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EFFECT OF SOME ORGANIC AND INORGANIC FERTILIZERS WITH SULPHUR ELEMENT ON YIELD OF CORN AND ITS INFLUENCE ON SOME SOIL PROPERTIES

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ABSTRACT

An experiment was conducted in field during 1999 and 2000 seasons in the experimental farm of Mallawy Agriculture Research Station, El-Menia Government to investigate the comparative effect of application of some organic fertilizers (filter mud cake FMC and farm yard manure FYM) or inorganic fertilizer (Ammonium nitrate 33.5% N Amm. nit.) at different levels, solely or with sulphur input on maize growth, yield, some nutrients uptake and soil pH. Three levels of each fertilizer sources were used, 1, 2 and 3 ton/fed. from FMC, 10, 20 and 30 m^3/fed. FYM and 60, 90 and 120 unit N/fed. Amm. nit. Elemental sulphur was added at levels of 0.0 (S_0) and 100 kg/fed. (S_1) to the sub-sub-plots.

The results revealed that a significant to highly significant increases in ears weight kg/plot and 100 grains weight g. with using different fertilizer sources, meanwhile plant height cm. remained unaffected. Significant to highly significant increases in leaves content of N%, P%, K% and Fe ppm of corn plants fertilized by FMC and FYM comparing with corn plants fertilized with Amm. nit., soil pH slightly affected due to using different fertilizer sources.

Regarding different fertilizers levels a significant to highly significant increases in 100 grain weight g., a pronounced increase in maize plant leaves content of N%, P%, K% and Fe ppm as a result of increasing fertility levels, highly significant reduction in soil pH was noticed when comparing using different fertilizers levels.

When comparing sulphur application treatments and without sulphur treatments, a highly significant variations were observed regarding plant height cm. and 100 grains weight g., sulphur application resulted in a highly significant increase in maize plant leaves contents of N%, P%, K% and Fe ppm, the use of sulphur as a soil amendment would increase the availability of these elements and evoke a plant response, sulphur application resulted in a highly significant reducing on soil pH compared with no sulphur treatments.

Keywords: Organic, Inorganic, Sulphur, Amendment.

INTRODUCTION

Organic amendments are known to have favourable effects on soil physical properties of soil. One of the effects most commonly cited is improvement the soil structure. Organic manures are well established to be involved in the fertilization plan in almost all the world. This may be due to the role of organic matter in improving physical, chemical and biological characteristics of soil as well as being a source for nutritional elements.

Saleh (1996) reported that application of FMC could successfully improve physical properties of both clay and sandy soils. However, higher rates of the material are needed in the case of coarse textured soils. Raman

et al. (1996) reported that the addition of pressumed cake to soil resulted in significantly higher grain and straw yields of sorghum crop.

Rameshwar and Singh (1998) reported that the direct effect of FYM during the first year of experimentation in maize improved the growth parameters like plant height, dry matter accumulation and ultimately effected on the grain yield of maize.

Sulphur is considered one of the essential elements for successful agriculture and its importance is frequently overlooked. The direct effect of sulphur on soil properties could be due to oxidation-reduction reactions related to sulphur which is considered a key for soil improvement. Sulphur application plays an important role in soil such as, reducing soil pH, improving soil water relations and increasing availability of nutrient elements, i.e. phosphorus, iron, manganese and zinc (Hilal, 1990; Hilal *et al.*, 1990; El-Fayoumy, 1996). Sulphur has proved to have an important role in increasing crop production under variable soil conditions. A correlation was observed between sulphur oxidizing activity and organic matter content. Barrow (1960) and Stewart *et al.* (1966) showed that the addition of organic materials and plant residues can greatly effect the process of sulphur mineralization.

The present work aims to study the effect of application of some organic fertilizer compared with mineral fertilizer solely or with sulphur on the plant growth and yield, the uptake of some nutrients by maize plant and the pH of soil.

MATERIALS AND METHODS

An experiment was done in field during 1999 and 2000 seasons in the experimental farm of Mallawy Agriculture Research Station, El-Menia Government using maize (*Zea mays* L.) to investigate the comparative effect of application of some organic nitrogenous amendments, i.e. filter mud cake (FMC) and farmyard manure (FYM) or inorganic nitrogenous fertilizer (Ammonium nitrate 33.5% N). Solely or with sulphur input on maize growth, yield, some nutrients uptake and soil pH.

The experiment design was split-split plot with four replications. The main plots were devoted to different fertilizer sources as follows:

Filter mud cake (FMC), farmyard manure (FYM) and Ammonium nitrate (33.5% N).

The sub-plots were assigned for three levels of each fertilizer sources as:

	C_1*	C_2* and C_3*		
FMC	1	2	3	ton/fed.
FYM	10	20	30	m^3/fed.
Ammn. nit.	60	90	120	unit N/fed.

* Different fertilizer levels.

The split-split-plots were assigned for elemental sulphur which added as follows:

S_0 without sulphur.

S_1 with 100 kg/fed. sulphur.

The area of each sub-sub-plot was 21 m^2, including 6 ridges, 6 m long, the two outer ridges were used as border.

Farmyard manure from Animal farm at Mallawy. Filter mud cake is a by-product of sugar industry from sugar cane Factory in Abo-Kurkas, El-Minia Government. It is largely composed of organic material mixed with inorganic (mineral) fraction. Table (1) show some chemical properties of FMC and FYM used in the treatments.

Table (1): Some chemical characteristics of organic amendment used in the study during the two growth seasons.

Organic amend-ment	Season	pH	Organic matter %	Total carbon %	Total N %	C/N	Avail. P ppm	Avail. K ppm
FMC	1st	6.60	37.92	21.92	1.44	15.3	3.9	145.5
	2nd	6.65	34.74	20.08	1.35	14.92	3.7	133.9
FYM	1st	6.85	14.50	8.38	0.47	17.82	0.39	128.0
	2nd	6.90	13.88	8.02	0.43	18.65	0.34	119.5

Soil properties were measured in six soil samples representing the used soil before receiving any treatments and shown as average in Table (2).

Table (2): Some physical and chemical properties of the soil used in the current study during the two growth seasons.

Season	Particle size distribution			Text-ure class	$CaCO_3$ %	Organic matter %	pH*	EC** DSm^{-1}	Available nutrients me/100g soil		
	Sand %	Silt %	Clay %						N	P	K
1st 1999	24.5	40.5	35.0	clay loam	2.10	1.18	7.8	0.80	34.0	5.4	1.6
2nd 2000	21.7	41.8	36.5	clay loam	2.35	1.26	7.9	0.92	36.9	6.5	1.55

* Soil: water suspension 1:2.5

** Soil: water extract 1:5.

Elemental sulphur, filter mud cake and farmyard manure treatments were added once during soil preparation. Also, superphosphate fertilizer was added during soil preparation at level of 60 unit P_2O_5/fed. potassium sulphate at level of 100 unit K_2O/fed. was added before the second irrigation.

Ammonium nitrate fertilizer was side dressed into two equal doses before the first and second irrigations.

Sowing date was at 25th of May using maize (Giza 2 cultivar), the other cultural practices were carried out as usual in maize fields.

Plant samples (leaves) were taken at the first of August for estimating some nutrient content.

At maturity stage twenty representative plants from the inner ridges of each sub-sub-plot were taken at random to record, plant height cm, ears weight/plot in kg and 100 grains weight, g.

After harvesting (25th of September) representing soil samples were collected to determined some soil properties at the end of the experiment.

Standard procedure for soil (Jackson, 1973) and plant analysis (Piper, 1967) were followed.

Statistical analysis was done according to the procedures outlined by Snedecor and Cochran (1967).

RESULTS AND DISCUSSION

The results obtained well be discussed under the following headings:

I. Growth studies:

1.1. Effect of fertilizer sources:

Regarding to the effects of nitrogenous sources, i.e. FMC, FYM or Ammonium nitrate on growth of *Zea mays* plants, it is clear from data in Table (3) that using FMC as nitrogen sources resulted in a significant to highly significant increase in ears weight/plot in kg compared with using FYM and Amm. nit. respectively in both seasons. A significant increase in 100 grains weight g. was noticed with using FYM compared with Amm. nit. treatments, whereas FMC treatments could not reach the level of significant in these case during both seasons. These results are in line with those obtained by Christodoulakis and Margaris (1996) on corn and Rameshwar and Singh (1998) on maize and wheat in sequence.

Plant height, cm. remained unaffected with using different nitrogenous sources in both season.

Table (3): Mean values of vegetative growth parameters and yield of *Zea mays* as affected by different fertilizer sources during the two growth seasons.

Plant parameters	Treatments			L.S.D.	
	FMC	FYM	Amm. Nit	0.05	0.01
	1st season 1999				
Plant height, cm.	202.33	201.94	201.83	N.S.	N.S.
Ears weight/plot in kg	17.79	16.67	14.58	1.644	2.491
100 grains weight in g.	28.79	29.68	26.93	2.053	3.110
	2nd season 2000				
Plant height, cm.	204.52	203.11	202.90	N.S.	N.S.
Ears weight/plot in kg	18.99	17.10	15.25	1.800	2.720
100 grains weight in g.	28.40	29.90	27.10	2.186	3.310

1.2. Effect of fertilizer levels:

Regarding to the effect of fertility levels as shown in Table (4) it is clear that 2nd and 3rd fertilizer levels resulted in a significant to highly significant increases in 100 grains weight g. respectively in both seasons, whereas plant height cm. and ears weight/plot in kg were slightly affected and could not reach the level of significant with using different fertility levels.

Table (4): Mean values of vegetative growth parameters and yield of *Zea mays* as affected by different fertilizer levels during the two growth seasons.

Plant parameters	Treatments			L.S.D.	
	C_1	C_2	C_3	0.05	0.01
	1st season 1999				
Plant height, cm.	200.27	204.68	201.14	N.S.	N.S.
Ears weight/plot in kg	16.52	16.40	16.12	N.S.	N.S.
100 grains weight in g.	28.01	28.25	29.14	0.822	1.110
	2nd season 2000				
Plant height, cm.	201.20	205.90	203.43	N.S.	N.S.
Ears weight/plot in kg	17.45	17.62	16.27	N.S.	N.S.
100 grains weight in g.	27.90	28.20	29.30	0.902	1.218

1.3. Effect of sulphur application:

With regard to the effect of sulphur application on growth of *Zea mays*, the obtained data in Table (5) revealed that application of sulphur, generally, increased maize growth, i.e. plant height cm. and 100 grain weight g. comparing with untreated plants. Highly significant variations were observed between sulphur application treatments and without sulphur treatments in both seasons regarding plant height cm. and 100 grains weight g. The obtained results are in agreement with those of Reneau and Hawkins (1980) whom observed that responses of corn to sulphur application generally occurred when sulphur concentrations in the leaf tissue were below 0.15% and added that responses also occurred with values as high as 0.22%. Gaines and Phatak (1982) on corn, soybean, tomato, cow pea tops and soybean roots, when found that sulphur fertilization increased growth characters of these crops when compared with the unfertilized treatment. The promotion effect of sulphur on growth of maize may be attributed to the effect of sulphur increasing the availability of certain plant nutrients notably phosphorus and several of micronutrients such iron, manganese and zinc (Abd El-Fattah *et al.*, 1984). Other similar results were reported by Morris *et al.* (1984) they mentioned that sulphur is one of many elements required for plant growth, it is important in the formation of protein and chlorophylls. Hilal and Abd El-Fattah (1987) stated that yield of barley dry matter per pot was shown to respond greatly to sulphur application in clay loam soil. Abd El-Fattah *et al.* (1990) stated that the yield of garlic increased with increasing the rates of applied sulphur and/or phosphorus.

Table (5): Mean values of vegetative growth parameters and yield of *Zea mays* as affected by sulphur treatments during the two growth season.

Plant parameters	Sulphur treatments		L.S.D.	
	S_0	S_1	0.05	0.01
	1st season 1999			
Plant height, cm.	197.42	206.64	3.810	5.145
Ears weight/plot in kg	16.23	16.46	N.S.	N.S.
100 grains weight in g.	27.68	29.25	0.982	1.326
	2nd season 2000			
Plant height, cm.	200.1	206.92	3.970	5.842
Ears weight/plot in kg	17.00	17.20	N.S.	N.S.
100 grains weight in g.	27.53	29.40	1.037	1.400

2. Some nutrients constituents in plant leaves:

2.1. Effect of fertilizer sources:

Concerning the effect of different fertilizer sources on nutrients content in maize plant leaves, the results in Table (6), clearly show significant to highly significant increases in leaves contents of N%, P%, K% and Fe ppm in maize plants fertilized by FMC and FYM respectively than leaves of maize plants fertilized by Amm. nit. during both seasons. The considerable increase in plant content of these elements with organic fertilizer treatments (FMC & FYM) than inorganic fertilizer treatments (Amm. nit.) is due to higher soil microbial and biological activity in FYM treated soil and highly increases in availability of nutrients in soil with using FMC. The obtained results was in harmony with the trends noticed by Singh *et al.* (1997).

Table (6): Average of some nutrients content in *Zea mays* leaves as affected by different fertilizer sources during the two growth seasons.

Components	Fertilizer sources			L.S.D.	
	FMC	FYM	Amm. Nit	0.05	0.01
	1st season 1999				
N %	1.464	1.348	1.193	0.1469	0.222
P %	0.262	0.241	0.193	0.022	0.0339
K %	1.439	1.561	1.321	0.0340	0.0516
Fe ppm	266.66	245.83	198.33	22.445	34.002
	2nd season 2000				
N %	1.508	1.400	1.187	0.1552	0.2343
P %	0.300	0.286	0.230	0.0441	0.0665
K %	1.50	1.61	1.392	0.0425	0.0645
Fe ppm	282.5	251.8	210.8	24.648	37.339

2.2. Effect of fertilizer levels:

Data in Table (7) reflect a pronounced increase in maize plant leaves content of N%, P%, K% and Fe ppm as a result of increasing fertility levels during both seasons. Using 3rd fertilizers level resulting a highly significant

increase in maize leaves content of these elements than using 1st level during both seasons. Significant to highly significant increases in maize plant leaves content of P%, K% and Fe ppm when comparing the use of 1st and 2nd fertilizer levels in both seasons.

Table (7): Average of some nutrients content in *Zea mays* as affected by different fertilizer levels during the two growth seasons.

Components	Fertilizer levels			L.S.D.	
	C_1	C_2	C_3	0.05	0.01
	1st season 1999				
N %	1.29	1.32	1.395	0.054	0.073
P %	0.218	0.231	0.248	0.006	0.008
K %	1.418	1.436	1.468	0.018	0.024
Fe ppm	222.5	235.83	252.5	6.244	8.432
	2nd season 2000				
N %	1.301	1.300	1.494	0.0609	0.0822
P %	0.260	0.271	0.285	0.0102	0.0154
K %	1.44	1.51	1.502	0.038	0.0514
Fe ppm	214.4	263.0	267.7	7.272	9.820

The combined effects of different fertilizer sources and levels on K% in *Zea mays* plant leaves are shown in Table (8), it clearly reveal that the highest K% in *Zea mays* leaves obtained from plants fertilized with the highest level of FYM fertilizer and the lowest K% in *Zea mays* leaves obtained from plants fertilized with Amm. nit. fertilizer during the two growth season. The obtained results reveal that the absorption of K was favoured by using FYM fertilizer and a pronounced increase in K absorption was noticed with using the highly fertilizer levels. This might be due to higher soil microbial and biological activity of FYM fertilizer which generally increases availability of K and several micronutrients.

Table (8): The combined effects of different fertilizer sources and levels on K% in *Zea mays* leaves during the two growth seasons.

Fertilizer levels	Fertilizer sources			Mean	L.S.D.	
	FMC	FYM	Amm. nit.		0.05	0.01
	1st season					
C_1	1.422	1.507	1.322	1.417		
C_2	1.415	1.57	1.323	1.436		
C_3	1.48	1.605	1.317	1.467		
Mean	1.439	1.560	1.30		0.031	0.042
	2nd season					
C_1	1.401	1.572	1.374	1.449		
C_2	1.525	1.626	1.395	1.515		
C_3	1.563	1.655	1.40	1.539		
Mean	1.496	1.617	1.389		0.039	0.051

2.3. Effect of sulphur application:

Data presented in Table (9) revealed that application of sulphur, clearly show a highly significant increase in maize plant leaves contents of N%, P%, K% and Fe ppm than leaves of maize plants untreated with sulphur. Sulphur plays an important role in the availability of N, P, K and micronutrients. Concerning the effect of elemental sulphur application on P availability, Khater (1981) showed that application of sulphur generally increased available P in alluvial soil. Shadfan and Hussen (1985) found a significant increase in $NaHCO_3$ extractable P from 10-13.5 ppm by applying 500 ppm S and 8 weeks of incubation in a loamy sand soil. Heter (1985) indicated that most of the added P to calcareous soil will be fixed as unavailable form for plants uptake due to alkalinity reaction of the soil. He found that the addition of sulphur and H_2SO_4 increase the availability of P. Abd El-Samad *et al.* (1990) found that available P increased with the addition of sulphur. Effect of elemental sulphur on the availability of micronutrients was studied by many investigators. They explained the indirect effect of sulphur in soil by its conversion to the sulphoric acid which has a solvent action for several important micronutrients. Babaria and Patel (1980) found that the addition of 8 ppm sulphur to black clayey calcareous soil has significantly increased the availability of Iron. Yousry *et al.* (1984a,b) found that DTPA extractable Fe and Mn increased in the treatments receiving elemental sulphur. The same results were obtained by Dawood *et al.* (1985) in calcareous soil. Abd El-Fattah and Hilal (1985) found that the use of sulphur as a soil amendment would, in case of Fe, Mn, Zn and Cu deficient soils, increase the availability of these elements and evoke a plant response.

Table (9): Average of some nutrients content in *Zea mays* leaves as affected by sulphur treatments during the two growth season.

Components	Sulphur treatments		L.S.D.	
	S_0	S_1	0.05	0.01
	1st season 1999			
N %	1.283	1.387	0.473	0.0639
P %	0.214	0.250	0.0056	0.0075
K %	1.395	1.486	0.0315	0.0426
Fe ppm	218.61	255.27	5.661	7.645
	2nd season 2000			
N %	1.328	1.402	0.0556	0.0751
P %	0.250	0.294	0.009	0.012
K %	1.447	1.554	0.0613	0.0827
Fe ppm	237.63	259.1	6.933	9.361

The combined effects of different fertilizer sources and sulphur treatments on K% in *Zea mays* plant leaves are shown in Table (10), it clearly reveal that the highest K% in *Zea mays* leaves was obtained from *Zea mays* plants fertilized by FYM and treated with sulphur, whereas lowest K% obtained from *Zea mays* plants fertilized by Amm. nit and without sulphur

addition during the two growth seasons. The obtained results reveal that the absorption of K was favoured by using both FYM fertilizer and sulphur addition. Which both increase the availability of K to plants.

Table (10): The combined effects of different fertilizer sources and sulphur treatments on K% in *Zea mays* plant leaves during the two growth seasons.

Sulphur treatments	Fertilizer sources			Mean	L.S.D.	
	FMC	FYM	Amm. nit.		0.05	0.01
	1st season					
S_0	1.435	1.515	1.235	1.395		
S_1	1.441	1.606	1.406	1.484		
Mean	1.438	1.560	1.320		0.0546	0.0738
	2nd season					
S_0	1.49	1.55	1.34	1.46		
S_1	1.52	1.67	1.45	1.546		
Mean	1.505	1.61	1.39		0.0611	0.0803

The combined effects of different fertilizer and sulphur levels on P% in *Zea mays* leaves are shown in Table (11), it clearly reveal that the highest P% in *Zea mays* leaves was obtained from *Zea mays* plant leaves fertilized with highest fertilizer levels (C_3) and treated with sulphur. In the same time the lowest P% in *Zea mays* leaves was obtained from *Zea mays* plant leaves fertilized by lowest fertilizer levels without sulphur addition during the two growth seasons. It means, that there was accumulative effect of both highest fertilizer levels and the influence of sulphur addition, this may be due to the role of sulphur and highest organic fertilizer levels in reduction soil pH and improving P availability.

Table (11): The combined effects of different fertilizer and sulphur levels on P% in *Zea mays* plant leaves during the two growth seasons.

Sulphur levels	Fertilizer levels			Mean	L.S.D.	
	C_1	C_2	C_3		0.05	0.01
	1st season					
S_0	0.20	0.21	0.22	0.21		
S_1	0.23	0.249	0.27	0.249		
Mean	0.215	0.229	0.245		0.0097	0.0131
	2nd season					
S_0	0.23	0.251	0.277	0.250		
S_1	0.266	0.286	0.330	0.29		
Mean	0.248	0.268	0.303		0.0105	0.0365

3. Soil pH as affected by different fertilizer sources, levels and sulphur treatments:

3.1. Different fertilizer sources:

Regarding to the effects of fertilizer sources, i.e. filter mud cake, farmyard manure or ammonium nitrate (33.5% N) on soil pH, it is clear from data in Table (12) that no significant variations were observed comparing using the different three sources. Soil pH level slightly affected due to using different fertilizer sources and could not reach the level of significance during both seasons.

3.2. Different fertilizer levels:

Regarding to the effects of different fertilizer levels on soil pH, it is clear from data in Table (12) that 3rd fertilizers level resulted in reducing soil pH. Highly significant reduction were observed when comparing 1st and 3rd fertilizer levels during both seasons. Meanwhile, when comparing 1st and 2nd fertilizer levels the reduction in soil pH was highly significant during first season only and slightly decrease in second season.

3.3. Sulphur application:

Regarding to the effect of sulphur application on soil pH, it is clear from data in Table (12) that highly significant variations were observed when comparing sulphur application treatments and with no sulphur treatments during both seasons, addition of sulphur to soils caused a decrease in soil pH.

Table (12): Average values of *Zea mays* soil pH as affected by different fertilizer sources, levels and sulphur treatments during the two growth seasons.

Season	Treatments							
	Fertilizer sources			Fertilizer levels			Sulphur treatments	
	FMC	FYM	Amm. nit 33.5%	b_1	b_2	b_3	S_0	S_1
1st season	7.617	7.643	7.625	7.661	7.612	7.612	7.685	7.572
LSD 0.05	N.S.			0.0265			0.0251	
0.01	N.S.			0.0359			0.0339	
2nd season	7.66	7.64	7.65	7.68	7.65	7.62	7.70	7.60
LSD 0.05	N.S.			0.0443			0.0302	
0.01	N.S.			0.0598			0.0407	

The obtained results are in agreement with those of Jones (1982), Heter (1985), Shadfan and Hussen (1985), Abd El-Fattah *et al.* (1990) indicated that sulphur application resulted in reducing soil pH, the rate of pH reduction was affected by the period of incubation and the amount of applied sulphur. Also, Dawood *et al.* (1990) found that soil pH decreased significantly by sulphur treatments while organic matter failed to cause a change in soil pH in calcareous soil.

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أثر بعض الأسمدة العضوية والمعدنية مع الكبريت المعدنى على محصول الذرة الشامية وأثرها على بعض خواص التربة

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أجريت تجربة فى المزرعة البحثية بمحطة البحوث الزراعية بملوى فى موسمى ١٩٩٩ ، ٢٠٠٠ تم دراسة استخدام الأسمدة العضوية (طينة المرشحات والسماد البلدى) أو الأسمدة المعدنية (نترات النشادر ٣٣,٥% ن) عند ثلاث مستويات مختلفة مع استخدام أو بدون الكبريت الزراعى .

كان تصميم التجربة قطاعات منشقة مرتين . وكانت معاملات التجربة كالتالى :

الوحدات الرئيسية (مصدر السماد)	الوحدات الشقية الاولى (مستوى السماد)	الوحدات الشقية الثانية (معاملات الكبريت)
١- طينة المرشحات	١ ، ٢ ، ٣ طن / ف	بدون كبريت ١٠٠ كجم/ف
٢- السماد البلدى	١٠ ، ٢٠ ، ٣٠ م٣/ف	،، ،، ،،
٣- نترات نشادر ٣٣.٥% ن	٦٠ ، ٩٠ ، ١٢٠ وحدة ن/ف	،، ،، ،،

أوضحت النتائج المتحصل عليها الآتى :

١ - كان لاستخدام مصادر التسميد العضوى تأثير ايجابى على كل من وزن الكوز للقطعة ووزن مائة حبة بينما لم يتأثر ارتفاع النباتات بذلك معنوياً . ايضاً تلاحظ حدوث زيادة معنوية فى محتوى أوراق نباتات الذرة الشامية من كل من النسبة المئوية للنيتروجين والفوسفور والبوتاسيوم ومحتواها من الحديد جزء فى المليون بالمقارنة بمعاملات السماد المعدنى نترات النشادر، ويعزى ذلك الى ارتفاع وشدة النشاط الميكروبى والبيولوجى فى حالة التربة المسمدة بالسماد البلدى وتأثير طينة المرشحات على زيادة صلاحية العناصر للإمتصاص عنه فى حالة السماد المعدنى نترات النشادر . لم يتأثر رقم الحموضة بالتربة معنوياً باختلاف مصدر السماد المستخدم فقد كان التأثير خفيف .

٢ - تلاحظ عند مقارنة أثر استخدام مستويات سمادية مختلفة حدوث زيادة معنوية الى عالية المعنوية فى وزن مائة حبة ، أيضاً حدوث زيادة مضطردة فى محتوى أوراق نباتات الذرة الشامية من كل من النسبة المئوية للنيتروجين والفوسفور والبوتاسيوم ومحتواها من الحديد جزء فى المليون ، أيضاً حدوث انخفاض عالى المعنوية فى رقم الحموضة للتربة عند استخدام المستوى المرتفع من الأسمدة .

٣ - تلاحظ أنه باستخدام الكبريت ومقارنته بالمعاملات التى لم يتم اضافة الكبريت معها حدوث زيادة عالية المعنوية فى ارتفاع النباتات ووزن مائة حبة ، ايضاً نتج عن اضافة الكبريت زيادة عالية المعنوية فى محتوى أوراق نباتات الذرة الشامية من كل من النسبة المئوية للنيتروجين والفوسفور والبوتاسيوم ومحتواها من الحديد جزء فى المليون ، ونتج أيضاً عند اضافة الكبريت انخفاض عالى المعنوية فى رقم الحموضة للتربة عنه فى حالة عدم اضافة الكبريت لها .

٤ - استخدام الكبريت المعدنى كمصلح للتربة يعمل على زيادة يسرة العناصر الغذائية بها ومواجهة احتياجات النبات منها .