_4^{=}$			P	K	Zn	Fe	Mn	Cu
Alluvial	0.61	2.6	7.90	0.69	1.06	0.88	0.90	0.55	-	1.06	0.85	1.48		39.2	8.5	478.24	2.10	6.5	6.2	2.38
calcareous	0.134	12.8	8.24	1.54	1.11	0.74	4.80	1.55	-	0.48	2.33	5.39		8.0	3.0	260.00	0.86	3.5	2.2	0.45

* Saluble ions in the extraction soil (1:5)

nitrate (33.5% N) at 0.6 g NH_4 NO_3 /pot as a solution after thinning of plants. Each main group was devided into four sub groups.

The first sub group was treated with FYM was added at rates 0, 1, 2 % of the used soil (FYM was used as a source of O M). Chemical analysis of FYM showed OM 28.2 %, 1.25 % N, C/N ratio 14.6, 0.52 % P, 1.3 % K, 90 ppm Zn, 532 ppm Fe, 50 ppm Cu and 115 ppm Mn.

The second subgroup was treated with 0, 15 and 30 ppm P_2O_5 of superphosphate (S.P) and triplephosphate (T.P). All phosphatic fertilizers and FYM treatments were added before the cultivation.

The third sub group was treated with zinc at rates of 0,10 and 20 ppm zinc (Zn) $ZnSO_4.7H_2O$ and Zn-EDTA.

The fourth sub group was treated with iron at rates of 0,15 and 30 ppm iron (Fe) as $FeSO_4.7H_2O$ and Fe-EDTA.

Iron and zinc fertilizers were added after 15 days from planting. The plants were harvested after 45 days from planting and dried at 70°C until its weight became constant weighted, ground and kept for chemical analysis. Dry weight of the samples was recorded and statical analyzed, according to Steel and Torrie (1980).

Plant analysis

Plant samples were digested with concentrated H_2SO_4 and H_2O_2 (Cottenie, 1980). Phosphorus was determined according to the method described by Jackson (1973). The concentration of Fe and Zn were determined using atomic absorption spectrophotometer according to Cottenie (1980).

Soil analysis

Some physical and chemical properties of these soil were determined as follows :

1. Mechanical analysis was performed according to the pipette method (Piper, 1950).
2. Total $CaCO_3$ was determined volumetrically by means of collin's calcimeter (Black, 1965).
3. Soil pH was determined in soil suspension (1 : 2.5, soil : water ratio) according to Richards (1954).
4. Total soluble salts as well as soluble cations and anions were measured in soil extraction (1: 5, soil : water) according to Jackson (1958).
5. Organic matter was determined according to Walkley and Black method (Jackson 1958).
6. Cation exchange capacity was measured by sodium acetate method as described by Richards (1954).
7. Available phosphorus was determined by the method of Olsen et al. (1954), in 0.5 M $NaHCO_3$ soil extract of pH 8.5 according to Jackson (1958).
8. Available Fe and Zn were determined according by Lindsay and Norvell (1978).

RESULTS AND DISCUSSION

Effect of farmyard manure on dry matter yield of corn plants

Data in Table (2) showed the effect of farmyard manure on Materials and Methods (g/ pot). The addition of FYM at rates 1 and 2% to the soil caused significantly increases of dry matter yield compared with the control plants. These increases may be attributed to role of organic matter which improve the physical, chemical and biological properties of soil. These results are in agreement with those obtained by El-Fiki (1994), El-Sherief (1997), El-Koumey (1998) and El-Shafei (1999).

Data in Table (2) revealed that the dry matter yield of corn plants was significantly affected by soil type. The highest mean value of dry matter yield was found in alluvial soil while the lowest one was obtained in calcareous soil. These results may be due to the improvement of soil condition for plant growth under alluvial soil compared with calcareous one. The most beneficial effect of FYM could be explained on bases that they encouraged the formation and stabilization of soil aggregates, consequently susceptibility of soil to crusting sharbly decreased, hence seed germination increased. These results are in agreement with those obtained by Awad (2001). Farmyard manure significantly enhanced hydraulic conductivity in the clay and calcareous soils through their effect on improving aggregation and macro-pores. Also application of FYM decreased soil reaction "pH" values and increased organic matter content.

Effect of different sources of P on dry matter yield

Data presented in Table (2) showed that phosphatic fertilizers application increased dry matter weights of corn plants grown in both alluvial and calcareous soils compared with the control plants, and the relationship between the obtained dry matter yield and the applied levels of both phosphatic fertilizers were positive. These results may be attributed to the important role of phosphorus on the roots growth which increase nutrients uptake and, also to phosphorus role in plant metabolism, which increase absorption leading to increasing dry weight (Marschner, 1998). These results are in agreements with those obtained by Mersal (1996).

Table (2): Effect of FYM, P, Zn and Fe treatments on the dry matter yield (g/pot) of corn plants.

Treatments		Alluvial soil	Calcareous soil
		g/pot	g/pot
Control	0	3.20	0.8
F.Y.M. (O.M)	1%	7.30	1.55
	2%	7.50	2.05
Superphosphate	15 ppm P_2O_5	4.10	1.40
	30 ppm P_2O_5	4.40	1.50
Triplephosphate	15 ppm P_2O_5	4.40	1.10
	30 ppm P_2O_5	4.50	1.20
Zn EDTA	10 ppm	3.70	1.20
	20 ppm	4.97	1.42
Zn So_4	10 ppm	3.60	1.01
	20 ppm	3.75	1.09
Fe EDTA	15 ppm	4.01	1.30
	30 ppm	4.35	1.20
Fe So_4	15 ppm	3.67	1.05
	30 ppm	3.93	1.22

L.S.D.	P		Zn		Fe	
	0.05	0.01	0.05	0.01	0.05	0.01
Fertilizers	0.263	0.353	0.2831	0.3796	0.288	0.386
Levels	2.630	0.353	0.2831	0.3798	0.288	0.386
Levels x Soil	3.720	0.499	0.400	0.5370	0.407	0.564
Soil x fertilizers	0.372	0.499	0.400	0.5370	0.407	0.546
Fertilizers x levels	0.455	0.677	0.490	0.06579	0.499	0.669
Soil x fertilizers x levels	0.644	0.864	0.639	0.9300	0.705	0.948

The same data revealed that the values dry matter of corn plants with triplephosphate additions were more than those with superphosphate at the same levels of application in alluvial soil. These increases are parallel to phosphorus availability in the studied fertilizers. This finding are in agreement with those, El-Koumey *et al.* (1993). While, the results indicated that the values of dry matter with superphosphate additions were more than with triplephosphate additions at the same levels of applications for plants grown on calcareous soil. This difference may be due to the different chemical formula of the fertilizers where, supperphosphate contains higher calcium and less phosphorus percentage than the triplephosphate. Calcium keeps phosphorus in available form to plants as mono or di-calcium phosphate, which still provides plants with phosphorus and calcium.

Ibrahim (2001) revealed that superphosphate produced more dry matter than triplephosphate with plant, leaves, stem and root. In general, the dry matter yield of corn plants was higher for plants grown on alluvial soil than those grown on calcareous one. These results are attributed to the effect of high exchange capacity of alluvial soil and its ability release nutrients during different stages of plant growth and had a beneficial effect on physical, chemical and biological properties of soils. These results are in agreement with those obtained by Khalil (2000).

Effect of different sources and rates of zinc and iron on dry matter yield.

Data in Table (2) showed that the applications of Fe or Zn sources and rates (15 and 30 ppm for Fe) and (10 and 20 ppm for Zn) resulted a significant increases in the dry matter yield of corn plants grown in both alluvial and calcareous soil as compared with the control plants.

The positive effect of Zn on plant growth due to the effect of Zn as component for some enzymes or as functional structural or regulatory for the others. Zn has an essential role in tyrptophane synthetase and metabolism. These results are in agreements with those obtained by Baza *et al.,* (1993) and El-Shafei (1999) who found that, application of Zn as $ZnSO_4$ up to 20 ppm significantly increased dry matter of corn plants grown on calcareous soil.

In addition it could be seen in Table (2) that Zn EDTA or Fe EDTA gave higher dry matter yield as compared with Zn or Fe-sulphate indicating that the enhancement of dry matter yield was proportional to soluble Zn and Fe in soil. This effect may be attributed to protection of Zn or Fe form against rapid oxidation or precipiation by soil materials. These result are in agreement with those reported by Haleem *et al.* (1992); Basyouny (1996) and Hammad (1997).

Effect of FYM on zinc content

Since Zn in plants is occurred as bound state in many complexes (proteins and enzymes) and is required for the activity of various kinds of enzymes (e.g. dehydrogenase, phosphodiestrase, carbonic anhydrase....etc.) (Moore and Patrick, 1988 and Romheld and Marschner, 1991). Data in Table (3) showed that FYM application increased Zn-uptake (mg/pot) with compared the control treatment. These data are in harmony with those obtained by Abdel-Kariem (1989), El-Fiki (1994), El-Sherief (1997) and Awad (2001) they showed that the application of FYM increased the Zn concentrtion and its uptake by different plants (corn, soybean, barley and tomato).

Effect of different sources of P on zinc content

Data in Table (3) showed that the application of phosphorus increased Zn-uptake (mg/pot) by corn plants grown on both alluvial and calcareous soils. On the other hand, the application of P at the higher level (30 ppm) slightly decreased the Zn uptake as compared with the lower level (15 ppm) this effect at the higher rates of P fertilizer on Zn concentration may be due to the antagonistic effect of P on Zn. These results were confirmative to those Yadav et al. (1985). In this connection, Mengel and Kirkby (1987) who suggested that the phosphate may affect on the physiological Zn-availability in plant tissues. Also, Megalah *et al.* (1993) stated that, P application resulted in a decrease in Zn availability of soils.

On the other hand, values of Zn-uptake by corn plants grown on alluvial soil which obtained with application of triplephosphate fertilizer were relatively higher than those obtained with superphosphate at all levels of phosphorus addition. This may be attributed to the high amount of dry matter production of corn plants as result of triplephosphate application compared with obtained with superphosphate. While values of Zn uptake by corn plants, grown on calcareous soil which obtained with application of superphosphate fertilizer were relatively higher than those obtained with triplephosphate at all levels of phosphorus addition. This may be attributed to the high amount of dry matter production of corn plants as a result of superphosphate application compared with those obtained with triplephosphate.

Effect of different sources of Zn on zinc content

Data in Table (3) showed that application of Zn-EDTA and $ZnSO_4$ at different levels in both soils markedly increased Zn uptake by corn plants as compared with untreated plants. These results are in agreement with, El-Shafei (1999) and El-Fiki (2000).

Table (3):Effect of different treatments on Zn and Fe uptake (mg/pot) of corn plants.

Treatments		Alluvial		Calcareous	
		Uptake (mg/pot)			
		Zn	Fe	Zn	Fe
Control	0	0.088	0.6408	0.014	0.1168
F.Y.M. (O.M)	1%	0.223	2.069	0.044	0.2763
	2%	0.284	2.1849	0.064	0.3753
Superphosphate	15 ppm P_2O_5	0.120	0.6899	0.028	0.1591
	30 ppm P_2O_5	0.113	0.6855	0.026	0.1561
Triplephosphate	15 ppm P_2O_5	0.125	0.7307	0.022	0.1194
	30 ppm P_2O_5	0.115	0.6929	0.020	0.1186
Zn EDTA	10 ppm	0.128	0.6457	0.041	0.1507
	20 ppm	0.164	0.5802	0.051	0.1372
Zn SO_4	10 ppm	0.115	0.6457	0.034	0.1311
	20 ppm	0.1497	0.5767	0.036	0.1231
Fe EDTA	15 ppm	0.0964	0.9565	0.0168	0.2246
	30 ppm	0.0959	1.1689	0.0171	0.2700
Fe SO_4	15 ppm	0.089	0.8732	0.0168	0.1801
	30 ppm	0.092	0.9516	0.069	0.2365

Moreover Basyouny (1996) and Hammad (1997) showed that Zn concentration and uptake of corn plants grown on soils treated with Zn-chelate were higher than those treated with $ZnSO_4$. $7H_2O$.

Effect of different sources of Fe on Zinc content

Data in Table (3) showed that application of Fe fertilizers sources caused a decreased in Zn uptake (mg/pot) as compared with control tratement. Data also revealed that, the high Fe-EDTA and $FeSO_4$ $7H_2O$ addition decreased Zn concentration of corn plants especially at high rate of Fe. This phenomenon might be explained by possible competition between chelates and plant roots for Zn and the antagonistic effect of Fe due to its higher solubility in the soil by chelat treatment (Mortvedte and Kelose, 1988).

Effect of FYM on iron content

Data in Table (3) showed that the FYM addition incresed Fe-content in corn plants as compared with control treatment. The effect of FYM on the soil properties and plants growth declare these increments.

The FYM contains nutrients such as Fe in available form and influence on these elements in the soils to make it available to plants. The present data confirm with finding of Soliman (1982) who found that addition of composted materials generally increased Fe uptake by soybean and corn plants. The addition of FYM increased Fe-uptake by soybean plants at different growth period. Also, Awad (2001) showed that the farm yard manure application increased the uptake of Fe as a result of increasing application rate.

Effect of different sources of P on iron content

Results in Table (3) showed that phosphorus fertilizers decreased iron uptake in corn plants. The decrease of iron concentration in plants may be attributed to decrease of iron availability in soil owing to the formation of insoluble iron phosphate compounds. Mersal (1996) these results in agreement with, Salem (1996) showed that iron content was decreased by increasing P application at all stages of both in alluvial and calcareous soils.

The results in Table (3) showed that values of Fe uptake in plants grown in calcareous soils which obtained with application triplephosphate were lower than those obtained with superphosphate fertilizer at all levels of phosphorus addition. This may be due to high soluble phosphorus in triplephosphate which decreased Fe absorption by plants. Robson and Pitman (1983) found that the Fe was taken up from neutral or alkaline solutions, it can be percipitated as ferric phosphate in the vascular bundles -along the leaf veins. On the other hand, values of Fe-uptake by corn plants was parallel to the dry matter yield.

Fe content in plants grown on the calcareous soils was lower than that grown on the alluvial one due to excessive $CaCO_3$ causing the conversion of Fe++ to insoluble forms (El-Gazzar *et al.,* 1979). Haldar and Mandal (1981) reported that the decrease of iron translocation from root to shoot was affected at high P level due to P/Fe interaction.

Effect of different sources of Zn on iron content

Data in Table (3) showed that, Fe uptake (mg/pot) in corn plants grown on both alluvial and calcareous soils are decreased in plants tissues with increasing Zn application rate (10 and 20 ppm). Increasing Zn application rate up to 20 ppm Za as Zn-EDTA or $ZnSO_4$ forms reduced the content of Fe in plant tissue especially in alluvial soil, indicating the antagonistic effect of Zn on Fe absorption by growing plants. These results are in agreerpent with those obtained by Megalah *et al.* (1994) El-Sharawy *et al.*

(1994) who found that application of Zn decreased iron concentration and its uptake in different plants. Reults showed that the values of Fe uptake (ppm) which obtained with application Zn-EDTA were lower than those obtained with $ZnSO_4$ fertilizer at all levels of zinc addition. This may be due to high solubility of zinc in Zn-EDTA fertilizer which decreased Fe absorption by corn plants. On the other hand, values of Fe uptake by corn plants grown on both alluvial and calcareous soils with application of Zn-EDTA fertilizer were relatively higher than those obtained with $ZnSO_4$. This may be attributed to the high amount of dry matter production of corn plants as a result of Zn-EDTA application compared with those obtained with $ZnSO_4$. These results are in agreement with hose by Basyouny (1996) and Hammad (1997) who found that iron concentration and its uptake were gradually decreased in plants tissues with increasing Zn application rate. The decrease of Fe uptake by wheat and corn plants fertilized with Zn depends on the from of applied Zn and the used soil.

Effct of different sources of Fe on iron content

Data in Table (3) showed that, addition of iron as $FeSO_4.7H_2O$ markedly increased the Fe uptake in the plant tissues compared with the untreated plants. However, Fe-EDTA was superior as a source of Fe in increasing Fe uptake compared with $FeSO_4.7H_2O$. These results are in agreement with those reported by Christine Nait (1992) who reported that $FeSO_4$ is very soluble, and the water content in the pot was high, subsequently $FeSO_4$ became ineffective very soon after application, while Fe-EDTA was taken up by the plants, and therefore, remained effective.

As mentioned above, the Fe uptake in corn plants grown in both alluvial and calcareous soils increased markedly with increasing Fe levels of two iron sources. The highest Fe contents were obtained for corn plant grown on both soils treated with Fe-EDTA. These result are in agreement with those reported, Moussa (2000) and Abou Hussien (2001) who showed that, concentration and its uptake of Fe in corn, sunflower, wheat plants increased with increasing Fe levels. Also, this results are in agreement with Basyouny (1996) and Hammad (1997) they found that iron application as Fe-EDTA was supperior for increasing the Fe content in wheat and corn plants grown on alluvial soil $FeSO_4$ was inferior as compared to the other two chelated sources.

Effect of FYM on the availability of some micro nutrients (Zn and Fe)

Data in Table (4) showed that application of FYM increased the availability of Zn and Fe in the used soils. This may be due to its improving effect on chemical and physical properties of the soil. Similar results were achieved by El-Koumey (1998) reported that increasing the level of farmyard manure decreased pH values and decreased E.S.P levels. It also increased DTPA extractable Fe, Mn, Zn and Cu.

Effect of different sources of P on the availability of some micro nutrients (Zn and Fe)

Data in Table (4) showed that application of P decreased the DTPA extractable Zn and Fe. This decrease may be due to formation of compounds with phosphate in soils, which reduced the availability of these nutrients in soil solutions. These results are in agreement with Haldar and Mandal (1981) and Megalah (1994) who revealed that applying phosphorus significantly decreased the content of DTPA extractable Zn, Fe, and Cu. In this connection El-Koumey et al. (1993) showed that the application of phosphatic fertilizers increased pH values in soil in the following order Abo Zabaal triplephosphate> Abo Zabaal superphosphate> Kafr El-Ziat superphosphate.

Table (4): Effect of different treatments on available Zn and Fe in used soils after plant harvest.

Treatments		Alluvial Soil		Calcareous Soil	
		Concentration (ppm)			
		Zn	Fe	Zn	Fe
Control	0	2.33	6.36	1.30	3.44
F.Y.M. (O.M)	1%	2.62	7.12	1.60	3.72
	2%	3.16	6.84	1.74	4.85
Superphosphate	15 ppm P_2O_5	2.02	6.14	0.80	3.36
	30 ppm P_2O_5	1.99	6.13	0.73	3.36
Triplephosphate	15 ppm P_2O_5	2.00	5.86	0.74	3.10
	30 ppm P_2O_5	1.97	5.72	0.78	3.10
Zn EDTA	10 ppm	6.27	5.83	6.00	3.42
	20 ppm	13.52	5.40	11.12	3.24
Zn SO_4	10 ppm	5.24	5.60	5.19	3.38
	20 ppm	8.47	5.32	8.19	3.10
Fe EDTA	15 ppm	2.09	7.98	1.10	5.08
	30 ppm	2.12	8.15	1.10	6.77
Fe SO_4	15 ppm	2.02	7.51	0.72	4.26
	30 ppm	2.00	7.80	0.63	4.76

Effect of different sources of Zn on the availability of some micro nutrients (Zn and Fe).

Data in Table (4) showed that application of Zn increased the DTPA-extractable Zn while decreased the DTPA-extractable Fe. These results are in agreement with those obtained by Mandal and Haldar (1980) and Falatah and Nadiem (1992). Data in Table (4) showed that application of Zn decreased the extractable Fe. The decrease may also be due to the ionic competition between Zn and Fe for chelating ligands. These results are in agreement with those obtained by Mandal and Haldar (1980), Falatah and Nadiem (1992) and Megalah (1994).

Effect of different sources of Fe on the availability of some micro nutrients (Zn and Fe).

Data in Table (4) showed that application of Fe increased the DTPA extractable Fe, while decreased the DTPA extractable Zn, which indicating that the strong antagonistic between Fe and Zn. These results are in agreement with those obtained by Abou Hussien (1997) and Moussa (2000).

REFERENCES

Abdel-Kariem, A.M.M. (1989). Role of organic matter on availability of some micronutrient in soils. Ph.D. Thesis, Fac. of Agric. Zagazig, Univ., Egypt.

Abou Hussien, E.A. (2001). Effect of potassium fertilizer on wheat response to iron in sandy soil treated by calcium carbonate. Conference of sustainable Agriculture Development. Fayoum Faculty of Agriculture March pp 292 - 504.

Abou Hussien, E.A. (1997). Evaluation of humic acids as iron carriers for plant nutrition. Menofiya, J. Agric. Res. 22 (2) : 581 - 611.

Awad, M.Y.M. (2001). Effect of some organic compounds on soil properties and plant growth. M.Sc. Thesis, Fae. of Agric. Menufiya Univ. Egypt.

Barsqum, S.W., M.N. Faiyad and B.Y. El-Koumey (1991). Effect of organic matter addition on nitrogen and phosphorus uptake by wheat. Menufiya J. Agric. Res. 16 (I): 987 - 1001.

Basyouny, E.A. (1996). The effect of different chelating compounds on the behaviour of some micronutri- ents in soil. M.Sc. Thesis, Fac. of Agric. Ain Shams. Univ., Egypt.

Baza, M.S.M., M.M.A. Badr and M.A.A. Amin (1993). Effect of soil application of phosphorus and method of application of some micronutrients on growth and mineral composition of maize plant. Egypt. J. Agric. Res. 71 (2) : 365 - 375.

Black, C.A. (1965). Methods of Soil Analysis. Am. Soc. Agron., Inc. Pub. Madison, Wisconsin, U.S.A.

Christine, Nait (1992). Effect of slow release iron fertilizers on chlorosis in grape. J. Plant Nutr. 15 : 1891 - 1912.

Cottenie, A. (1980). "Soil and Plant Testing as Basis of Fertilizer Recommendations". F.A.O. Soils Bull., 38 / 2 Fao, Rome.

El-Attar, H.A., H. El-Sheemy, E.M. El-Zahaby and I.I. Mahmoud (1986). Phosphate behaviour with some clay minerals hydroxides and limestone Egypt. J. Sap. Sci. 26 (1): 21-32.

El-Fiki, S.F. (1994). Effect of some macro., and micronutrients on yield and its biochemical components of soybean. M.Sc. Thesis, Fac. of Agric., Menufiya Univ., Egypt.

El-Fiki, S.F. (2000). Effect of some macro., and micronutrients application on yield and nutrients control of maize. Ph.D. Thesis, Fac. Agric., Menufiya Univ., Egypt.

El-Gazzar, A.M., M.W. Taha and E. Ghaley (1979). Effect of different levels of phosphorus on growth and mineral composition of greenhouse grown oranges, olives and guaves. Alex. J. Agric. Res. 27: 107-118.

El-Koumey, B.Y. (1998) : Influence of organic manures alone or combined with B or Zn on maize plant. Menufiya J. Agric. Res., 23 (4) : I 129 - 1 139.

El-Koumey, B.Y., M.R.M. Rabeh and S.W. Barsoum (1993). Effect of organic fertilization and some micro-nutrients on balady mandarin trees 1- growth and nutrients content. Zagazig J. Agric. Res. 20 (6): 1995-2013.

El-Shafei, F.S. and B.Y. El-Koumey (1994). Influence of use of sewage effluent in irrigation on soil and plants. Menufiya, J. Agric. Res., 19: 2521-2534.

El-Shafei, F.S. (1999). Effect of poudrette, zinc and copper application on corn growth and nutrients uptake in calcareous soils. Menufiya J. Agric. Res. 24 (4): 1429-1439.

El-Sharawy, M.O., I.M. Elwan and E.M. Abd-Elmoniem (1994). Response of corn plants to feeding with phosphorus and zinc. Menufiya J. Agric. Res. 19 (1): 765-778.

El-Sherief, M.A.B. (1997). Phosphorus nutrition of barley plant as influenced by zinc, Manganese and organic matter application to saline soil. Thesis, Fac. Agric., Menufiya Univ., Egypt.

Falatah, A.M. and M.S. Nadiem (1992). Changes in extractable Zn and P applied as organic and inorganic forms to a certain calcareous Saudi Arabian Soil. J. King Saud Univ., Agri. Sci. 4 (2): 287-297.

Haldar, M. and L.N. Mandal (1981). Effect of phosphorus and zinc on the growth and phosphorus, zinc, copper, iron and manganese nutrition of rice plant and Soil, 29: 415-425.

Haleem, A.A., W.B. Anderson, M.K. Sadik and A.A. Abdel Salam (1992). Iron availability as influenced by phosphate and ferrous and ferric-sulfate fertilizers J. Plant Nutr. 15: 1955-1970.

Hammad, M.M.H. (1997). Behavior of some synthetic compounds and elements in the soils. M.Sc. Thesis Fac. of Agric. Menufiya Univ. Egypt.

Ibrahim, I.I.M. (2001). Soil Mg/Ca ratio in relation to the availability of phosphorus its translocation in plant. Ph.D. Thesis, Fac. of Agric. Menufiya Univ. Egypt.

Jackson, M.L. (1958). Soil chemical Analysis. Constable and Co. Ltd., London.
Jackson, M.L. (1973). "Soil Chemical Analysis". Prentice Hall, Inc., Engle-Wood Cliffs, N.Y.
Khalil, H.M. (2000). Influence of soil properties on plant requirements of phosphorus in some soils of Egypt. M.Sc. Thesis, Fac. of Agric., Menufiya Univ., Egypt.
Lindsay, W.L. and W.A. Norvell (1978). Development of a DTPA soil test for zinc, iron, manganese and copper. Soil Sci. Am. J. 42: 421-427.
Mandal, L.N. and M. Haldar (1980). Influence of phosphorus and zinc application on the availability of zinc, copper, iron, manganese and phosphorus in waterlogged rice soils. Soil Sci. 130 (5): 251-257.
Marschner, H. (1998). “Mineral Nutrition in Higher Plants”. Academic Press, Harcourt Barace Jovanovisch. Publischer.
Megalah, S.S. (1994). Effect of phosphorus and zinc application on the availability of phosphorus and some micronutrients in the soils of Egypt. Egypt, J. Agric. Res., 72 (2): 333-347.
Megalah, S.S., A.S. El-Sebaay and M.M.R. Abd El-Maksoud (1993). Phosphorus and zinc availability as affected by their interaction in some soils of Egypt. Egypt, Menufiya J. Agric. Res., 18 (3): 1705-1715.
Megalah, S.S., S.E. Heggy, M.M.R. Abd El-Maksoud and A.S. Abd El-Nour (1994). Effect of zinc levels and its application methods on corn plants grown in different soils of Egypt. Egypt, J. Agric. Res., 72 (1): 23-33.
Mersal, F.R.I. (1996). Effect of phosphorus and iron fertilization on plant growth on soil varied in alkalinity M.Sc. Thesis, Fac. of Agric. Menufiya Univ., Egypt.
Mengel, K. and E.A. Kirkby (1987). "Principles of Plant Nutrition". International potash Institue, Bern Switzerland.
Moore, P.A. and W.H. Patrick (1988). Effect of zinc deficiency on alcohol dehydrogenase activity and nutrient uptake in rice. Agron, J., 80: 882-885.
Mortvedte, J.J. and G. Kelose (1988). Gain sorghum response to banded acid-type fertilizer in iron deficient soil. J. Plant Untr., 11: 1292-1310.
Moussa, B.I.M. (2000): Response of wheat plants grown in sandy soils to K and some micronutrients fertilization. Egypt. J. Soil Sci., 40 (4): 481-493.
Olsen, S.R., C.V. Cole, F.S. Watamable and L.A. Dean (1954). Estimation of Available Phosphate in Soils by Extraction with Sodium Biocarbonate USDA Circ. 939, U.S. Government printing office, Washington, D.C.
Piper, C.S. (1950). Soil and Palnt Analysis. Inter. Sci. Publ., Inc. New York.
Richards, L.A. (1954). Diagnosis and Improvement of Saline and Alkali Soils. U.S. Salinity Lab. Staff Agric. Handbook No. 60.
Robson, A.D. and M.G. Pitman (1983). Interaction Between Nutrients in Higher Plants. In: Inorganic plant nutrition (Lauchli, A. and Bieleski, R.L. Eds.) P. 147-173, Springer Verlag Berlin, Heidelberg, New York, Tokyo.
Romheld, V. and H. Marcschner (1991). Function of Micronutrients in Plants, In “Micronutrients in Agriculture” Published by : Soil Sci. Soc. Amer., Inc. Madison, Wisconsim, U.S.A., 297.
Salem, S.Y.M. (1996). Release and distribution of some macro and micro-nutrients in some soils of Egypt under different levels of moisture. M.Sc. Thesis, Fac. of Agric., Menufiya Univ.
Soliman, H.S.H. (1982). The effect of the functional group and some nutrients produced during decomposition of organic matter in plant nutrition. Ph.D. Thesis. Fac. of Agric. Zagazig Univ., Egypt.
Steel, R.G.D. and J.H. Torrie (1980). “Principles and Procedures of Statistics, A Biometrical Approach". Seond Edit. Mc. Graw-Hill, Co. New York.
Yadav, D.S., R.S. Antil, V. Kumar and M. Singh (1985). Effect of phosphate and zinc application on dry matter yield and uptake of nutrients in cowpea (Vigna unguiculata L., Walp). Z. pflanzenernaehr. Bodenk., 148: 233-240.

تأثير المادة العضوية ومصادر مختلفة من الفوسفور والزنك والحديد على محتوى الأرض والنبات من بعض العناصر الصغرى

فاطمة سعد الشافعى[1] ، بدر يوسف الكومى[1] ، محمد مصطفى شحاتة[1] ، سامية سعد الكلاوى[2]

[1] قسم علوم الأراضى – كلية الزراعة جامعة المنوفية

[2] مركز البحوث الزراعية

الملخص العربى

أقيمت تجربة أصص بكلية الزراعة . جامعة المنوفية لدراسة تأثير مصادر ومعدلات مختلفة من الفوسفور والزنك والحديد وكذلك المادة العضوية على نمو نبات الذرة فى كلا من الأراضى الرسوبية والجيرية .

وجمعت عينات التربة الطينية من الطبقة السطحية لمزرعة كلية الزراعة بشبين الكوم جامعة المنوفية والتربة الجيرية من الطبقة السطحية لمزرعة النوبارية محافظة البحيرة.

وضع 2 كجم من عينات الأرض فى كل أصص ارتفاعة 15 سم وتم زراعته بـ 5 حبوب من الذرة . تم خف النباتات الى 3 نباتات بعد 14 يوم من الزراعة رويت الأصص بإنتظام حتى وصل مستوى الرطوبة بالأرض الى 60% من السعة المائية الكلية (W.H.C) .

وقسمت التجربة إلى :

1- القسم الأول لدراسة تأثير المعاملة بمعدلات مختلفة من السماد العضوى (السماد البلدى) (صفر ، 1 ، 2% من وزن التربة).

2- القسم الثانى لدراسة تأثير المعاملة بمعدلات مختلفة (صفر ، 15 ، 30 مللجم P_2O_5) من كل من سوبر فوسفات وتربل فوسفات .وقد أضيف كلا من التسميد العضوى والفوسفاتى قبل الزراعة .

3- القسم الثالث تم معاملة بالزنك بمعدلات (صفر ، 10 ، 20 مللجم/ كجم) فى صورتى كبريتات زنك $ZnSO_4 . 7H_2O$ وزنك مخلبى Zn-EDTA .

4- القسم الرابع تم معاملته بالحديد بمعدلات (صفر ، 15 ، 30 مللجم/ كجم) فى صورتى كبريتات حديدوز $FeSO_4 . 7H_2O$ وحديد مخلبى Fe-EDTA .

تم إضافة الزنك والحديد بعد 15 يوم من الزراعة ، حصدت النباتات بعد 45 يوم وجففت فى الفرن عند 70°م وحسب وزنها الجاف وطحنت ثم تم تحليلها كيميائياً .

وتم إجراء التقديرات التالية :

أ – تحليل التربة : تم تقدير الصورة الميسرة للفوسفور والزنك والحديد والمنجنيز والنحاس.

ب- الصفات الخاصة بنمو النبات : تم تقدير الوزن الجاف للنبات .

ج- تحليل النبات : تم تقدير محتوى نبات الذرة من العناصر الصغرى (زنك وحديد)

ويمكن تلخيص النتائج المتحصل عليها فى الآتى :

القسم الأول : تأثير السماد العضوى :

1- أدت إضافة السماد البلدى بمعدلاته 1 ، 2% الى كل من الأرض الطينية والجيرية الى زيادة معنوية فى المادة الجافة لنباتات الذرة بالمقارنة بالنباتات غير المعاملة (كنترول).

2- كانت أعلى قيم للمادة الجافة للنباتات النامية فى الأرض الطينية بينما أقل قيم للمادة الجافة للنباتات النامية فى الأرض الجيرية .

3- أدت إضافة السماد البلدى الى كل من الأرضين الى زيادة تركيز وامتصاص الزنك والحديد بواسطة نبات الذرة .

4- أدت إضافة السماد البلدى الى زيادة الزنك والحديد المستخلص بـ DTPA .

5- أدت إضافة الأسمدة المعدنية الفوسفاتية إلى زيادة معنوية في المادة الجافة لنباتات الذرة النامية في كلا من الأرضين الطينية والجيرية وهذا دليل على استجابة النباتات للتسميد الفوسفاتى وخاصة في الأراضى الجيرية.

6- المادة الجافة لنباتات الذرة المسمدة بالتربل فوسفات أعلى من المسمدة بالسوبر فوسفات في الأراضى الطينية بينما حث العكس في الأراضى الجيرية .

7- الممتص من الزنك والحديد بواسطة نباتات الذرة النامية فى الأرض الطينية أعلى من الممتص من هذه العناصر للنباتات النامية فى الأرض الجيرية والمعامة بالفوسفور.

8- أدت إضافة الأسمدة الفوسفاتية الى نقص كمية الزنك والحديد المستخلصة بـ DTPA فى كلا من نوعى التربة.

9-كانت أعلى قيم لمحصول المادة الجافة لنباتات الذرة النامية فى كلا من الأرض الطينية والجيرية والمسمدة بالزنك المخلبى Zn-EDTA عن تلك المسمدة بكبريتات الزنك .

10-الكميات الممتصة من العناصر الصغرى (زنك ، حديد) بواسطة نباتات الذرة النامية فى كلا من الأرض الرسوبية والجيرية تزداد مع الزنك المخلبى Zn-EDTA بالمقارنة مع كبريتات الزنك . وكان معدل الاستجابة لنبات الذرة أكثر فى الأرض الجيرية المعاملة بالزنك المخلبى .

11- إضافة أسمدة الزنك تزيد من الزنك الميسر فى كلا من الأرضين الرسوبية والجيرية .

12-إضافة أسمدة الزنك تزيد من الزنك وتقلل من الحديد المستخلص بـ DTPA .

13-الكمية الميسرة من العناصر الصغرى (Zn, Fe) تزداد فى كل من الأرضين الطينية والجيرية المعاملة بالزنك المخلبى Zn-EDTA عن تلك المعاملة بكبريتات الزنك .

14-أدت إضافة الحديد عن مختلف مستوياته (15 ، 30 مللجم/ كجم) ومن مختلف مصادره الى زيادة معنوية فى محصول المادة الجافة لنباتات الذرة النامية فى كل من الأرض الطينية والجيرية .

15-إضافة الحديد المخلبى Fe-EDTA أدى الى زيادة محصول المادة الجافة أكثر من كبريتات الحديدوز .

16-يزداد الممتص من العناصر الصغرى (Zn, Fe) معنويا بواسطة نباتات الذرة النامية فى كل من الأرضين مع الحديد المخلبى مقارنة مع كبريتات الحديدوز .

17-إضافة الحديد تزيد من الحديد المستخلص فى كل من الأرضين ، بينما تقلل من الكميات المستخلصة من الزنك.