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Effect of farmyard manure, sulphur and humic acid fertilization on Onion productivity.

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Abstract

In order to determine the effect of farmyard manure (FYM), sulphur (S), humic acid (H) fertilization and their interactions on growth, chemical composition, yield and quality of onion plants cv. Italian Red, two experiments were conducting during 2013/2014 and 2014/2015 successive winter seasons at the Experimental Station of Agriculture College, Mansoura Univ., Egypt. The main obtained results could be summarized as follows:
FYM addition at the rate of $20m^3$ gave higher values than $10m^3$ addition in all studied characteristics except crude fiber %, NO_3-N (ppm) and bulb moisture% in both seasons.
Sulphur fertilizer at 200kg/fed. caused superiority in the same studied parameters except crude fiber% , NO_3-N ppm and bulb Moisture % in both seasons.
Humic acid fertilizer at the rate of 15 kg /fed. achieved highest values comparing to other treatments in all estimated parameters in both seasons except crude fiber%, bulb moisture% in both seasons and NO_3-N (ppm) in the second season.
The interaction among $20m^3$ FYM, 200kg/fed. sulpher and 15 Kg/fed. humic acid gave significant increases in dry weight (g/plant), plant height (cm), chlorophyll a+b (mg/g Fw), crude protein %, total carbohydrates%, TSS% , sulpher volatile oil% and total yield (t/fed.), but NO_3-N (ppm) accumulation was decreased in both seasons.

Keywords: Onion, FYM, sulpher, humic acid, vegetative growth parameters, yield, quality

Introduction

Onion (*Allium cepa* L.) is one of the most important vegetables in the world. It can be eaten fresh, fried, roasted or boiled. It also used for, spice or medicinal purposes. It contains vit. A, iron and calcium, also it reduces blood sugar. Average area in Egypt was about 127008 fed. with an average of 16.5 ton bulb/fed. (FAO. 2013.)

Farmyard manure is one of the traditional organic manure for improving soils properties, either physical or chemical and biological besides conserving water holding capacity. Its effect may be directly in increasing crop yield by supplying some nutritional elements in available forms, or indirectly throughout biological decomposition **(Marschener., 2012)**

Soil structure affects by continuous usage of inorganic fertilizer. So, organic manures can use as a partial substitution to mineral fertilizers (**Naeem *et al.*, 2009).** Organic sources of plant nutrients are considered as an important factor for onion production (**Funda *et al.* 2011).**

Abdel Naby *et al*. (2012) found that FYM addition in present of recommended dose of NPK fertilizer caused significant increments in onions vegetative growth

parameters, total yield and decreased NO_3 and NO_2 content. **Yohannes *et al.* (2013)** revealed that farmyard manure significantly influenced onion plant height, leaves number and length, maturity, bulb weight and yield. But, diameter of leaf, bulb length and diameter as well as unmarketable yield were not affected by FYM application.

Bashir *et al.* (2015) found significant effect of variety and organic fertilizers on onion bulb measurements and total yield.

Sulphur is one of the essential elements needed for plant growth; it is ranking just after nitrogen, phosphorus and potassium. It is important for the formation of some amino acids, oils and proteins and it is a structural component of protoplasm; and forming of certain enzymes and vitamins. **(Hitsuda *et al.* 2005)**

Onions need higher amount of S **(Porto *et al.* 2007**. Sulphur fertilization also affect bulb pungency, that is defined as the combination of flavor and a dour, which are functions of the concentrations of thiosulphonic and sulphonic volatile acids containing S **(Schunemann *et al.* 2006).**

Many investigators reported that vegetative growth characteristics of plant were greatly affected with sulpher application. height of Plant, fresh as well as dry weights and leaves number /plant were increased by sulphur application (**Poornima, 2007; Hafiz and mohamoud, 2008; Al- Fraihat, 2009 on onion and Farooqui *et al.* 2009 on garlic).**

Humic acid plays an important role in improving soil pH which reflected on elements availability to absorb by plant roots and consequently improve plant growth and productivity (**Marschener, 2012**).

Humic acids can reduce evaporation of. Also, it increases soil water holding capacity, permeability of the plant membranes and intensify enzyme systems of plants. It enhance cell division, root growth, and decrease stress deterioration. Under the effect of humic acids, plants grow more stronger and acquire best resistance of plant diseases. Humates reduce soil erosion by increase cohesive forces of the fine soil particles. They enhance the soil structure, especially physical properties by increasing buffening qualities and exchange capacity; enhance chelation of many nutrients and make them more available for plants. It also used in the case of the negative effect of salt that would inhibit the growth of plants and uptake of nutrients. It is commonly use as major component of bio-stimulant formulations such as cytokinin and auxine **(Mai, 2015).**

Geries (2013) and Bettoni *et al.* (2016) reveled that using foliar application or addition with humic acid of onion plants markedly increased growth, bulb yield, quality and chemical constituents.

Therefore, the purpose of this research is to study the impact of different rates of FYM, sulphur, and humic acid fertilization to get the best and highest productivity and quality of onion bulbs.

Materials and Methods

This experiment was done during 2013/2014 and 2014/2015 two successive winter seasons at the Experimental Station Mansoura Univ., Egypt to evaluate the effect of two FYM levels, three levels of sulphur and three humic acid addition either solely or in combination with each other on vegetative growth, chemical composition, yield, and quality of Onion plants c.v. taliany red.

The experimental design was strip split plot with three replicates. Each experiment consists of 18 treatments comprising FYM rates *i.e.*10 and 20 m^3/fed., three levels of sulphur; *i.e.* 0, 100 and 200 kg/fed. and three rates of humic acid*; i.e.* 5, 10 and 15 kg /fed. FYM treatments were randomly set in the vertical plots, the rates of sulphur were randomly arranged in the horizontal plots and humic acid levels were in the sub-plots. Each treatment consists of three replicate; thus, the total experimental plots number were 54. Total amount of FYM, sulphur and humic acid were added at soil preparation.

The unit area of the experiment was 10.8 m^2 and it contained three ridges 6m each long and wide. Onion seedlings were transplanted into the field on 30 and 24 November in the first and second seasons, respectively. All plants were fertilized with 45 kg P2O5, 80 kg N and 50 kg K_2O /fed. (the recommended doses) The studied doses divided into two equal parts; the first was after 20 days from transplanting date and the other one was month later in both seasons of study. Other agricultural and horticultural practices were adopted as a Ministry of Agriculture recommendation.

Mechanical and chemical analysis of soil, FYM and humic acid:

Samples from experimental soil were randomly taken before planting at the depth of 0 – 30 cm from soil surface to evaluate the mechanical and chemical soil properties as shown in Table 1.

Table 1: The experimental soil mechanical and chemical properties:

seasons	Mechanical analysis (%)				Texture class	OM (%)	SP (%)	CaCO$_3$%	E.C dS.m^{-1} 1:5	pH (1:2.5)	Available (ppm)		
	Clay sand	Fine Sand	silt	clay							N	P	K
1st	4.5	29.6	36.5	29.4	SCL	1.69	39.4	3.47	1.03	8.11	45.3	5.47	228
2nd	4.7	32.4	34.6	28.3	SCL	1.58	37.8	3.71	0.94	8.16	43.9	5.18	205

*Soil suspension (1:2.5) ** Soil extraction (1:5)
OM%: Organic matter SP%: Saturation percentage E.C: Electrical conductivity

Table 2: Chemical analysis of used FYM:

properties	OM%	C%	N%	C/N ratio	P%	K%	PH	EC m.mohs/cm
FYM	39.8	23.1	0.79	18.2:1	0.38	0.47	6.03	4.38

Table 3: Humic acid Chemical analysis:

Characteristics	Values	Macro-elements	Values (%)	Micro-elements	Values (ppm)
EC (ds/m^{-1})	1.13	Total N	2.14	Total Fe	3.93
pH	2.70	Total P	0.27	Total Zn	2.30
OM (%)	52.03	Total K	3.16	Total Mn	1.68
Carbon	30.25				
C / N	14 : 1				

Data Recorded:

After ninety days from transplanting date, 10 plants samples were randomly taken for each experimental unit to determine the following measurements:

Vegetative growth:

1- Plant fresh weight (g)
2- Plant dry weight (g)
3- Plant height (cm)
4- Leaves number /plant.

Chemical composition:-

1- **Chlorophyll content** was measured using the method described by **Goodwine (1965).**

2- **Total nitrogen**, **phosphorus and Potassium** leaves content in the of onion plant was detected using the method modified and described by **Jones *et al*. (1991)**

Yield and Quality measurements:

Bulbs of each plot were harvested at the maturity stage, and then the following parameters were recorded.

1- Carbohydrates%: It was measured in bulb of onion plant due to the method described by **Hedge and Hofreiter (1962).**

2- Sugar%: Total soluble sugar in bulb was determined using the method described by **Hedge and Hofreiter (1962).**

3- Vitamin C (mg/100g): It was estimated in onion bulbs using the method reported in **AOAC (2000).**

4- Crude protein %: Crude protein in each bulb sample was calculated by multiplying the total N by 6.25 **(AOAC 2000)**.

5- NO_3-N ppm: Nitrate content in bulb was determined using the method reported by **Singh (1988)**.

6-Total soluble solids percentage (TSS %): in bulb of onion was determined by using Hand Refractometer.

7- Crude fiber (%): in bulb of onion, it was determined according to the method described by **(AOAC, 2000)**

8- Volatile Sulfure content (%): in onions was determined according the method described by **Hans (1935).**

9- Moisture %: 5 g of each air-dried powder sample were accurately weighed using porcelain crucible, and then dried at 105° C until constant weight in an oven. The weight loss was calculated as percent moisture using the method described in **AOAC (2000)**

10- Total bulb yield: It was estimated as total weight of bulb of onion (ton/ fed)

Statistical analysis:

Obtained data were statistically analyzed using the analysis of variance (ANOVA) technique for the strip split – plot design. Means of all treatments were compared using method of least significant difference (LSD) at probability of 5 % according to the procedure described by **Gomez and Gomez (1984)**.

Results and Discussion

Effect of FYM:

Table 4 shows that FYM addition in rate of 20 m^3 gave significant increments in vegetative growth characteristics *i.e*. fresh, dry weights, plant height and leaves number /plant comparing to 10 m^3 applications. The results were true in the two seasons of study. The same trend was obtained by chemical constituents *i.e* chlorophyll a, b, total, N, P, K, in leaves, crude protein%, total carbohydrate%, sulfur volatile oil %,Vit. C, TSS and total sugar in bulbs in the both seasons (Tables 5 to 8). Crude fiber%, NO_3-N, moisture% in bulbs were increased significantly by adding 10 m^3 FYM/fed. Fertilization onion plants with 20 m^3 FYM gave total yield significantly higher than 10 m^3 FYM/fed. as shown in Table 8.

Effect of sulphur fertilization:

The above mentioned Tables show that Sulphur fertilization at the rate of 200kg/fed. caused significant increments in the above parameters of vegetative growth, chemical constituents, quality and total yield except crude fiber%, NO_3-N and moisture% in bulbs in the two seasons. Concerning bulb yield, there were insignificant differences between 100 and 200 kg/fed. but both Sulphur fertilizers (100 and 200 kg/fed.) caused significant increase over without addition treatment.

Effect of humic acid addition:

Addition 15 kg/fed. humic acid gave significant increments over 5 and 10 kg/fed. in all aforementioned characteristics except crude fiber%, moisture% in the seasons and NO_3-N concentration in the second season (Tables 5 to 8)

Effect of interaction:

a- Vegetative growth

Fertilization treatment with 20 m^3 FYM plus 200 kg S/fed. and 15 kg HA/fed. gave the highest significant values in plants dry weight and plant height in the two seasons of the experimentation as shown in Fig 1 and 2

Table 4: Fresh, dry weights/plant, plant height and number of leaves/plant as affected by farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

Characters / Treatments	Fresh weight (g/plant)		Dry weight (g/plant)		Plant height (cm)		Number of leaves/plant	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
A- Farmyard manure levels:								
20 m^3/fed	65.70	64.85	8.55	8.72	62.00	67.03	7.07	7.63
10 m^3/fed	59.31	61.75	7.74	8.04	57.81	64.40	6.88	7.37
F. test	*	*	*	*	*	*	*	*
B- Sulphur levels:								
Without	46.81 c	48.72 b	6.18 c	6.34 c	53.88 b	60.94 b	6.27 b	6.77 b
100 kg/fed	67.59 b	67.33 a	8.82 b	8.98 b	60.77 a	66.16 ab	7.16 a	7.55 a
200 kg/fed	73.12 a	73.84 a	9.44 a	9.82 a	65.05 a	70.05 a	7.50 a	8.16 a
C- Humic acid levels:								
5 kg/fed	54.48 c	55.06 b	7.06 c	7.35 c	57.33 b	63.22 b	6.77 c	7.16 b
10 kg/fed	62.11 b	64.54 ab	8.14 b	8.41 b	59.61 ab	65.83 ab	7.00 b	7.50 ab
15 kg/fed	70.92 a	70.29 a	9.23 a	9.38 a	62.77 a	68.11 a	7.16 a	7.83 a
D- Interactions:								
A × B	NS	NS	NS	*	*	*	NS	NS
A × C	*	NS	*	*	*	*	NS	NS
B × C	*	*	*	*	*	*	*	*
A × B × C	NS	NS	*	*	*	*	NS	NS

Table 5: Chlorophyll a, b and total chlorophylls a+b as affected by farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

Characters / Treatments	Chlorophyll a (mg/g FW)		Chlorophyll b (mg/g FW)		Chlorophylls a+b (mg/g FW)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
A- Farmyard manure levels:						
20 m^3/fed	0.677	0.694	0.449	0.451	1.126	1.145
10 m^3/fed	0.614	0.638	0.400	0.426	1.014	1.064
F. test	*	*	*	*	*	*
B- Sulphur levels:						
Without	0.622 b	0.644 b	0.397 b	0.435 c	1.019 c	1.079 c
100 kg/fed	0.653 a	0.672 ab	0.427 ab	0.438 b	1.079 b	1.110 b
200 kg/fed	0.661 a	0.682 a	0.450 a	0.443 a	1.111 a	1.125 a
C- Humic acid levels:						
5 kg/fed	0.632 c	0.651 c	0.405 b	0.423 c	1.037 b	1.074 c
10 kg/fed	0.645 b	0.666 b	0.437 a	0.433 b	1.082 a	1.100 b
15 kg/fed	0.659 a	0.681 a	0.431 a	0.459 a	1.090 a	1.140 a
D- Interactions:						
A × B	NS	NS	NS	*	NS	*
A × C	NS	NS	NS	NS	NS	*
B × C	*	*	*	*	*	*
A × B × C	NS	NS	NS	NS	NS	*

Table 6: N, P and K percentages in leaves, crude protein and total carbohydrates percentages in bulbs as affected by farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

Characters / Treatments	N % (in leaves)		P % (in leaves)		K % (in leaves)		Crude protein (%)		Total carbohydrates (%)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
A- Farmyard manure levels:										
20 m^3/fed	3.94	3.59	0.334	0.348	3.47	3.29	11.32	11.58	28.26	27.68
10 m^3/fed	3.58	3.24	0.304	0.318	3.23	3.08	10.21	9.80	25.39	24.54
F. test	*	*	*	*	*	*	*	*	*	*
B- Sulphur levels:										
Without	3.50 b	3.18 b	0.286 c	0.300 b	3.060 c	2.91 c	9.98 c	9.98 c	25.89 c	25.06 c
100 kg/fed	3.84 ab	3.49 a	0.329 b	0.342 a	3.464 b	3.28 b	11.03 b	10.82 b	27.12 b	26.45 b
200 kg/fed	3.93 a	3.57 a	0.342 a	0.357 a	3.539 a	3.36 a	11.30 a	11.26 a	27.47 a	26.82 a
C- Humic acid levels:										
5 kg/fed	3.61 c	3.27 c	0.297 c	0.311 b	3.17 c	3.02 c	10.33 c	10.13 c	26.30 c	25.51 c
10 kg/fed	3.74 b	3.40 b	0.318 b	0.332 ab	3.35 b	3.17 b	10.77 b	10.74 b	26.81 b	26.09 b
15 kg/fed	3.92 a	3.56 a	0.341 a	0.356 a	3.53 a	3.37 a	11.20 a	11.20 a	27.38 a	26.73 a
D- Interactions:										
A × B	NS	*	NS	NS	*	*	NS	NS	*	NS
A × C	NS	*	NS	NS	NS	*	*	NS	*	NS
B × C	*	*	*	*	*	*	*	*	*	*
A × B × C	NS	NS	NS	NS	NS	NS	*	NS	*	NS

Table 7: Crude fiber, NO_3-N, sulfur volatile oil, moisture and total sugar percentages as affected by farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

Characters / Treatments	Crude fiber (%)		NO_3-N (ppm)		Sulfur volatile oil (%)		Moisture (%)		Total sugar (%)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
A- Farmyard manure levels:										
20 m^3/fed	6.67	7.00	65.51	64.54	1.492	1.517	66.95	67.46	6.52	6.62
10 m^3/fed	7.33	7.62	67.90	65.96	1.367	1.289	68.03	68.83	5.84	5.95
F. test	*	*	*	*	*	*	*	*	*	*
B- Sulphur levels:										
Without	7.57 a	7.97 a	68.62 a	66.27 a	1.019 c	0.998 c	68.47 a	69.16 a	5.66 c	5.91 b
100 kg/fed	6.81 b	7.08 b	65.89 b	64.91 b	1.428 b	1.402 b	67.16 b	67.80 b	6.35 b	6.41 a
200 kg/fed	6.62 c	6.88 c	65.60 c	64.57 c	1.842 a	1.808 a	66.84 c	67.47 c	6.52 a	6.53 a
C- Humic acid levels:										
5 kg/fed	7.34 a	7.67 a	66.70 b	65.82 a	1.294 c	1.270 c	68.03 a	68.71 a	5.90 c	6.08 c
10 kg/fed	6.99 b	7.33 b	66.22 c	65.27 b	1.428 b	1.402 b	67.48 b	68.16 b	6.17 b	6.27 b
15 kg/fed	6.67 c	6.93 c	67.18 a	64.67 c	1.567 a	1.536 a	66.97 c	67.56 c	6.46 a	6.50 a
D- Interactions:										
A × B	*	NS	*	NS	*	*	*	NS	*	NS
A × C	*	*	*	NS	*	*	*	NS	*	NS
B × C	*	*	*	*	*	NS	*	*	*	*
A × B × C	NS	NS	*	NS	*	NS	NS	NS	NS	NS

Table 8: Vitamin C, TSS and bulbs yield as affected by farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

Characters / Treatments	Vitamin C (mg/100 g)		TSS (%)		Bulbs yield (t/fed)	
	2013/2014	2014/2015	2013/2014	2014/2015	2013/2014	2014/2015
A- Farmyard manure levels:						
20 m^3/fed	19.61	18.96	5.72	5.62	17.60	18.46
10 m^3/fed	18.01	17.69	5.40	5.44	17.19	18.03
F. test	*	*	*	*	*	*
B- Sulphur levels:						
Without	18.25 c	17.68 c	5.27 c	5.14 b	16.75 b	17.45 b
100 kg/fed	19.00 b	18.47 b	5.65 b	5.66 a	17.54 a	18.41 a
200 kg/fed	19.18 a	18.81 a	5.75 a	5.80 a	17.89 a	18.88 a
C- Humic acid levels:						
5 kg/fed	18.50 c	17.98 b	5.39 c	5.31 c	16.62 c	17.65 b
10 kg/fed	18.81 b	18.37 a	5.56 b	5.54 b	17.49 b	18.17 ab
15 kg/fed	19.12 a	18.61 a	5.72 a	5.75 a	18.06 a	18.91 a
D- Interactions:						
A × B	*	NS	NS	NS	*	*
A × C	*	NS	*	*	*	*
B × C	*	*	*	*	*	*
A × B × C	NS	NS	*	*	*	*

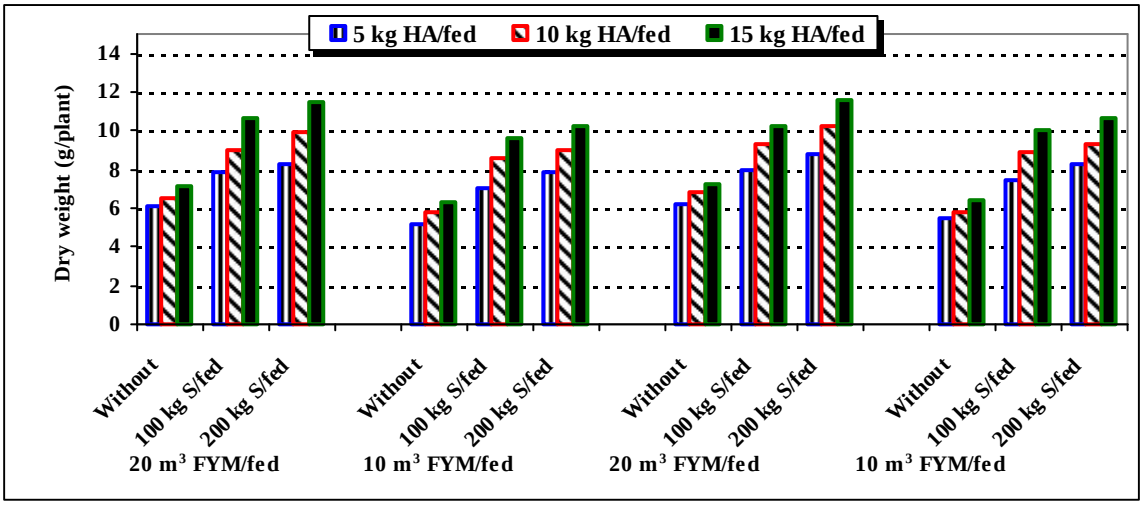

Fig. 1: Dry weight (g/plant) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

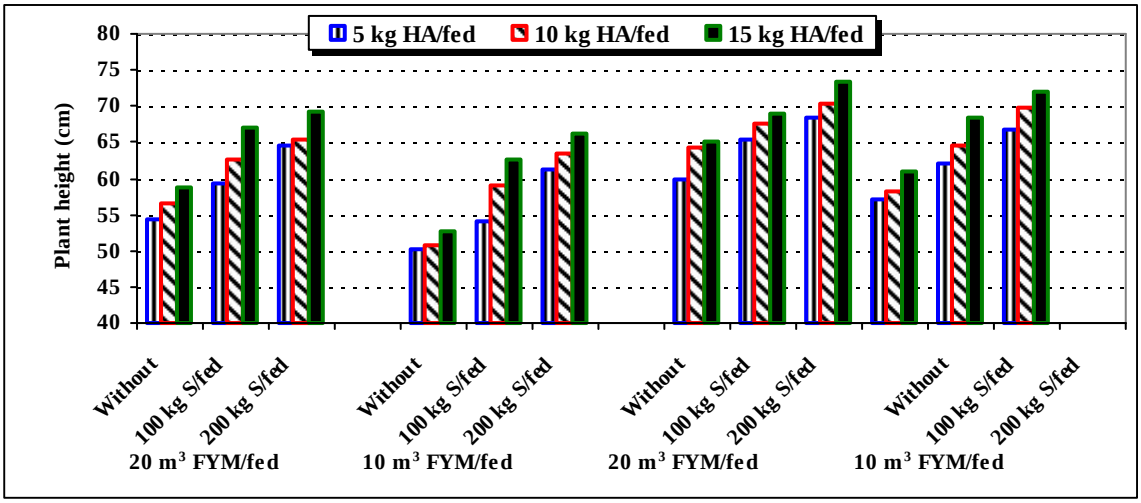

Fig. 2: Plant height (cm) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

b- Chemical composition

Fig 3 shows the significant increments for the interaction among the previous treatments in chlorophyll a, b and total in onion leaves followed by interaction among 20 m^3 FYM plus 100 kg S/fed. and 15 kg HA/fed. these results were true in both seasons. The same trend was occured with sulpher volatile oil in bulbs. Fig 8

c- Quality parameters

Crude protein%, total carbohydrates and TSS% in onion bulbs were used to estimate quality parameter under the effect of the interaction among the experimental treatments. Results show significant superiority of the interaction among 20 m^3 FYM plus 200 kg S/fed. and 15 kg HA/fed. over the other interactions in both seasons. (Fig 4, 5 and 6).

The highest values of NO_3-N ppm in onion bulbs were obtained from the interaction among 20 m^3 FYM plus 0 kg S/fed. plus 5 kg HA/fed. and the differences were significant. Meanwhile the lowest values were obtained when plants treated with 20 m^3 FYM plus 200 kg S/fed. and 15 kg HA/fed. in the two seasons of the experiment. (Fig 7)

d- Bulb yield (ton/fed.)

The interactions among 20 m^3 FYM, 200 kg S/fed. and 15 kg HA/fed. gave the highest yield with significant differences over the other interactions.(Fig.9)

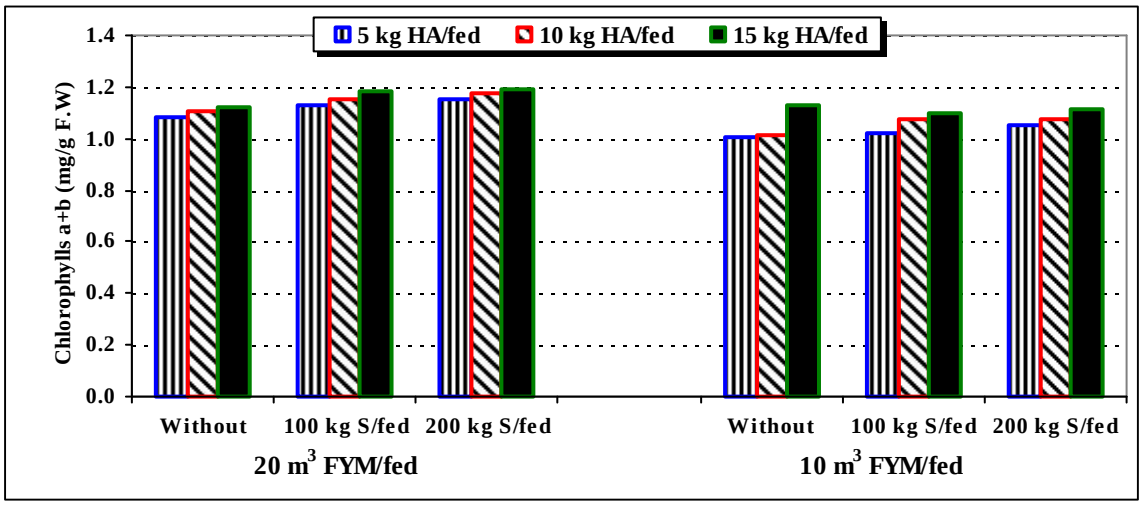

Fig. 3: Chlorophylls a+b (mg/g F.W) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2014/2015 season.

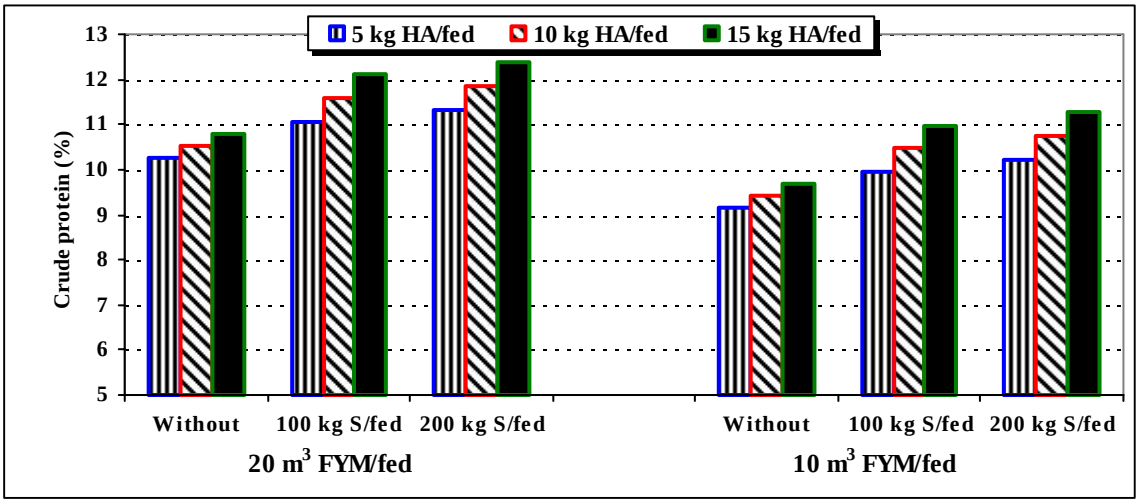

Fig. 4: Crude protein (%) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2013/2014 season.

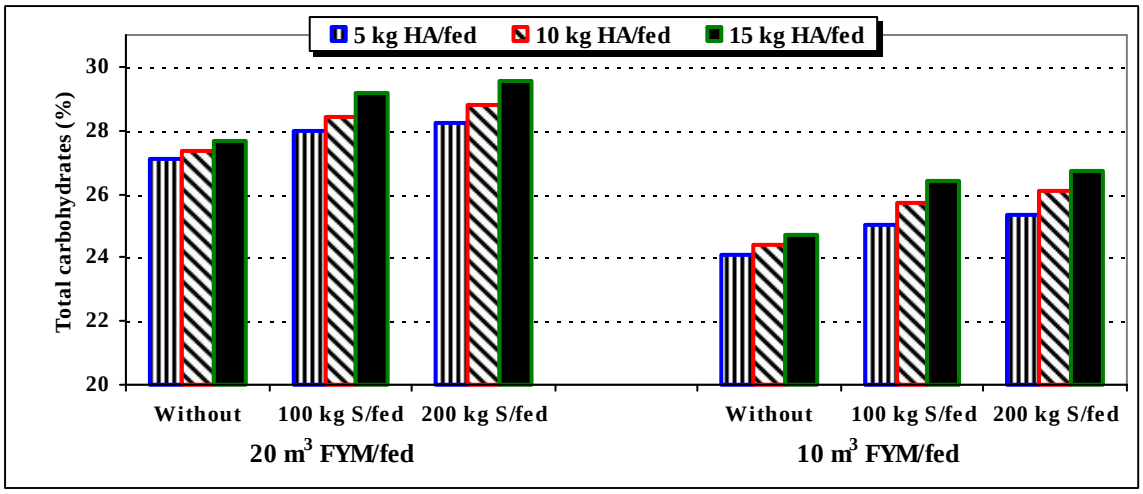

Fig. 5: Total carbohydrates (%) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2013/2014 season.

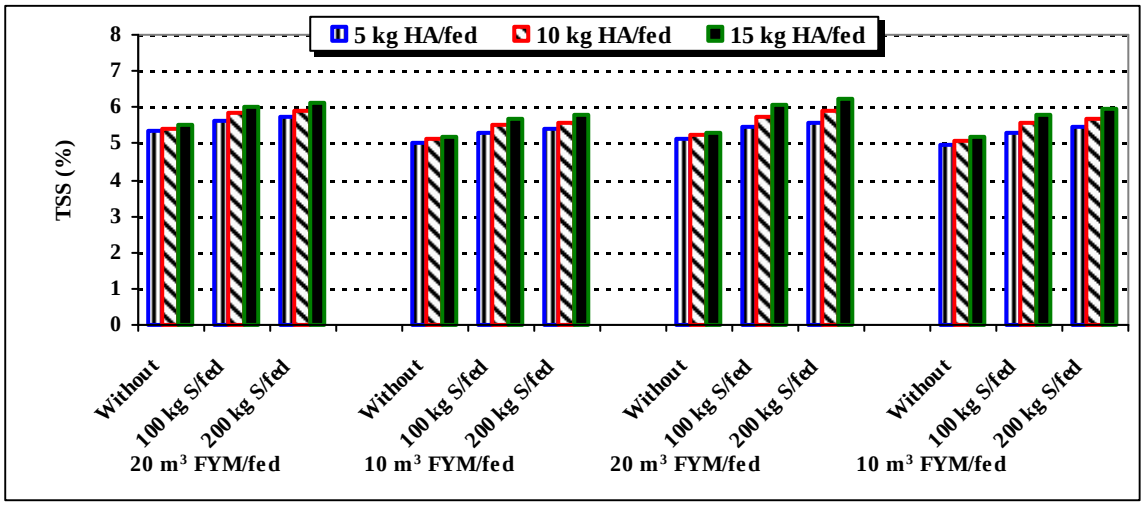

Fig. 6: TSS (%) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

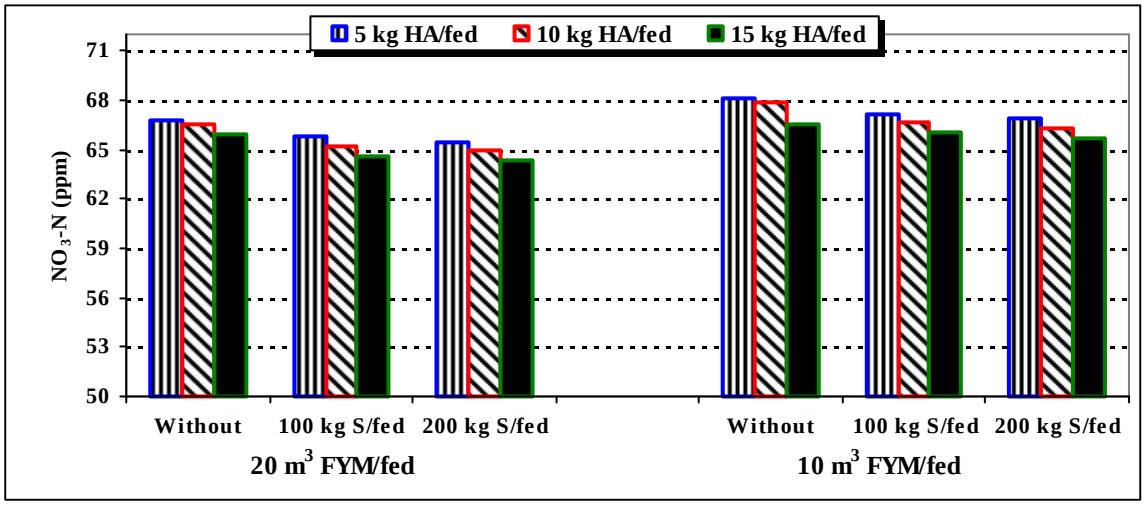

Fig. 7: NO_3-N (ppm) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2013/2014 season.

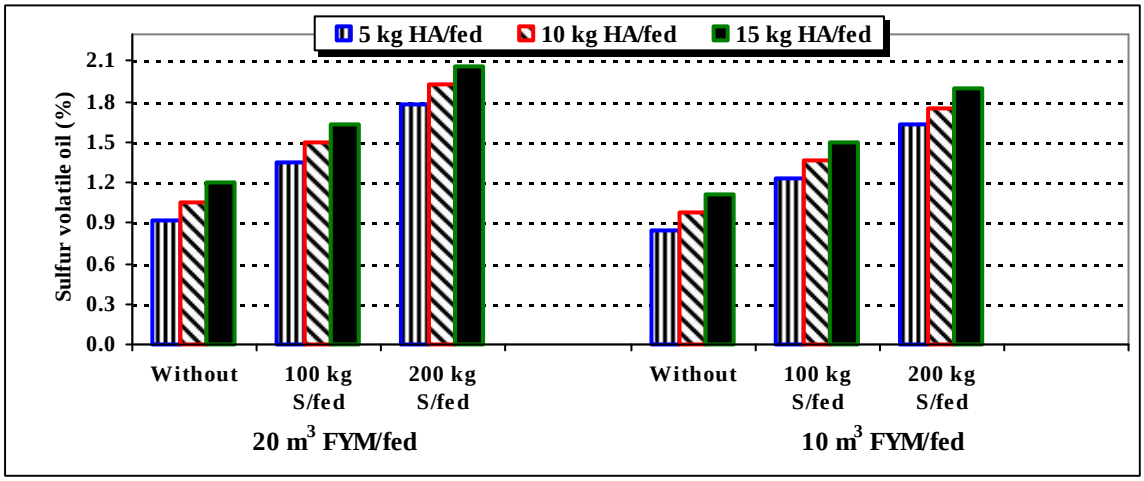

Fig. 8: Sulfur volatile oil (%) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2013/2014 season.

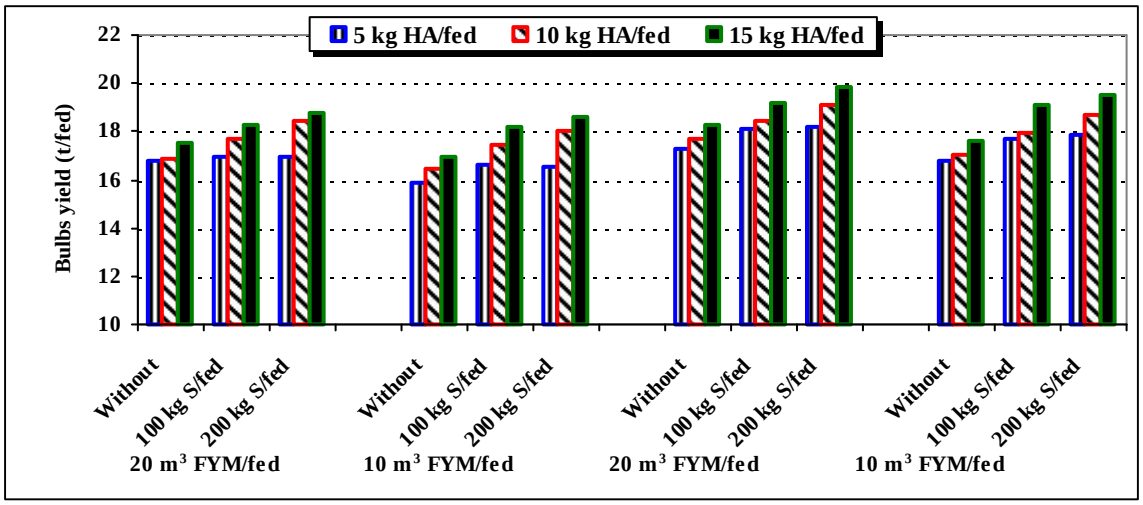

Fig. 9: Bulbs yield (t/fed) as affected by the interaction among farmyard manure, sulphur and humic acid levels during 2013/2014 and 2014/2015 seasons.

Obtained results can be discussed by clarifying the direct and indirect effects of treatments used on vegetative growth which reflected on chemical constituents, quality and yield.

The high level of FYM 20m^3/fed. which showed superiority in vegetative growth parameters, may be due to its roles in improving the physical and chemical properties of soil such as aggregation, aeration permeability, water holding capacity and increasing the some macro and micro nutrients. It improves also drainage, reduces soil PH, increasing the microorganisms activity which reflected on the increment of the plant roots absorption and consequently caused a positive impact on vegetative parameters **(Marschener, 2012)**.These results are in agreement with those obtained by **Funda *et al.* (2011) and Yohannes *et al.* (2013)**

Onion plants fertilized with 200kg/fed. S gave the highest values comparing to 100kg S/fed. these results may be due to its important roles on growth and development of onion plants thus it is an important of two amino acids (cysteine and methionine) which are essential for protein formation, enzyme activation, chlorophyll formation although it is not a constituent of chlorophyll, also it is required by plants crude protein, oil content formation moreover it increases onion plants hardiness and formation of glycosides that give characteristic odors and flavors to onion. Sulpher is necessary for formation of vitamins and synthesis of some hormones and glutathione. It improves tolerance to heavy metal toxicity in onion plants **Haneklaus *et al*. 2007).** These reasons caused an improvement in onion plants growth which reflected on yield increment and increased significantly sugar, crude protein, chlorophyll concentrations, TSS, total carbohydrates and sulpher volatile oil% as shown in aforementioned Tables.

Humic acid plays positive influence on physiological processes (cell respiration, photosynthesis, protein synthesis, water and nutrient uptake and enzymatic activity) **(Traversa *et al*. 2013).** This effect depends on the applied dose. It can have positive effects by enhancing the micro nutrient availability and microbiological activity. **(Hartz, 2010).** For these reasons onion plants applied with 15 kg /fed. of HA gave superiority in the vegetative characteristic. These increments reflected on yield, chemical composition and bulbs quality.

The interaction among these treatments reflected positively on plant growth and development and consequently on yield and its components.

High levels of FYM, S and HA caused significant increase in crude fiber%, total sugar%, Vit.C (mg/100g), TSS and total carbohydrates%. These results may be attributed to the positive effect of vegetative growth parameters as mentioned previously which reflected on chlorophyll formation and in turn caused increasing the efficiency of photosynthesis which led to the high formation of carbohydrates, sugar, TSS and Vit.C and hence an increase in protein synthesis, on other hand caused a decrease in NO_3N concentrations in bulbs.

Effect of interaction among the factors under study on chemical composition and quality attributes can be attributed to the same reasons mentioned previously.

Decreasing nitrate accumulation in onion bulbs by increasing the rate of FYM, S and HA may be due to the increment in the biological activities in the root reizospher which led to raising N consumption and decreasing nitrate concentration in the plant tissues.(**Benton Jones 2012)**

From results obtained can be guidance fertilization onions with 20 m^3 FYM plus 200 kg S/fed. and 15 kg HA/fed.

References

Abdel Naby, H.M.A; K.K., Dawa; EL.I. El – Gamily and Nourgehan, M.I.M., salem (2012). Effect of organic and mineral fertilization and some foliar treatments on onion yield and quality. Submitted in Partial fulfillment of the requirements for the degree of master of scince. Mans. Uni.

Al- Fraihat, A. H. (2009). Effect of different nitrogen and sulphure fertilizer levels on growth, yield and quality of onion (*Allium cepa* L.). Jordan J. Agric. Sci. 5(2): 155- 166.

AOAC (2000). Association of Official Analytical Chemists, 17th ED. Of AOAC. international published by AOAC. international Maryland, USA., 1250pp.

Bashir, A.Y; Liman Y.M and I.M. Zangoma (2015). Effect of different source of organic manure on the growth and yield of irrigated onion in damaturu local government area of Yobe state, Nigeria. Department of Agricultural Technology. International J. of Multidisciplinary Academic Res.,vol. 3.No. 4.2015. ISSN 2309-3218.

Benton Jones, Jr. (2012). Plant nutrition and soil fertility manual. Second Edition. CRC Press in an imprint of Taylor& Francis Group, an Informa Business.

Bettoni, M.M.; Mogor A.F.; Pauletti V.; Goicoechea N.; Aranjuelo I. and I. Garmendia (2016). Nutritional quality and yield of onion as affected by different application method and doses of humic substances. J. of Food Composition and Analysis 51: 37-44.

De Souza, L.F.G.; Filho, A.B.C.; De Tulio, F.A. and R.H.D. Nowaki (2015). Effect of Sulphur dose on the productivity and quality of onions. Australian J. of crop Sciences 9(8): 728-733.

FAO (2013). FAOSTATC, FAO Statistics Division, May 2013.

Farooqui, M.A., I.S. Naruka, S.S. Rathore, P.P. singh and R.P.S. Shaktawat. (2009). Effect of nitrogen and sulphur levels on growth and yield of garlic (*Allium sativum* L.). Asian J. of Food and Agro- Industry. Special Issue, S 18-23.

Funda, Y.; C. Safak; M. Nilgun and C.E. Bihter (2011). Effect of organic and inorganic fertilizers on yield and mineral content of onion (*Allium cepa* L.), African J. of Biotechnology, 21 September, 2011, Vol.10 (55, pp. 11488-11492.

Geries, L.S.M. (2013). Effect of nitrogen fertilizer and foliar spraying with humic acid on growth and yield of onion (*Allium cepa* L.). Egypt. J. of Appl. Sci., 28(4): 204-226.

Gomez, K.N. and A.A. Gomez (1984). Statistical Procedures for Agricultural Research. John Wiley and Sons, New York, 2nd ed., 68 P.

Goodwine, T. W. (1965). Quantitative Analysis of the Chloroplast Pigments. Academic Press, London and New York.

Hafiz, M.M. and A.R. Mahamoud (2008). Response of onionplants to the fertilization by nitrogen sources and agricultural sulphur rates. J. Agric. Sci. Mansoura Univ., 33(7): 5235- 5243.

Haneklaus, S., E. Bloem, and E. Schnug (2007).sulfur and plant disease. In: Mineral nutrition and plant disease, L. E. Datnoff, W.H. Elmer, and D. M. Huber, Eds., 101-118. St. Paul,MN: The American phytopathological Society.

Hans, P. (1935). A method for estimation the volatile sulpher content and pungency of onions. J. of Agric. Research, Washington, D.C. Vol. 51 No.9

Hartz, T.K.- Bottoms T.G.(2010). Humic substances generally ineffective in improving vegetable crop nutrient uptake or productivity. Horticulture Sci., 45: 906-910.

Hedge, I.E. and B. T. Hofreiter (1962). "Carboydrate Chemistry (Eds Whistler R.L. and Be Miller, J.N.) Academic Press New York.

Hitsuda, K.; Yamada M. and D. Klepker. (2005). Soil and crop Management : sulfur requirement of eight crops at early stages of growth. Agronomy J. 97, 155- 159.

Jones, I.R.; I. Benton; B. Wolf and H.A. Mills (1991). Plant analysis. Hand book, Methods of plant analysis and inter-predation. Micro-Macro. Publishing, inc., USA. P, 30-34.

Mai, M.A. Baset (2015). Nutrition of crop plants. Nova Science Publishers. (CF Comp.Search)

Marschener, P. (2012). Marschener's Mineral nutration of higher plants. Third Edition. Academic Press in an imprint of Elsevier.

Mishu, M.H; Ahmed F.;Rafii M.Y.; Golam F. and M.A Latif (2013). Effect of sulpher on growth, yield and yield attributes in onion (*Allium cepa* L.)Aust J. Crop Sci. 7(9): 1416-1422.

Naeem, M.M. Masroor, A. Moinuddin and M. Siddiqui (2009). Triacontanol stimulates nitrogen-fixation, enzyme activities, photosynthesis, crop productivity and quality of hyacinth bean (*Lablab purpureus* L.).Sci.Hortic.,121:389-396.

Poornima, K. S. (2007). Effect of Potassium and sulphur on yield and quality of onion and chilli intercrops in a vertisol. M.Sc. Thesis (Agriculture) Univ. Of Agric. Sci, Dhawad.

Porto, D.R.Q; Filho, ABC; May A. and P.F. Vargas (2007). Acumulo de macronutrients pela cultivar de cebola "Superex" estabelecida por semeadura direta. Cienc Rural. 37(4):949-955.

Schunemann, A.P.; Treptow R.; Leite.; D.L and J.L. Vendruscolo (2006). Pungencia e caracteristicas quimicas em bulbos de genotipos de cebola (*Allium cepa* L.) cultivados no Alto Vale do Itajai, SC, Brasil. Rev Bras Agrocienc. 12(1):77-80.

Singh, J. P. (1988). A rapid method for fertermination of nitrate in soil and plant extracts. Plant and soil. 110: 137-139.

Traversa, A.; Loffredo E.; Palazzo A.J.; Bashore T.L. and N. Senesi (2013). Enhancement of Germination and growth of Slickspot Peppergrass in a New Medium with Two Compost Organic Fraction. Commun. Soil Sci. plant Anal., 44: 2636-2646.

Yohannes, K.W., Belew, D. and A. Debela (2013). Effect of farmyard manure and nitrogen fertilizer rates on growth, yield and yield components of onion (*Allium cepa* L.) at Jimma, Southwest Ethiopia. Asian J. of plant Sci. 10: 3923:3974.

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