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Response of onion *(Allium cepa L.)* plants to peanut compost and sulphur fertilizer.

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Abstract: Two field experiments were conducted to evaluate the effects of Sulphur rate without and with peanut compost Onion (*Allium cepa L.*) yield quantity and quality, under drip irrigation system, during 2012 and 2013 seasons. Experiments were carried out in the Research and Production Station, National Research Centre, El-Nobaria Site, Beheara Governorate, Delta Egypt. Sulphur fertilizer was applied at rates of 0, 100, 200 and 300 kg fed^{-1} after planted and Peanut compost application at 20 ton fed^{-1}. The obtained results could be summarized in the following:
Growth and yield parameters were significantly increased by application of peanut compost. Plant height, bulb diameter, Fresh weight, Dry weight and bulb yield were significantly increased by increasing of Sulphur rate. The combination between Sulphur at 300 kg fed^{-1} and peanut compost at 20 ton fed^{-1} gave the highest growth and production as well as minerals composition (N, P, K, S, Fe, Mn, Zn and Cu) compared to other treatments.
Key words: Composts- Onion - Organic matter - Peanut compost - Sulphur.

Introduction

Onion (*Allium cepa L.*) is one of the most important vegetable crops grown in Egypt and increasing the production of good quality of onion, under the Egyptian environmental condition, is an important target by the growers to fulfill the export and local market requirements [1]. The total cultivated area was 36153 Fadden and the total production was 305201 tons [2]. The average bulb yield fed^{-1} in Egypt is still in need to be improved to face the increasing demand of onion. Mineral fertilizers play an important role of onion plant growth and productivity.

Sulphur (S) is one of 16 elements essential for crop growth. Although sulphur is considered a secondary nutrient, it is often called the fourth major nutrient ranking just below nitrogen, phosphorus, and potassium. Deficiencies of sulphur in crop production are increasing worldwide. Modern agriculture requires adequate fertilization of sulphurto achieve maximum crop yield and performances. Plants use sulfate,the oxidized form of sulfur existing in the soil, as a sulphursource[3, 4].

Sulphur is essential for many plant functions. Some of them are: A structural component of protein and peptides, active in the conversion of inorganic N into protein, a catalyst in chlorophyll production, a structural component of various enzymes and structural component of the compounds that give the characteristic odors and flavors to onion. Some studies have shown that S supply influences bulb yield, plant dry matter and flavor intensity in onion crop [5].

Abdel- Fattah *et al.*[6] and HalaKandil*et al.*[7]found that the addition of sulphur to soils caused a decrease in soil pH, the rate of decrease was increased with the rate of sulphur application, soil type and sulphur oxidizing bacteria.

Indraini-Das et al.[8] and Singh and Mann [9] indicate that macronutrients and micronutrients availability were increased with increased rate of sulphur and that's dependent upon soil type and rate of sulphur added.

Sandy soils in Egypt are characterized with poor nutrients (including macronutrients and micronutrients) and unfavorable environmental conditions which negatively affect growth and productivity of vegetables including onion plants[10]**.**

Organic materials such as crop residues, farmyard manure, town refuses, rice straw, cotton stalks, water hyacinth compost, peanut compost, banana waste are available in abundance and reach tremendous amounts day after day. Accordingly, it seems logic to utilize by such residues through some types of profitable activities instead of their acting as environmental pollutants. Addition of composts improves soil chemical and physical properties. Increasing soil water holding capacity and improves soil structure and aggregates. Chemical properties including, decreasing soil pH, increasing of cation exchange capacity and enhance of the availability of the most nutrients which are important for plant growth and agricultural production. Application rate in addition with chemical fertilization ranged between 10 to 20 tons per Fadden[11, 12]**.**

The aim of this subject is to do a comparison within using different Sulphur rate without or with peanut compost and study their effects on the growth, bulbs yield and it's some nutrients status.

Materials and Methods

Soil analysis:-

Physical and chemical properties of El-Nobaria Soil were determined and particle size distributions along with soil moisture were determined as described by Klute[13.] Soil pH, EC, cations and anions, organic matter, $CaCO_3$, total nitrogen and available P, K, Fe, Mn, Zn, Cu were run according to Black *et al.*[14]**.** Some physical and chemical properties of El-Nobaria soil are shown in Table (1)

Table (1): Some physical and chemical properties of the used soil at El-Nobaria, Research and Production Station, National Research Centre.

Soil property	**Particle size distribution %**				**Soil moisture constant %**			
Physical	**Sand**	**Silt**	**Clay**	**Texture**	**Saturation**	**FC**	**WP**	**AW**
	68.7	**24.5**	**6.8**	**S L**	**32.0**	**19.2**	**6.1**	**13.1**
Chemical	**pH[a]**		**EC[b]dS/m**		**$CaCO_3$ %**		**OM [c] %**	
	7.8		1.8		3.07		0.16	
	Soluble cations (meq/l)				**Soluble anions (meq/l)**			
	Ca^{++}	**Mg^{++}**	**K^+**	**Na^+**	**$CO_3^=$**	**HCO_3^-**	**Cl^-**	**$SO_4^=$**
	3.00	2.00	0.32	2.09	0.00	1.41	0.70	5.30
	Total		**Available**		**Available micronutrients**			
	N		**P**	**K**	**Fe**	**Mn**	**Zn**	**Cu**
	mg/100 g soil				**ppm**			
	15.0		9.4	16.0	7.8	3.3	1.86	4.0

a: Soil pH was measured in 1:2.5 soil-water suspension, b: EC was measured as dSm^{-1} in soil paste, S L: sandy loam c: organic matter.

Peanut compost was prepared by the method of Abdel Moez and Wanas, [15.]Some properties of the prepared compost are presented in Table (2).

Table (2): Some chemical properties of peanut compost.

O.M %	Total N %	C/N ratio	pH (1:2.5)	EC dsm^{-1}	Available nutrients %		DTPA- extractable (ppm)			
					P	K	Fe	Mn	Zn	Cu
36.18	1.40	25.84	6.4	0.63	1.58	0.98	32.2	9.4	11.5	1.3

Two field experiments were conducted in Research and Production Station, National Research Centre, El-Nobaria, Beheara Governorate, Egypt under drip irrigation system at 2012 and 2013 growth seasons to evaluate the effect of different element sulphur rate with or without peanut compost on growth parameters, bulb yield, oil content and composition as well as nutrient statues of onion plants. each experiment included eight treatments which were the combinations of four rats of sulphur (0, 100, 200 and 300 kg fed^{-1}). Peanut compost added in half treatments before planting at 20 ton fed^{-1}. The design of every experiment was complete randomized block with four replications and plot area 21 m^2 (4.2 X 5.0 m). Each plots contents of six row and space between plant 50 cm. Calcium super phosphate (15.5% P_2O_5) at 150 kg fed^{-1} and potassium sulphate (48% K_2O) at 50 kg fed^{-1} were added prior to planting as is customary for the region. Nitrogen fertilizer was applied in the form of ammonium nitrate (33.5% N) in two parts. The first part was applied after 30 days from planting and the second one month later. All the plants received natural agriculture practices whenever they needed.

Seedling of the onion cultivar Giza 20 (yellow) were transplanted 10 cm on the first week of October and growth parameters recorded after 45 days from transplanting, according to FAO [16]**.** Harvested after 130 days from transplanting yield parameters were determined according to Gabal*et al.* [17]**.** The obtained data were statistically analyzed according to Sendcor and Conchran[18]**.**

Results and Discussion

Data in Table (3) show that effect of different sulphur rate without or with peanut compost on growth parameters of onion plant such as plant height, leaf number per plant, bulb diameters fresh and dry weight. The plant height was significantly increased at 100, 200 and 300 kg Sulphur per Fadden were applied compared with control whether if you add or not to add compost. This increase was higher with peanut compost compared with Sulphur application alone. These results were in accordance with those obtained by Rizk et al**.,** [19].

Table (3): Effect of sulfur rate without compost or with peanut compost on growth and yield of onion (means two seasons).

Treatments Sulfur (kg/fed.)	Plant Hight (cm)	Leaf No./ plant	Bulb diameter (cm)	Fresh weight (g/plant)		Dry weight (g/plant)	
				Leaf	bulbs	Leaf	bulbs
Without compost							
Control	55.3	6	3.72	30.43	57.91	2.34	8.36
100	58.4	7	4.23	37.64	91.07	2.76	13.87
200	65.1	8	4.88	43.29	98.83	3.86	15.84
300	68.6	8	5.36	45.83	105.34	3.99	17.67
L.S.D at 5%	0.86	0.08	0.12	0.89	0.99	0.20	0.19
With 20 ton fed^{-1} compost							
Control	57.3	7	3.97	33.81	63.82	2.61	9.21
100	61.6	9	4.68	39.79	97.44	2.92	14.85
200	69.7	10	5.45	49.22	109.98	4.01	17.33
300	72.8	10	6.47	51.11	112.26	4.48	18.92
L.S.D at 5%	0.78	1.09	0.14	0.28	0.35	0.17	0.23

Data clear that all vegetative growth parameters were significantly response to increasing the rate of elemental sulphur 100, to 300 kg fed^{-1}.These results were true in both growing seasons. The highest values were obtained in plants treated sulphur at 300 kg fed^{-1} with 20 ton fed^{-1} peanut compost. These results are in harmony with those obtained by HalaKandil and Nadia Gad [20]**.** They showed that increasing sulphur rates in plant media from 50 up to 300 kg fed^{-1} increased canola growth and oil seed yield as well as seed quality.

The obtained data in Table 3 show that application of peanut compost at 20 ton per Fadden combine with Sulphur gave positive significant effect on fresh and dry weight of onion. The lowest values of bulb fresh and dry weight recorded at control treatment without peanut compost followed by control with 20 kg fed^{-1}peanut compost. The highest value of bulb fresh and dry weight (112.26, 18.92 g per plant) obtained at 300 kg Sulphur per Fadden with 20 ton per Fadden peanut compost respectively. These results are harmony with those obtained byRizk et al., [19]**.**

Result in Fig (1) show that all Sulphur rate increased the bulb yield and the biggest increase at 300 kg sulphur per Fadden with 20 ton peanut compost per Fadden. Results also showed that the relative calculate values as percentage from control. Increased sulphur rate from 100 to 300 kg/fed^{-1} without compost and with peanut compost lead to increase in bulb yield percentage 8.57, 20.7and 40.9%, 10.8, 27.1 and 44.0% respectively. These results are in agreement with those reported by Rizk et al., [19]**.**

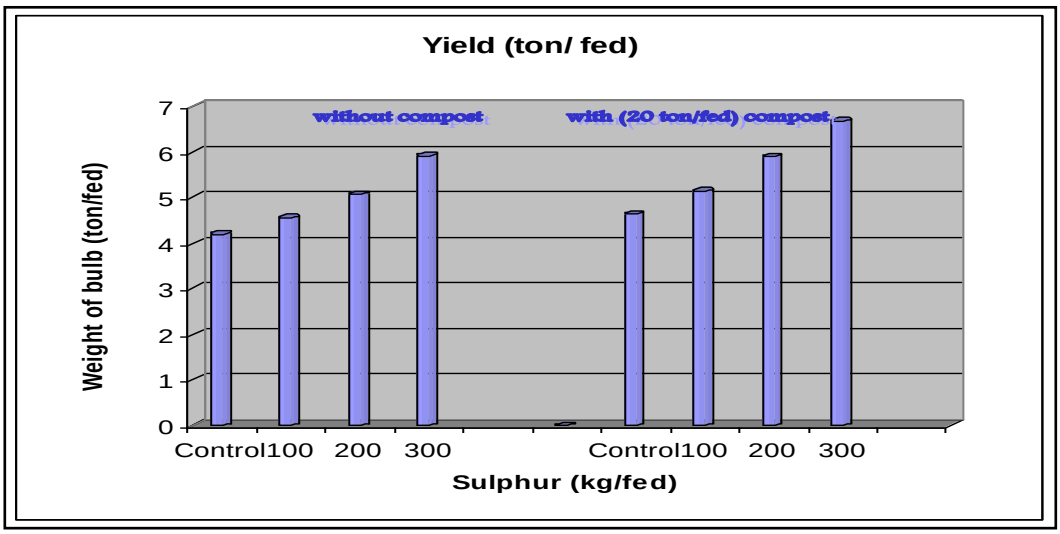

Fig. (1): Effect of sulfur rate without compost or with peanut compost on yield of onion (means two seasons).

Data present in Table (4) show that, all Sulphur rate significantly increased the content of macronutrients (N, P, K and S) and micronutrients (Fe, Mn, Zn and Cu) as compared with control plants. The highest values of N, P, K and S (0.55, 0.36, 0.51 and 5.7 % respectively) and Fe, Mn, Zn and Cu (132, 85.8, 42.1 and 14.7 ppm respectively) were obtained at 300 kg Sulphur with 20 ton peanut compost per Fadden. The lowest values were found at control without peanut compost. These results are agreement with those obtained by Geries, [21] he found that foliar spraying of onion plants with humic acid at the rate of 2 kg fed^{-1} at 60, 80 and 100 days after transplanting markedly increased vegetative growth (plant hight, number of leaves per plant, bulb diameter, fresh and dry weights of whole plant) bulb yield and its components (average bulb weight, marketable bulbs yield, culls bulb weight and total bulbs yield), onion quality (bulb diameter total soluble solids (%) and dry matter content) and chemical composition in both seasons.

Table (4): Effect of sulfur rate without compost or with peanut compost on macronutrients and micronutrients contents of onion (means two seasons).

Treatments Sulfur (kg/fed.)	Macronutrients (%)				Micronutrients (ppm)			
	N	P	K	S	Fe	Mn	Zn	Cu
Without compost								
Control	0.39	0.21	0.38	1.0	125	56.7	30.2	9.1
100	0.41	0.22	0.40	2.5	131	75.1	34.6	10.0
200	0.45	0.24	0.42	3.9	136	78.3	38.8	11.6
300	0.48	0.27	0.48	4.4	139	80.2	41.0	12.7
L.S.D at 5%	0.038	0.037	0.037	0.37	1.88	1.43	1.60	0.39
With 20 ton fed^{-1} compost								
Control	0.46	0.23	0.40	1.1	121	68.0	33.1	10.2
100	0.49	0.25	0.43	2.7	124	80.3	36.2	11.1
200	0.51	0.28	0.45	4.1	127	83.1	39.7	13.5
300	0.55	0.36	0.51	5.7	132	85.8	42.1	14.7
L.S.D at 5%	0.041	0.039	0.045	0.29	2.49	0.69	0.67	0.43

Conclusion:

The addition of Sulphur leads to increase in onion growth as well as the quantity and quality of yield at the usual amount of fertilizer. Peanut compost application enhances all growth and yield parameter of onion. Sulphur at 300 kg fed^{-1} with peanut compost at 20 ton fed^{-1} gave the highest growth, bulb yield, macronutrients and micronutrients contents.

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