J. Agric. Sci. Mansoura Univ., 32 (12): 10741 - 10754, 2007

EFFECT OF SULPHUR APPLICATION AND FOLIAR SPRAYING WITH SOME MICRONUTRIENTS ON PRODUCTIVITY, YIELD COMPONENS AND SEED CHEMICHAL PROPERTIES OF PEANUT GROWN ON A NEWLY CULTIVATED LOAMY SAND SOIL

Abd El-Kader, Mona G.; Samia H. Ashmaye and Kh. A. H Shaban
Soils, Water and Environ. Res. Institute, Agric. Res. Center, Giza, Egypt

ABSTRACT

A field experiment was carried on peanut (*Archis hypogaea* L., cv. Giza 6) grown on a soil. At El-Quassasin region, Ismailia Governorate, Egypt during two successive seasons of 2006 and 2007 to study the effect of S application and foliar spraying with Zn, B and Mo their combinations on seed /plant, seed yield /fed, 100 seed weight, oil, sugar, protein as well as seed contents of some macro and micronutrients.

The obtained results could be summarized as follows:-

1-The highest values of peanut seed yield and its attributes as well as seed quality were obtained when plants treated with S combined with foliar spraying with (Zn +B).

2-The highest nutrient content were obtained with S combined with foliar spraying with (Zn+B).

3-Soil available N, P, K and S were increased due to the applied different treatments. The highest N, P, K and S values were observed with the combined treatment of (S+Zn+B).

4-The highest values of available Zn, B and Mo were obtained due the combined treatment (S+Zn+B).

INTRODUCTION

Peanut is one of the most important oil crops and food seed legume, it contains about 50% oil, 25-30% protein, 20% carbohydrate and 5% fiber and ash and make a substantial contribution to human nutrition (Fageria *et al*., 1997). Peanut is one of the most important crops which cultivated successfully in a newly reclaimed sandy soil in Egypt. Production of oil crops in Egypt is insufficient for local consumption. So, it is great improving peanut production, which could achieved by several agricultural practices, such as chosen the promising varieties, foliar spraying with zinc, boron, molybdenum and gypsum application under sand soil conditions.

Sulphur application in sandy soils which has its marginal nutrient status, improved the quality of peanut seeds. Sulphur plays a role in containing amino-acids like methionine, systine and systein which are essential constituents of proteins. Venkotesh *et al*.(2002) found that protein yield of peanut seeds was significantly increased by applying of gypsum.

With respect to the influence of micronutrients, many investigators reported the importance of zinc or boron or/and molybdenum application for improving plant growth and yield attributes of peanuts (Brar,*et al.* 1980;

Deshpande *et al*., 1986; Pal,1986; Revathy *et al.,*1997; Sontakey *et al*., 1999 and Darwish *et al*., 2002).

Zinc is an essential component or activator for many enzymes involved in photosynthesis and hence has an important role in early seeding vigor (Welch, 1995). Sarkar *et al*.(1998) stated that application of Zn andMo gave the greatest effect in increasing groundnut biomass production, leaf rea index, crop growth rate and yield attributes, resulting in 61% greater pod yield over control. Lourduraj *et al*. (1998) found that Zn, B, Fe, Mn and Mo produced the highest groundnut pod yield. Darwish *et al*.(2002) found that fertilized peanut by zinc sulphate ad boric acid gave the highest values of seed yield and oil yield/fed. Ali and Mowafy (2003) pointed out that foliar spraying with Zn of B and their combination slightly improved yield and its attributes as well as quality in two seasons. Rifat, *et al*., (2004) stated that Zn and B fertilization had a significant effect on the seed yield, pod yield, seed weight/plant as well as seed oil content for the combined data.

As for boron, it plays a role in plant metabolism and in the synth of nucleic acid. Also, it is important for tissue development and facilitates sugar translocation (Gouch and Dugger, 1954). In this respect, Bhuiyan *et al*.(1997) mentioned that application of 1 kg/ha increased groundnut nodulation and seed yield. Grewal *et al*.(1998) found that oil seed rap shoot and root dry matter production as well as chlorophyll content of fresh leaf tissue were significantly influenced by B supply at early vegetative growth in sand culture.

Molybdenum also plays an important role in nitrogen metabolism and nitrogen fixation. El-Sayed (2006) found that the S x Mo interaction on total sugar percentage indicated that in absence of applied S, 1ppm Mo significantly increased the total sugars of soybean.

The current study was crried out to, evaluate the effect of sulpher application, foliar spray with Zn, B, Mo and their combinations on peanut yield, yield components, seed chemical composition, as well as available nutrient contents in soil a newly cultivated sandy soil.

MATERIALS AND METHODS

To achieve the previous target a field experiment was carried out at farm, El-Quassasin Governorate, during the two successive seasons of summer 2006 and 2007. Table (1) shows some physical and chemical properties of the experimental soil in both seasons.

The studied soil is loamy sand in texture, slightly saline, poor in both organic matter and available macro or micronutrients. In both seasons was conducted a field experiments in a complete randomize blocks design, with three replicates. This study was designed to study the effect of the interaction between sulphure and some micronutrients (Zn, B and Mo) on their contents in soil, peanut growth, seed yield and its concentrations of N, P, K, Zn, B and Mo. The seeds of peanut (*Arachis hypogaes* L., cv.) Giza 6, were obtained from Agriculture Research Center, Giza, Egyp,. and 12 May in the both first and second seasons, under surface irrigation system. The experimental unit area (plot) was 5 x 10 m^2, containing five rows. The distance between rows and plants were 50 and 25 cm, respectively. At harvest (October 7th in both seasons), the weights of seed per plant (g) and fedan (kg). were determined. The organic manure was thoroughly mixed with 0-30 cm of the soil surface two weeks before planting (10 m^3/fed). The used N,P and K were added in the form of urea (46N%) at three equal doses, besides calcium superphosphate (15.5% P_2O_5) and potassium sulphate (48% K_2O). at the rates of 30 and 50 kg/fed, respectively. The applied twelve treatments are represented by combinations between sulpher (S), zinc (Zn), boron(B) and molybdenum (Mo). Addition of 200 kg/fed elemental sulphur before planting and during soil tillage. Zn was as applied in spray solution of 3.33g $ZnSO_4$/L/plot,(2 kg Zn SO_4 / fed) on the 8th June and 10th July 2006, in first season, the 7th, of June and 4th of July 2007 in 2nd one.

Borax ($Na2B_4O_7$. $10H_2O$) was used as a source of B, and it was applied also as foliar spray at the same Zn application dates, with solution of 0.83 g borax /L/plot (0.5 g borax /fed.). Ammonium molybdenum was used as a source of Mo as foliar spray at the same times of Zn and B application dates with solution of 0.32 g Mo/L/plot.

The treatments were as follows: 1) control 2) S, 3) Zn, 4) B, 5) Mo, 6) S+Zn, 7) S+B, 8) S+Mo, 9)Zn +B, 10) Zn +Mo, 11)Zn + B + Mo and 12) S + Zn + B.

The analysis of both soil and plants were carried out by using the methods described by Black (1962) and Chapman and Pratt(1961). Available Zn, B and Mo were extracted by DTPA and determined using Inductively Coupled Plasma (ICP) Spectrometer model 400(Soltanpour, 1985). Protein percentage was calculated by multiplying the nitrogen percentage by the converting factor 6.22 (Hymowizer *et al*.,1972). Determination of oil percentage in dry seed was estimated using soxhlet apparatus according the method described by A.O.A.C.(1990). The total sugars were determined by using the method of FAO (1980).

Statistical analysis of the obtained data was carried out by using L.S.D. at levels for comparison between means of different treatments Sendecor and Cochran, 1972).

Table (1): Some physico-chemical characteristics of the studied soil before planting

Particle size distribution (%)				Textural class	Organic matter (%)	$CaCO_3$ (%)
C. sand	F. sand	Silt	Clay			
27.98	51.74	5.67	14.61	**Loam sand**	0.78	1.69

Chemical analysis of soil paste extract

pH	EC dS m^{-1}	Soluble ions (meq l^{-1})							
		Ca^{++}	Mg^{++}	Na^+	K^+	$CO_3^=$	HCO_3^-	Cl^-	$SO_4^=$
7.85	7.6	17.3	8.5	49.0	0.78	--	6.3	34.0	35.28

Macro-microelements content in soil used before planting

Macro elements (mg/kg)				Microelements (mg/kg		
N	P	K	S	Zn	B	Mo
30	3.78	159	2.52	0.95	0.86	0.69

RESULTS AND DISCUSSION

Yield and yield components of peanut

The data of yield and yield components of peanut are presented in Table (2). The data clearly indicate that application of sulphur (S), zinc (Zn, boron (B), molybdenum (Mo) and their combinations significantly increased the seed weight (g/plant), weight of 100 seed, oilseed percent, seed yield, sugar percent, protein percent and seed yield (kg/fed)

Effect of S application:

Concerning the effect of S on peanut yield and its components in the first season, the application of S significantly increased seed weight, 100 seed weight, oil seed %. Application of sulphur increased seed weight, 100seed weight, seed oil% and seed yield kg/fed with relatively increase percentage 26.12, 4.76, 11.30, 16.91% respectively over the control treatment. The increase of peanut yield as a result of S application may be attributed to the effect of S in decreasing soil pH (Jones, 1982; Spires and Braswell, 1992 and Kassem *et al*. 1995), and consequently increasing the nutrient uptake and translocation (Stromberg and Tisdale, 1979; Shadfan and Hussen, 1985 and Hening et al., 1991), the improving tree condition and increasing the total yield in accordance with these results, those reported by Cummings *et al*. (1981), Kayode and Ojeniyi(1991), Kassem *et al*.(1995), Abdulsalam and El-Garawany (1998)and Abdel-Nasser and El-Shazly (2000), Adhikari *et al*. (2003) and Ali et al. (2004) recorded significant increase in weight of 100-seed and oil yield by increasing of sulphur.

Seed protein:

The result in Table (2) indicated that the application of S increased protein % in peanut, in which the protein percent increased in crud protein may be attributed to that S is one of the constituents of amino-acids (Methionine-cystine-systeine). Therefore, in absence of S, the amino acids and crud protein content were low. Hanower and Brazozwska(1964) and Nock *et al*. (1992) reported that S deficient plants of groundnut had less protein and more soluble nitrogen in all plant parts. They reported also, that there was accumulation of arginine, asporagine and decrease in cystine, cystenie and methionine contents. Shams El-Din and Ali (1996) and Ali *et al*.(2004) indicated that application of S increased protein in the peanut.

Seed sugar :

Sugar percent in peanut was increased with S application by 15.22% as compared with the control. Zhang and Smith (1996), El Sayed (2005) found that the application of S increased sugar in soybean.

Seed oil :

Data in Table (2) indicated that seed oil percent was increased significantly when peanut plants treated with S and foliar spraying with Zn or B or Mo and their combinations as compared with the control. The relatively increase percentage in oil seed when sulphur applied was 11.3% as compared with the control. This results are in accordance with those reported by Ali *et al*. (1995b), Venkatesh *et al*.(2002), Adhikari *et al.*(2003) and Ali *et al*.(2004).

2

2-Effect of micronutrient and their combinations:

Regarding the influence of foliar spraying with Zn, B, Mo and their combinations on yield and its component of peanut (Table 2), the results indicated significant increases as compared to the control. The increase percentages for the seed weight (g/plant), 100-seed weight, seed oil%, seed yield (Kg/fed), sugar % and protein %,.as a result of foliar spraying with Zn were 26.52%, 16.24, 4.04%, 23.02%, 30.02% and 84%, respectively over the control treatment. This may due to the role of zinc in the synthesis of amino acid tryptophane which is a precursor the auxin of indole acetic acid which has a role in symbiotic N_2-fixation by legumes. It has also a role in starch metabolism (Jyung *et al*.,1975) and closely involved in N-metabloism in plant (Price *et al*., 1972). Foliar spray of boron increased yield and its components as compared to the control treatment, may be due to its role in plant metabolism and in the synthesis of nucleic acids. Also, it is an important element for tissue development and facilitates sugar translocation (Gauch and Dugger, 1954). In this respect Helmy and Shaban (2007) found that the foliar of Zn and B increased yield and its components. In the other hand the foliar of Mo increased yield and its components as compared with the control, this may be due to the Mo play an important role in nitrogen metabolism and nitrogen fixation. Data in Table (2), also showed that the combination between sulphur and micronutrients (Zn, B and Mo) significantly increased yield and its components, as follows: S+Zn > S+ B > S+Mo > Zn+Mo > Zn+B+Mo > S+Zn+B This result indicates that application sulphur increased yield and its components, may be attributed to the effect of decreasing soil pH and increasing released available nutrients (Alxanders, 1977; Alawi *et* al, 1980 and Yousry *et al*., 1984).

Macronutrient contents in seed

Nitrogen content

It is clear from the data in Table (3) that foliar spraying with the combination of (Zn+B) in the presence of S addition was superior for increasing the N% in seeds as compared to the other applied treatments. Kowalenko(1979) stated that S application enhanced N availability and uptake by reducing nitrate losses and stimulated the reduction of NO_3 to NH_4 thereby increasing N uptake and consequently increasing plant growth.

Data also revealed an ascending order for N increases as follows: (S+Zn+B) > (Zn + B + Mo) > (Zn + Mo) > (Zn + B) > (S + Mo) > (S + B) > (S + Zn) > B > Mo > Zn > S. The corresponding relatively percentages reached increase 108, 104, 102, 101, 96, 94, 91, 88%, 86, 84 and 82% respectively, over the control treatment.

Phosphorus content in seed

Data in Table (3) show that the phosphorus percent was increased significantly due to applying the different treatments as compared to the control. As for the S application and foliar spraying with Zn or B or Mo and their combinations, it is clear that all treatments increased the percent of P as shown in the order of: (S +Zn +B) > (S + B + Mo) > (Zn + Mo) > (Zn+ B) > (S + Mo) > (S + B)> (S + Zn) > B> Mo> Zn> S.

Table (3): Macronutrient contents in peanut seed

Treatments	N (mg/kg soil)		P (mg/kg soil)		K (mg/kg soil)		S (mg/kg soil)	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	1.72	1.89	0.12	0.14	0.71	0.78	0.14	0.19
S	3.14	3.25	0.18	0.22	0.98	1.06	0.20	0.24
Zn	3.18	3.28	0.23	0.26	0.88	0.98	0.17	0.21
B	3.24	3.32	0.27	0.30	0.92	0.99	0.19	0.22
Mo	3.21	3.29	0.29	0.32	0.89	0.97	0.21	0.27
S+Zn	3.29	3.34	0.30	0.33	1.02	1.07	0.24	0.31
S+B	3.34	3.38	0.32	0.36	1.05	1.11	0.28	0.33
S+Mo	3.38	3.46	0.31	0.34	1.08	1.12	0.31	0.36
Zn + B	3.46	3.52	0.34	0.38	1.10	1.15	0.23	0.28
Zn + Mo	3.48	3.53	0.37	0.41	1.14	1.18	0.23	0.27
Zn + B + Mo	3.51	3.56	0.38	0.42	1.05	1.08	0.27	0.30
S + Zn + B	3.58	3.66	0.41	0.44	1.18	1.21	0.31	0.35
L.S.D.at 0.01	0.0449	0.0471	0.0263	0.0166	0.051	0.021	0.0237	0.0216

Potassium content in seed

As shown in Table (3) addition of sulphur as well as foliar spraying with Zn or B or Mo and their combinations significantly increased K percent by seed of peanuts. It was noticed that (S+Zn+B) treatments surpassed the other treatments for increasing the percent of K in seeds.

Sulphur content in seed

Data in Table (3) also, show that the sulphur percent was increased significantly due to the applied different treatments as compared to the control.

Micronutrient contents in seed

Data in Table (4) pointed out that application of S fertilization and foliar spraying with Zn, B and Mo and their combinations increased significantly the percentages of Zn and B in peanuts seeds as compared to the control treatment. This may be due to S application could be attributed to its positive effect on solubilizing some soil elements to making them more readily available for plant (Yousry *et al*.,1984).

Table (4): Micronutrient concentrations in peanut seed.

Treatments	Zn (mg/kg)		B (mg/kg)		Mo (mg/kg)	
	2006	2007	2006	2007	2006	2007
Control	10.38	11.47	6.37	7.35	0.879	0.898
S	12.58	14.35	9.17	10.34	0.889	0.104
Zn	17.21	18.12	9.24	10.41	0.952	0.107
B	12.89	15.28	10.86	12.45	0.963	0.110
Mo	15.84	17.23	10.88	12.47	0.105	0.115
S+Zn	19.67	22.47	11.12	13.21	0.108	0.113
S+B	18.97	20.15	13.82	15.19	0.115	0.118
S+Mo	18.78	20.48	13.88	15.21	0.118	0.124
Zn + B	21.28	22.87	15.37	17.18	0.123	0.128
Zn +Mo	21.39	22.99	15.48	17.15	0.120	0.122
Zn + B + Mo	21.96	23.10	16.24	18.17	0.132	0.136
S + Zn + B	22.68	23.24	16.33	18.29	0.137	0.142
L.S.D. at 0.01	0.2566	0.1652	2.722	1.1286	0.0054	0.0033

Zn uptake by peanut seed was illustrated in Table (4). The greatest Zn content in seeds was occurred with the S application in combination with Zn + B.

As shown in Table (4) addition of sulphur and the foliar spraying with Zn or B and their combinations significantly increased B content in seeds. The data showed the superioiority of (S + Zn + B) treatment.

On the other hand Mo content was decreased when appling Mo alone as compared with the control, S, Zn and B, but it tended to increase with the treatments of Zn +S, S + B, S +Mo, Zn + B, Zn + Mo, Zn + B+Mo and S+ Zn + B. The treatment of S+Zn+B increased Mo content in seeds as compared with molybdenum treatment only. On the other hand Mo contents were increased when applying S as compared with control and compared Zn with control, also compared B with control.

Data in Table (4) showed that the highest content of molybdenum by peanut was recorded with applied B alone. Finally Mo content decreased when the plans treated with Mo alone combined with the elements of S, B, Zn and Mo or with others. This result may be attributed to the molybdenum was antagonists with sulphur because S decreased soil pH but molybdenum need high pH.

The results in Tables (2, 3 and 4) indicate that the highest yield of peanut seed and its attributes as well as seed quality were associated with the plants supplied S combined with foliar spraying with Zn + B during the studied two seasons.

Available macronutrient contents in the experimental soil after harvesting.

Data in Table(5) indicated that S application and foliar spraying with Zn or B or Mo increased available N, P, K and S contents in soil as compared to the control.

Table (5): Available macronutrient contents in the studied soil.

Treatments	N (mg/kg soil)		P (mg/kg soil)		K (mg/kg soil)		S (mg/kg soil)	
	2006	2007	2006	2007	2006	2007	2006	2007
Control	31	34	3.89	4.91	166	173	2.96	3.49
S	39	45	4.27	5.26	173	184	5.76	6.45
Zn	32	37	4.95	5.14	178	188	4.88	5.17
B	39	44	4.99	5.29	182	192	4.94	5.19
Mo	37	42	5.14	5.31	184	194	4.79	5.14
S+Zn	42	48	5.37	6.14	188	197	5.37	6.48
S+B	48	52	5.49	6.18	190	198	5.39	6.52
S+Mo	49	54	5.56	6.21	193	199	5.36	6.49
Zn +B	46	50	5.64	6.34	187	195	5.28	6.35
Zn + Mo	48	51	5.51	6.28	190	196	5.22	6.29
Zn + B + Mo	51	54	5.67	6.37	198	202	5.89	6.54
S + Zn + B	53	56	5.77	6.39	199	207	6.04	6.58
L.S.D. at 0.01	2.381	1.977	0.303	0.145	2.353	2.553	0.385	0.056

Available micronutrients contents in the experimental soil after harvesting

Data in Table (6) show that the application of different treatments slightly increased available Zn, B and Mo contents in soil as compared to the control treatment. It is clear from the data in Table (6) that, foliar spraying with combination of (Zn + B) in the presence of applied S was superior for increasing the contents of Zn, B and Mo in the soil as compared to the other treatments.

As for the combination between S application and foliar spraying with Zn or B or Mo data show that the treatments of (S+Zn+B) seem to be the most promotive, which is possibly due to beneficial effete of S in increasing the availability of other nutrients in soil. These results may be attributed to the oxidation of S to SO_4^{2+} by microorganisms, and in turn decreased soil pH and which enhancing the availability of soil nutrients. These results agree with Spires and Braswell (1972) and El-Shazly (1999). Also, S application have a great effect on soil physical and chemical properties, such as soil bulk density, pore size distribution and soil water retention (Baver *et al,* 1972; Rogasik and Smukalski, 1988).

Table (6): Micronutrients available content in soil after two seasons

Treatments	Zn (mg/kg)		B (mg/kg)		Mo (mg/kg)	
	2006	**2007**	**2006**	**2007**	**2006**	**2007**
Control	1.02	1.04	0.88	0.91	0.77	0.80
S	1.07	1.09	0.94	0.96	0.79	0.82
Zn	1.15	1.17	0.96	0.98	0.83	0.85
B	1.14	1.16	1.05	1.08	0.86	0.88
Mo	1.11	1.13	0.98	1.03	0.94	0.96
S+Zn	1.24	1.26	1.08	1.10	0.87	0.89
S+B	1.19	1.22	1.12	1.14	0.88	0.91
S+Mo	1.20	1.19	1.09	1.11	0.96	0.99
Zn + Mo	1.27	1.29	1.14	1.16	0.92	0.95
Zn +Mo	1.26	1.28	1.10	.13	0.98	1.03
Zn + B + Mo	1.31	1.33	1.15	1.18	1.02	1.06
S + Zn + B	1.34	1.36	1.17	1.19	1.04	1.08
L.S.D. at 0.01	0.0515	0.0289	0.0512	0.0208	0.028	0.0228

Conclusion

Application of sulphur and foliar spraying with Zn, B & Mo and their combinations in relatively coarse texture soils, which have its marginal nutrients, improved the quality of peanut seeds, improved the fertility of soil, i.e., enhancing the available macro and micronutrients in soil

REFERENCES

A.O.A.C.(1990). Official Methods of Analysis. Association of Official Analytical, Arlington, Virgina, USA.

Abdel-Nasser, G. and S. M. El Shazly(2000). Effect of sulphur application on soil physical and chemical characteristics, nutrient status, yield and fruit quality of Balady orange trees. J. Agric. Res., Tanta Univ., 26(1):72-92.
Abduisam, M. A. and M. M. El-Garawany(1998). Barley response to soil type, organic manure and sulphur rates. Arab Univ. J. Agric. Sci. Ain Shams Univ., 6(1):135-149.
Adhikari, J. ; D. Samanta and R. C. Samui (2003). Effect of gypsium on growth and yield of confectionery groundnut (Arachic hypogaea) varieties in summer season. Indian J. Agric. Sci.73(2):108-109.
Adhikari, J. ; D. Samanta and E. C. Samui(2003). Effect of gypsum on growth and yield of confectionery groundnut (Arachis hypogea) varities in summer season. Indian J. Agric. Sci.73(2):108-109.
Alawi, B. J.; J. L. Stroehlein, E. A. Hanlon and F. Turner(1980). Quality of irrigation water and effects of sulphur acid and gypsum on soil prperties and Sudan grass yield. Soil Sci., 129:315-319.
Alexander, M.(1977). Introduction to soil Microbiology. 2nd ed., John Wiley and Sons. Inc., New York.
Ali, A. A. G. and S. A. E. Mowafy (2003). Effect of potassium and phosphorus fertilizer with the foliar application of zinc and boron on peanut in sandy soil. Zagazig J. Agric. Res., 30(20):335-358.
Ali, A. A. G.; E. H. Fayed; H. A. Basha and A. M. Hassan (1995a). response of peanut to some agricultural practices. II-Influence of sowing dates and application of phosphorus and gypsum on yield and yield attributes of peanut. Zagazig J. Agric. Res.22(1):49-68.
Ali, A. A. G.; E. H. Fayed; H. A. Basha and A. M. Hassan (1995b). response of peanut to some agricultural practices. 111-Influence of sowing dates and application of phosphorus and gypsum on quality of peanut. Zagazig J. Agric. Res., 22:349-366.
Ali, A. A. G.; O. A. Zeiton; H. G. M. Geweifel and M.A. Taha (2004). Some factors affecting productivity of peanut (Arachis hypogaea L.) cultivated sandy soil. Zagazig J. Agric. Res., 31(6):2565-2595.
Basha, H. A. (1994). Response of some groundnut cultivars to different planting space in newly cultivated sandy soil. Zagazig. J. Agric. Res. Vol 21 (3A)655-670.
Baver, L.D.; W. H. Gander and W. R. Gardner Ed. (1972). Soil Physics. 4th Ed., John Wiley & Sons, New York.
Bhuiyan, M. A. H.; M. H. H. Rahman; D. Khanam and M. R. Khatun(1997). Effect of micronutrients (Mo and B) and rhizobial inoculum on nodulation and yield of groundnut. Legume Res., 20(3/4): 155-159.
Black. C. A. (1962). Methods of Soil Analysis I&II. Amer. Soc. Agron. Inc., Pubisher, Madison, Wisconsin, USA.
Brar, M. S.; B. Singh and G. S. Sekhon(1980). Leaf analysis for monitoring the fertuilizer requirements of peanut. Comm.. Soil Sci. Plant Anal., 11(4):335-346.
Chapman, H. D. and P. F. Paratt (1961). Methods of Analysis for Soil Plant and Waters. Agric. Publ. Univ., of California, Riverside.

Cummings, C. M.; I.P. Mainland and J.P. Lilly(1981). Influence of soil pH, S and sawdusts on Blueberry survival, growth and yield. J. Amer. Soc.Hort. Sci., 106(6):783-785.

Darwish, D. S.; El-G.A. El-Garreib; M. A. El-Hawary and O.A. Rafft(2002). Effect of some macro and micronutrients application on peanut production in a saline soil in El-Fayum governorate, Egypt. J. Appl. Sci.; 17(4):17-32.

Deshpande, S. L.; V.K. Paradkar and S. K. Dubey(1986). Effect spacing and zinc application on yield of groundnut. Madras Agric. J. 73(9):521-523(c.f.Field Crop Abstract, 41(9):5978,1988).

El-Sayed, S. A. M. (2006). Effect of sulphur, phosphorus and molybdenum application on chemical composition of soybean grains. J. Adv. Agric. Res. (Fac. Agric. Saba Basha). Vol.11(2):259-267.

El-Shazly, S. M. and G. Abdel-Nasser(1999). Efficiency of phosphorus fertilizers as affected by soil sulphur application on Balady Mandarin Plants). Agric. Sci., Mansoura Univ., 24(12):7623-7638.

Fageria N. K.; V.C. Baligar and C. A. Jones (1997) Growth and mineral nutrients of field crops. 2^{nd} Edition Marcel Dekker. Inc., New York 1001 page, 494.

FAO(1980). Soil and plant testing and analysis. FAO Soil Bulletin 38/1. FAO, Rome, Italy.

Gauch, H. G. and W. M. Dugger,(1954). The physiological action of boron in higher plants: a review and interpretation. Maryland Agric. Exp. Sta. Bull. A-80(Tech) (c.f.Micronutrients. In Agriculture. Soil Sci. Soc. Amer. Ios., Madison, Wisconsin USA,1972).

Grewal, H.S.; R. D. Graham and J. Stangoulis (1998). Zinc –boron interaction effects in oil seed rape. J. Plant Nut.; 21(10): 2231-2243.

Hanowe, P. and J. Brazozowska(1964). Absorption and distributing of ^{32}S deficiency on metabolism of sugars and nitrogen. Agrochimica, 8:263-274.

Helmy, A. M. and Kh. A. Shaban (2007). Response of peanuts to K fertilization and foliar spraying with zinc and boron under sandy soil conditions. Zagazig J. Agric. Res., 34.(4):737-752.

Hening, H.; D. Sparks and J. J. Evans(1991). Sulphur deficiency influence vegetative growth, chlorophyll and element concentrations and amino acids of peach. J. Amer. Soc. Hort. Sci., 116(6):974-980.

Hymowizer, T.; F. Collins and W. M. Walker, (1972). Relationship between the content of oil, protein and sugar in soybean seed. Agron. J., 64:613-616.

Jones, U.S. (1982). Fertilizers and Soil Fertility. Second edition, Reston Publishing company, Reston Virginia, A Prentice Hall Company.

Jung, W. H.; A. Ehmann; K. K. Schlender J. Scala(1975). Zinc nutrition and starch metabolism in *Phaseolus vulgaris* L. Plant Physiol., 55: 414-420.

Kassem, A. A.; H. A. Kassem and H. M. Kamal (1995). The influence of sources, level of nitrogen fertilizers and fertilizers and/or sulphur application on guava trees growth in alkaline sandy soil. Menofiya J. Agric. Res.; 20(3):1223-1235.

Kayoed, G.O. and S.O.Ojeniyi (1991). Response of maize to sulphur in the tropical savannas of Nigeria. 2nd Afrcan Soil Sci.Conf. 161-165.

Kowalenko, C. G.(1979). Rapid analysis of soil nitrate with sulphur. Can.J.Soil Sci.,59:221-223.

Lourduaj, A. C.; S. Sanbagavalli and S. Pannerselvam,(1998). Integrated nutrient management in groundnut. Agric. Sci. Digest (Kamal)18(4):252-254 (c.f. Field Crop Abstract, 52(9):6637).

Maha, M. Abd-Alla (2004). Effect of certain agricultural practices on productivity of peanut. 1. Influnece of sowing dates and potassium application on yield and yield attributes of some peanut cultivars. Zagazig J. Agric. Res., vol.31No.(3):843-866.

Nock, L.P.; L. J. Rogers and H. Thonas (1992). Metabolism of protein and chlorophyll in leaf tissue of festucd pratensis during chloroplast assembly and senescence. Phytochemistry 31:1465-1470.

Pal, P.K (1986). Impact of rhizobial strains and micronutrients on grain yield of peanut (Arachis hypogaea). Envir. & Ecol., 4(4):721-724.

Price, C. A.; H.E. Clark and H.E. Funkhouser (1972). Functions of micronutrients in plants,(c.f.Micronutrints In Agriculture, pp. 31-42; Soil Sci.Soc Amer, Madison, Winconsin.

Revathy, M.; R. Knishnasamy and T. Chitdeswari (1997). Chelated micronutrients on the yield and nutrient uptake by groundnut. Madras Agric. J., 84(11/12):956-662(c.f.Field Crop Abstract, 52(2):1080,1999).

Samia, M. A. Hussei; A. M. El-Melegy and M. A. Halkel (2000). Effect of nitrogen frequency, gypsum application, plant density and their interaction on growth and yield of peanut under drip irrigation system in North Sinai J. Agric. Sci. Mansoura Univ., 25(5):2427-2438.

Sarhan, A. A. (2001).behavior and productivity of two peanut cultivar under Agro-Horticultural system. Zagazig J. Agric. Res., Vol. 28No. (6): 1009-1034.

Sarfar, R. K.; A. Chakraborty and B. Bala(1998). Analysis of growth and productivity of groundnut (Arachis hypogaed L.) in relation to micronutrient application. Indian J. plant Phys., 3(3):234-236.

Shadkan, H. and A. A. Hussen (1985). Effect of sulphur application on the availability of P, Fe, Mn and Cu in selected Sudia Soils. In Proc. 2nd Arab regional Conf. On sulphur and its usages, P.3-23.

Shams El-Din, G. M. and E. A. Ali (1996). Upgrading productivity of two peanut (Archis hypogaeal L.) varieties through applying optimum plant spacing and micronutrients application. Arab Univ. J. Agric. Sci, Ain Shams Univ., Cairo 4(1/2):53-67.

Snedecor, G. W. and W. G. Corhan (1967). Statistical Methods. Iowa State University Press. Pp.593, Ames, Iowa, U.S.A.

Soltanpour, N.(1985). Use of ammonium bicarbonate-DTPA soil test to evaluate elemental available and toxicity. Soil Sci. Plant Anal.,16(3):323-338.

Sontakey, P. Y.; C. N. Chore; N. Beena; S. N. Potkile and R. Deotale(1999). Response to sulphur and zinc as soil application in groundnut. J. Soils & Crops (c.f.Soils&Fert., 63(5):4956,2000).

Spieres, J. M. and J. H. Braswell (1992). Application sulphur additions on growth, yield and leaf nutrient content of rabbit eye blueberry. J.Amer. Soc. Hort. Sci., 117(2):230-233.

Stromberg, L. K. and S. L. Tisdale(1979). Treating irrigated and land soils with acid forming sulphur compounds. The sulphur Institute Technical Bulletin, 24

Venkatesh, M. S.; B. Majundar, B. La I. and Kallashumar(2002). Relative performance of sulphur source on sulphur nutrition of groundnut (Arachis hypogaea) in acid Alfisol of Meghalaya (India). Agric. Sci.., 72(4):216-219.

Venkatesh, M.S.; B. Majumdar; B.Lal and Kallashkumar (2002). Relative perfoermance of sulphur sources on suphur nutrition of groundnut (*Arachis hypogaea*) in acid Alfisol of Meghalaga India J. Agric. Sci., 72(4):216-219.

Welch, R. M. (1995). Micronutrient nutrition of plants. Crit.Rev. Plant Sci.,14:49-82.

Yousry, M. A. El-Leboudi and A. Khayter(1984). Effect of sulupher and petroleum by products soil characteristics. I. Availability of certain nutrients in a calcareous soil under intermittent leaching.Egypt.J.Soil Sci. 24(3):185-194.

Zhang, F. and D.L. Smith (1996). Inoculation of soybean (*Clycine max* L.Merr.) With genistein-preincubated Bradyrhizobium japonicum or genistein directly applied into soil increase soybean protein and dry matter yield under short season conditions. Plant and Soil.197:233-241.

تأثير اضافة الكبريت والرش ببعض العناصر الصغرى على انتاجية، مكوناتمحصول والخواص الكيميائية لبذور الفول السودانى النامى فى أرض رملية طميية حديثة الاستزراع

منى جمال عبد القادر ، سامية حسن عشماوى و خالد عبدة حسن احمد شعبان
معهد بحوث ألأراضى والمياه والبيئة – مركز البحوث الزراعية – الجيزة –مصر

أجريت تجربة حقلية على أرض رملية طميية منزرعة بالفول السودانى (صنف جيزة6) بمنطقة القصاصين بمحافظة الاسماعلية خلال موسمي 2006 ، 2007 لدراسة التسميد بالكبريت المعدنى بمعدل 200كجم/فدان والرش ببعض العناصر الصغرى (الزنك والبورون والموليبدنيم) والتداخل بينهما على محصول الحبوب وجودتة وكذلك امتصاص بعض العناصر الكبرى والصغرى. كما اشتملت الدراسة على استبيان هذا التأثير على الجزء الميسر من بعض المغذيات فى التربة بعد الحصاد خلال الموسمين.

وتوضح الدراسة أن أرض التجربة رملية وفقيرة فى العناصر الغذائية ، تم تسميد الارض بسماد عضوى بمعدل 10م^3/فدان من سماد الدواجن قبل الزراعة باسبوع، وتم اضافة الاسمدة المعدنية NPK بالمعدلات الموصى بها ، حيث تم اضافة النيتروجين على صورة يوريا على ثلاث دفعات والفوسفور على صورة سوبر فوسفات قبل الزراعة والبوتاسيوم على صورة كبريتات البوتاسيوم قبل الزراعة.

ويمكن تلخيص النتائج المتحصل عليها كما يلى:-

1- ازدات قيم محصول حبوب الفول السودانى بالكجم/فدان نتيجة اضافة المعاملات المختلفة مقارنة بالكنترول ، كانت أعلى زيادة فى محصول الحبوب مع المعاملة (كبريت + زنك+ بورون)

2- ازدات نسبة الزيت والسكر والبروتين فى حبوب الفول السودانى نتيجة لاضافة المعاملات المختلفة ، وكانت أعلى زيادة فى هذه النسب عند المعاملة (كبريت + زنك+ بورون)

3-أعلى قيم لمحتوى العناصر الكبرى والصغرى فى حبوب الفول السودانى كانت عند المعاملة(كبريت + زنك+ بورون)

4-ازدادت قيم النتروجين والفوسفور والكبريت الميسرة فى التربة بعد الحصاد نتيجة لاضافة المعاملات المختلفة وكانت أعلى قيم للنتروجين والفوسفور والبوتاسيوم والكبريت (53، 5.77، 199، 6.04 ميللجرام/كجم تربة على التوالى) للموسم الثانى قد تم التحصل عليها نتيجة المعاملة (كبريت + زنك+ بورون)

5-أعلى قيم للزنك والبورون والموليبدنيم الميسرة بالتربة بعد الحصاد للموسمين ألاول (1.34، 1.17، 1.04 مجم/كجم تربة) والثانى (1.36، 1.19، 1.086 مجم/كجم تربة) تم التحصل عليها نتيجة للمعاملة(كبريت + زنك+ بورون)

Table (2): Yield and its components of peanut.

Treatments	Seed weight (g/plant)		100 seed weight (g)		Seed oil (%)		Seed yield (kg/fed)		Sugar (%)		Protein (%)	
	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007	2006	2007
Control	4.25	4.68	42	44	30.18	31.45	278	289	21.48	22.78	10.75	11.81
S	5.36	5.41	44	46	33.59	34.12	325	335	24.75	25.35	19.63	20.31
Zn	5.38	5.44	46	49	31.39	31.78	342	350	27.93	28.29	19.88	20.50
B	5.47	5.49	48	53	38.63	39.52	352	361	31.18	33.47	20.25	20.75
Mo	5.49	5.53	49	56	39.52	39.69	355	366	31.24	33.61	20.06	20.75
S+Zn	6.41	6.55	53	58	41.34	41.59	366	374	34.77	37.90	20.56	20.88
S+B	6.45	6.60	55	59	43.48	43.66	375	380	37.89	41.28	20.88	21.13
S+Mo	6.52	6.66	58	61	44.36	44.54	379	386	39.85	43.42	21.13	21.63
Zn +B	6.61	6.68	59	63	44.42	44.68	382	388	41.36	46.50	21.63	22.00
Zn + Mo	6.62	6.71	60	65	44.52	44.72	388	394	43.42	48.23	21.75	22.06
Zn + B + Mo	6.72	6.84	62	66	45.12	45.31	401	398	49.79	51.70	21.74	22.25
S + Zn + B	6.77	6.86	64	68	45.23	45.37	408	400	50.67	52.10	22.38	22.88
L.S.D. at 0.01	0.559	0.870	2.744	2.084	0.160	0.065	2.718	1.615	4.284	0.267	0.664	0.0301

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

Abd El-Kader, Mona G.

10742

10743

10744

10745

10746

10747

10748

10749

10750

10751

10752

10753

10754