Response of Some Onion Genotypes to Mineral, Organic and Biofertilizers

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Abstract: This study was carried out at Gemmeiza Agriculture Research Station Farm, Agriculture Research Center, Gharbeia Governorate, in 2014/2015 and 2015/2016 seasons to study response of some onion genotypes to mineral, organic and biofertilizers on vegetative growth, yield and its components. The obtained results showed that there were significant differences among onion genotypes of all studied characters in both seasons. Composite 16 Oblong genotype gave the highest number of leaves/plant at 90 days from transplanting, bulbing ratio at 90 and 120 days from transplanting, bulb weight, marketable and total yield as compared with other onion genotypes tested in both seasons. The obtained results indicated that fertilization treatments had the significant effects on all studied traits in both seasons. Application of 5 ton compost + 67.5 kg N/feddan (75% of recommended) surpassed other studied fertilization treatments and resulted in the highest values of number of leaves/plant at 90 days, bulbing ratio at 90 and 120 days from transplanting, bulb weight (g), culls yield (t/fed), marketable yield (t/fed) and total yield (t/fed) in both seasons. The interaction between onion genotypes and fertilization treatments significantly affected number of leaves/plant at 90 days, bulbing ratio at 90 and 120 days from transplanting, bulb weight, marketable and total yield in both seasons. Fertilized onion plant Composite 16 Oblong genotype with 5 ton compost + 67.5 kg N/feddan gave the highest values of number of leaves/plant at 90 days, bulbing ratio at 90 and 120 days from transplanting, bulb weight (g), culls yield (t/fed), marketable yield (t/fed) and total yield (t/fed) as compared with all other treatments in both seasons.

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1. Introduction

Onion (*Allimcepa, L.*) is one of the most important corps due to its value for local consumption and exportation great attention should be paid towards improving yield keeping quality and maturity date. The first step of Egyptian strategy government is to increasing yield and quality of onion which lead to increase exporting onion, consequently increasing from foreign currency income. These increasing might be achieved by using new and high yielding cultivarsor applied optimum nutrients.

There are wide variations among onion cultivars in bulb yield and bulb quality. Thus choosing and using best onion cultivars is one of the most critical components of onion production. Inthisregard; **Soleymani and Shahrajabian (2012)** and **Abouazoom *et al*. (2014**) stated that number of leaves and bulbing ratiowassignificantly influenced by cultivars and maximum values of these traits were resulted from Cisakht and Morado DeAmpostacultivars. **Tesfalegn (2015)** and **Deepasharma and Kumudjarial (2017)** showed that Melkan Red and Agrifound Dark Red cultivars gave the highest bulb weight, marketable and total bulb yield.

Mineral fertilizers are one of the principle factors that affect onion growth and production. Nitrogen fertilizer is essential nutrient for plant growth and yield of onion plant. Since, onion plant take up large amounts of nitrogen, Increasing nitrogen fertilizer addition caused some problems such as increasing soil erosion, soil compaction, environment pollution and public health risk **(Top *et al*., 2002).**

Therefore, attempts have been made to solved this problems by instead of part of mineral nitrogen with organic *i.e.* farmyard manure and compost or biofertilizers *i.e.* nitrobein as well as microbein as a biofertilizers are considered as an important source of humus, macro and micro elements carrier and increase the activity of the useful micro organism **(El-Gizy, 1994)**. Addition of organic fertilizers improved soil structure, which can encourage root development and lead to encourage plant growth **(Singer *et al*., 1998). Naik*et al*. (2014) and El-Dardiry *et al*. (2015**) reported that average number of leaves, bulb weight and bulb yield of onion were significantly higher when added farmyard manure or bio-compost with 50% of recommended NPK. **Ganesh and Sureshkumar (2016)** and **Gebremichael *et al*. (2017)** obtained that application of 75% NPK + 5t/ha vermicompost gave the highest number of leaves, bulbing ratio, mean bulb

weight and marketable yield of onion. **Shedeed *et at.* (2014)** and **Meena *et al.* (2015)** showed that average bulbing ratio and total yield of onion were significantly increasing when added bio fertilizer (Nitrobein or Azosprillium) with 50% of recommended nitrogen.

Therefore, this investigation was carried out to study the response of some onion genotypes to mineral, organic, and biofertilizers under the environmental conditions of Middle Delta, Gharbeia Governorate.

2. Materials and Methods

Field experiments was conducted at the experimental Farm of Gemmeiza Agricultural Research Station, Gharbeia Governorate during the two successive winter growing seasons of 2014/2015 and 2015/2016. This investigation was aimed to study the response of some onion genotypes to mineral, organic and biofertilizers in growth characters, yield and its components of onion bulbs.

The experiment treatments studied were as follows:-

I – Onion genotypes (G):

Four onion genotypes tested, genotypes seed were obtained from Onion Research Section, Agriculture Research Center, Egypt. This studied genotypes were characterized as follows:

Table 1: The name of tested genotypes from onion research Section, their method of development and country in which releases were developed

Genotype	Development method	Releasing country
1) Giza 20	Selection from Egyptian deletion cultivars Behairy.	Egypt
2) Giza white	Selection from Egyptian deletion types, bulbs are thick flat, white outer dry scales and flesh total soluble solids (TSS) and dry matter are relatively high and high in good keeping quality.	Egypt
3) Composite 16 white	Selected from Composite crosses between 10 American and two Egyptian cultivars.	Egypt
4) Composite 16 oblong	new nucleus selected by Onion Research Section from intersingle cross between 10 American cultivars and Giza 20 or Giza 6, bulbs are high thick flat to oblong shape, white fresh, yellow brownish outer dry scales and stored for a long period.	Egypt

II – Fertilization treatment used were as follows:

1. Control added 90 kg N/ fed. (100% recommended doses).
2. Applied $20m^3$ farmyard manure/fed (FYM/fed).
3. Applied $20m^3$ FYM/fed. + 67.5kgN/fed. (75% of recommended).
4. Applied $20m^3$ FYM/fed. + 45 kg N/fed. (50% of recommended).
5. Applied 5 ton compost/ fed.
6. Applied 5 ton compost /fed. + 67.5 kg N/fed. (75% of recommended).
7. Applied 5 ton compost /fed. + 45 kg N/fed. (50% of recommended).
8. Treated onion seedlings by 4kg nitrobein / fed.
9. Treated onion seedlings by 4kg nitrobein / fed. + 67.5 kg N/fed. (75% of recommended).
10. Treated onion seedlings by 4kg nitrobein / fed. + 45 kg N/ fed. (75% of recommended).
11. Treated onion seedlings by 4kg microbein / fed.
12. Treated onion seedlings by 4kg microbein / fed. + 67.5 kg N/ fed. (75% of recommended).
13. Treated onion seedlings by 4kg microbein / fed. + 45 kg N/ fed. (75% of recommended).

The experimental desigen was split plot design with four replications. The main plots were designated to the four onion genotypes, whereas fertilization treatments were randomly distributed in sub plots. Each plot contained 6 ridges, 3.5 meters long and 50 cm width, occupying an area of 10.5 m^2 (i.e 1/400 Fed.).

The chemical analysis of farmyard manure and compost for organic fertilizers were as shown in Table (2). The mechanical and chemical analysis of soil at the experimental site are presented in Table (3). Particle size distribution was carried out using the method of **Black (1965)**. The preceding crop of the experiment soil was maize in both seasons.

The amounts of farmyard manure and compost fertilizers were added at soil preparation directly before ridging and amounts of nitrogen fertilizer was divided into two portions; one half being applied one month after transplanting time before the first irrigation, and the remaining portion was applied before the second irrigation, 60 days from transplanting. The biofertilizers (nitrobein and microbein), which containing active bio-nitrogen fixation bacteria was obtained from Bacterilization Unite, Microbiology Dept., Soil Water Res. Int., ARC, Giza. Seedlings of onion genotypes were dug and

inoculated by sooking their roots in the specific aqueous solution of the biofertilizer for 30 minutes just before transplanting at the rate of 4 kg/fed.

Onion seed were sown in the nursery on 10th October while transplanting took place on 15th December in the both seasons.

Characters measured:

1 – Vegetative growth characters:

A representative sample of 10 plants were taken from each plot at 90 and 120 days after transplanting where the following measurement the following trait:

a) Number of leaves/plant.

b) Bulbing ratio (bulb diameter cm/ bulb neck diameter cm): it was calculated according to **Mann (1952)**.

2 – Yield and its components:

Onion plant in the four inner rows of each plot when 50% of tops fell down were harvested. After harvested bulbs were left in the to cure two weeks, then tops and roots were removed and the following data were recorded:

1) bulb weight (g)
2) culls yield (ton/fad)
3) marketable yield (ton/fad)
4) total yield (ton/fad).

3 – Economic analysis:

Economic analysis was done to calculate net return and the benefit cost ratio with each treatment.

1) Cost of cultivation:

Cost of cultivation was estimated on the basis of local charges for different agro-inputs, i.e. labor, fertilizer, compost, FYM, and other necessary materials. Cast of cultivation of threeteen treatments was calculated separately.

2) Gross return:

Total onion bulb yield was converted into gross return (L.E./fed) on the basis of local market price.

3) Net return:

It was calculated by subtracting the cost of cultivation from the gross return.

4) Benefit cost ratio:

It was calculated by the formula, B: C ratio = Gross return/Cost of cultivation.

All data of the experiment were statistical analyzed according to the technique of variance (AVOVA) for the split plot design as published by **Gomez and Gomez (1984)**, using "MSTAT-C" computer soft were package. Least Significant Difference (L.S.D) method was used to test the differences between treatment means at 5% level of probability as described **Snedecor and Cochran (1980)**.

Table 2: Chemical analysis of farmyard manure and compost fertilizers in 2014/2015 and 2015/2016 seasons

Organic fertilizer	N %	P %	K %	0.M %	C/N ratio
2014 / 2015 season					
Farmyard manure	0.42	0.48	2.18	32.10	34.42
Compost	0.80	1.50	2.30	63.68	14.68
2015 / 2016 season					
Farmyard momure	0.45	0.45	1.60	26.29	29.25
Compost	0.81	1.40	1.80	61.90	11.43

Table 3: Mechanical and chemical analysis of soil at experimental site in 2014/2015 and 2015/2016 seasons.

Parameter	Value	
	First season	Second season
1- Mechanical analysis:		
coarse sand	**1.60 %**	**1.50 %**
fine sand	**12.91 %**	**14.40 %**
silt	**37.23 %**	**35.90 %**
clay	**40.82 %**	**43.0 %**
CaCo3	**3.90 %**	**3.20 %**
Organic matter	**1.57 %**	**1.98 %**
Texture class	**Silty clay loam**	
2- Chemical analysis:		
Available nitrogen	**33 ppm**	**35 ppm**
Available phosphorous	**8 ppm**	**8.8 ppm**
Available potassium	**420 ppm**	**440 ppm**
Soil reaction (PH) {in: 2.5 soil suspention}	**8**	**8**

3. Results and Discussion

Number of leaves/plant, bulbing ratio, bulb weight (g), culls yield (t/fed), marketable yield (t/fed) and total yield (t/fed) of some onion genotypes as affected by fertilization treatments in 2014/2015 and 2015/2016 seasons as shown in Tables 4 and 5.

Results presented in Tables 4 and 5 show clearly that the onion genotypes were significantly differed in number of leaves/plant at 90 days from transplanting, while bulbing ratio significantly differed at 90 and 120 days from transplanting in both seasons, in this connection onion genotypes were significantly differed in bulb weight, culls yield (t/fed), marketable (t/fed), and total yield (t/fed) in both seasons. It could be noticed that composite 16 oblong gave the highest number of leaves/plant 8.75 and 8.39 at 90 days from transplanting and bubling ratio 1.98 and 3.17 as well as 1.84 and 3.10 at 90 and 120 days from transplanting in 2014/2015 as well as2015/2016 seasons, respectively. Also, it gave the highest values of bulb weight 125.51 and 123.43 g, marketable yield 13.300 and 12.699 (t/fed) and total yield 14.759 and 14.217 (t/fed), on the other hand, it gave the lowest value of culls yield 1.459 and 1.538 (t/fed) as compared with other tested genotypes in 2014/2015 and 2015/2016 seasons, respectively. The differences in studied onion genotypes of different traits may be attributed to the genetic variation between genotypes. The superiority of composite 16 oblong in marketable yield may be due to it gave the heaviest bulb weight which led to raising total yield and had the lowest culls yield, therefore increased marketable yield per feddan. These results are in agreement with those obtained by **Soleymaniand Shahrajabian (2012), Abouazoom *et al*. (2014), Tesfalegn (2015) and Deepssharma and Kumudjarial (2017).**

Data recorded in Tables 4 and 5 indicated that fertilization treatments had significantly affected all studied characters in both seasons. The obtained results illustrated that application of 5 ton compost + 67.5 kg N/fed. (75% of recommended) surpassed other studied fertilization treatments in both seasons. This treatment gave the highest number of leaves/plant 8.60 and 8.54 as well as 8.90 and 8.52, bulbing ratio 2.82 and 3.69 as well as 2.47 and 3.54 at 90 and 120 days from transplanting as compared with other treatments in 2014/2015 as well as 2015/2016 seasons, respectively. Also it gave the highest bulb weight 130.33 and 128.91g, marketable yield 14.858 and 14.454 t/fed and total yield 16.478 and 15.984 t/fed.

Table 4: Average number of leaves/plant, Bulbing ratio and Bulb weight (g) of some onion genotypes as affected by fertilization treatments in 2014/ 2015 and 2015/2016 seasons.

Characters / Seasons / Treatments	Number of leaves/plant				Bulbing ratio				Bulb weight (g)	
	2014/2015		2015/2016		2014/2015		2015/2016		2014/2015	2015/2016
	90	120	90	120	90	120	90	120		
Genotypes (G):										
Giza 20	7.29	8.05	7.80	7.70	1.82	2.98	1.75	2.88	112.35	115.25
Giza white	7.98	7.89	8.12	7.68	1.70	2.87	173	2.77	106.07	105.81
Composite 16 white	8.10	7.87	8.19	7.55	1.73	3.09	1.74	3.01	108.22	107.81
Composite 16 oblong	8.75	7.71	8.39	7.42	1.98	3.17	1.84	3.10	125.51	123.43
L.S.D at 5%	0.31	N.S	0.28	N.S	0.10	0.17	0.05	0.07	3.73	3.21
Fertilization treatments (F):										
90kg N/fed. (control) = (100%)	8.51	8.17	8.13	7.95	2.30	3.57	2.27	3.47	129.99	124.49
$20m^3$ FYM /fed.	7.98	7.68	7.71	7.33	1.26	2.49	1.25	2.10	94.83	96.66
$20m^3$ FYM +67,5kg N/fed. (75%)	8.44	7.94	8.72	7.66	1.96	3.16	1.91	3.16	116.16	113.16
$20m^3$ FYM + 45kg N/fed. (50%)	8.05	7.81	8.38	7.63	1.89	3.06	1.85	3.01	112.83	110.41
5ton compost /fed.	7.79	7.51	8.40	7.60	1.62	2.73	1.59	2.62	95.08	95.74
5ton compost + 67.5kg N/fed. (75%)	8.60	8.54	8.90	8.52	2.82	3.69	2.47	3.54	130.33	128.91
5ton compost +45kg N/fed. (50%)	8.33	7.92	7.88	7.55	1.92	3.09	1.87	3.06	120.66	118.91
4kg nitrobein /fed	7.32	7.11	7.41	7.22	1.29	2.77	1.25	2.69	91.24	89.08
4kg nitrobein + 67.5kg N/fed. (75%)	8.08	7.81	7.91	7.44	1.92	3.07	1.88	2.99	113.99	110.33
4kg nitrobein+ 45kg N/fed. (50%)	8.20	7.72	8.18	7.49	1.86	3.10	1.70	3.05	110.41	107.66
4kg microbein / fed.	7.79	7.55	7.52	7.57	1.33	2.71	1.29	2.62	94.41	89.16
4kg microbein +67.5kg N/fed. (75%)	8.13	7.97	7.91	7.70	1.90	2.97	1.82	2.88	112.49	113.41
4kg microbein +45kg N/fed. (50%)	8.03	7.91	8.33	7.49	1.90	3.00	1.80	2.83	113.08	111.08
L.S.D at 5%	0.55	0.48	0.51	0.40	0.08	0.21	0.09	0.10	4.03	4.10
Interaction:										
GxF	*	N.S	*	N.S	*	*	*	*	*	*

On the contrary it recorded the lowest average of culls yield 1.620 and 1.530 t/fed in the both 2014/2015 and 2015/2016 seasons, respectively. On the contrary, the lowest means of bulbing ratio 1.26 and 2.49 as well as 1.25 and 2.10 at 90 and 120 days from transplanting and the highest of culls yield 2.798 and 2.889 t/fed were resulted from plants fertilized by $20m^3$ farmyard manure only in 2014/2015 as well as 2015/2016 seasons, respectively. Also the lowest means of number of leaves/plant 7.32 and 7.11 as well as 7.41 and 7.22 at 90 and 120 days from transplanting and bulb weight 91.24 and 89.08 g were produced from plant treated with 4kg nitrobein/fed. Also treated onion seedling by 4kg microbein/fed gave minimum values of marketable yield 8.045 and 7.610 t/fed and total yield 10.126 and 9.507 t/fed in 2014/2015 as well as 2015/2016 seasons, respectively.

These results suggested that it could be decreasing mineral nitrogen fertilizer rate up to 25% from recommended dose with 5 ton compost to obtained the highest onion yields.

Table5: Average culls yield, marketable yield and total yield of some onion genotypes as affected by fertilization treatments in 2014/ 2015 and 2015/2016 seasons.

Characters / Seasons / Treatments	Culls yield (t/fed)		Marketable yield (t/fed)		Total yield (t/fed)	
	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016
Genotypes (G):						
Giza 20	2.771	2.334	11.053	10.612	13.824	12.946
Giza white	2.459	2.120	10.412	10.174	12.871	12.294
Composite 16 white	2.256	1.873	10.744	10.476	13.000	12.349
Composite 16 oblong	1.459	1.538	13.300	12.679	14.759	14.217
L.S.D at 5%	0.380	0.201	0.688	0.505	0.586	0.629
Fertilization treatments (F):						
90kg N/fed. (control) = (100%)	2.113	2.530	13.502	12.823	15.615	15.353
$20m^3$ FYM /fed.	2.798	2.889	8.120	7.798	10.918	10.687
$20m^3$ FYM +67,5kg N/fed. (75%)	2.492	2.149	12.122	11.663	14.614	13.812
$20m^3$ FYM + 45kg N/fed. (50%)	2.674	2.050	11.655	11.372	14.329	13.422
5ton compost /fed.	1.902	1.863	8.236	8.030	10.138	9.893
5ton compost + 67.5kg N/fed. (75%)	1.620	1.530	14.858	14.454	16.478	15.984
5ton compost +45kg N/fed. (50%)	1.975	1.806	11.450	11.305	13.425	13.111
4kg nitrobein /fed	2.083	2.025	8.355	8.072	10.438	10.097
4kg nitrobein + 67.5kg N/fed. (75%)	2.727	2.121	11.625	11.168	14.352	13.289
4kg nitrobein+ 45kg N/fed. (50%)	2.283	2.031	10.950	10.504	13.233	12.535
4kg microbein / fed.	2.081	1.897	8.045	7.610	10.126	9.507
4kg microbein +67.5kg N/fed. (75%)	2.200	1.943	11.071	10.698	13.271	12.641
4kg microbein +45kg N/fed. (50%)	2.604	2.046	11.400	10.913	14.004	12.959
L.S.D at 5%	0.378	0.320	1.065	0.901	1.093	0.520
Interaction:						
GxF	N.S	N.S	*	*	*	*

This treatment may be reduce environmental pollution and decreased production costs. The important role played by the compost plus mineral nitrogen fertilizer provide much higher nitrogen which essential for synthesis of chlorophyll, enzymes and proteins as well as induce cell division and initiate meristematic activity, while organic nitrogen would slowly mineralized through the growing seasons. Similar results were reported by **Naik *et al.* (2014), El-Dardiry et al. (2015), Ganesh and Sureshkumar (2016) and Gebremichael *et al*. (2017).**

Results showed that the interaction effect between onion genotypes and fertilization treatments on number of leaves/plant at 90 days from transplanting, bulbing ratio at 90 and 120 days from transplanting, bulb weight (g), marketable yield (t/fed) and total yield (t/fed) in 2014/ 2015 and 2015/5016 seasons are shown in Tables 6,7,8,9,10 and 11.

Table6 : Averages number of leaves / plant at 90 days from transplanting as affected by interaction between some onion genotypes and fertilization treatments in 2014 /2015 and 2015 / 2016 seasons

Fertilization Treatments 2014 / 2015

Genotypes	90kg N/fed.(control) = (100%)	20m³FYM /fed.	20m³ FYM +67.5kg N/fed. (75%)	20m³ FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	8.64	8.33	8.33	8.34	7.77	8.55	8.52	8.25	8.45	8.16	7.50	8.52	8.44
Giza White	8.71	7.66	8.61	7.77	7.97	8.33	8.11	7.55	8.00	8.55	8.00	8.03	7.63
Comp . 16 White	8.35	7.92	8.55	7.91	7.98	8.73	8.07	7.88	8.22	8.12	7.30	7.90	8.18
Comp. 16 oblong	8.36	8.04	8.29	8.18	7.96	8.90	8.63	8.40	7.66	8.00	8.19	8.49	8.48
L.S.D at 5%	0.48												

Fertilization Treatments 2015 / 2016

Genotypes	90kg N/fed.(control) = (100%)	20m³FYM /fed.	20m³ FYM +67.5kg N/fed. (75%)	20m³ FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	8.00	7.66	8.66	8.66	7.66	8.66	8.33	8.00	7.66	8.33	8.00	7.66	8.00
Giza White	8.00	7.64	8.00	8.33	8.00	8.33	7.90	8.66	7.66	8.33	7.93	8.00	8.33
Comp . 16 White	8.43	8.11	8.44	7.76	7.50	8.33	7.76	8.11	8.33	8.44	7.22	8.00	8.11
Comp. 16 oblong	8.10	6.44	8.68	8.67	8.14	8.88	8.44	8.88	8.00	8.44	8.55	7.99	7.88
L.S.D at 5%	0.66												

Table7 : Averages bulbing ratio at 90 days from transplanting as affected by interaction between some onion genotypes and fertilization treatments in 2014 /2015 and 2015 / 2016 seasons

Fertilization Treatments 2014 / 2015

Genotypes	90kg N/fed.(control) = (100%)	20m³FYM /fed.	20m³ FYM +67.5kg N/fed. (75%)	20m³ FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	2.31	1.14	2.00	1.87	1.52	2.72	2.09	1.21	2.03	1.82	1.26	1.80	2.00
Giza White	2.24	1.34	2.05	2.03	1.88	2.45	1.81	1.37	2.06	1.96	1.18	2.13	2.03
Comp . 16 White	2.30	1.23	1.85	1.78	1.55	2.27	2.03	1.20	1.86	1.73	1.48	1.74	1.56
Comp. 16 oblong	2.37	1.75	1.96	1.89	1.55	2.85	1.38	1.77	1.75	1.94	1.40	1.95	2.03
L.S.D at 5%	0.20												

Fertilization Treatments 2015 / 2016

Genotypes	90kg N/fed.(control) = (100%)	20m³FYM /fed.	20m³ FYM +67.5kg N/fed. (75%)	20m³ FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	2.16	1.12	1.97	1.91	1.48	2.58	2.00	1.15	1.93	1.63	1.13	1.87	1.83
Giza White	2.36	1.20	2.00	2.01	1.80	2.39	1.81	1.47	1.96	1.73	1.19	2.06	2.03
Comp . 16 White	2.30	1.16	1.76	1.65	1.50	2.13	1.97	1.20	1.83	1.77	1.25	1.50	1.44
Comp. 16 oblong	2.27	1.58	1.94	1.84	1.59	2.81	1.70	1.20	1.83	1.67	1.70	1.86	1.93
L.S.D at 5%	0.41												

Table8 : Averages bulbing ratio at 120 days from transplanting as affected by interaction between some onion genotypes and fertilization treatments in 2014 /2015 and 2015 / 2016 seasons

Fertilization Treatments 2014 / 2015

Genotypes	90kg N/fed.(control) = (100%)	$20m^3$FYM /fed.	$20m^3$ FYM +67.5kg N/fed. (75%)	$20m^3$ FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	3.55	2.06	3.06	2.99	2.35	3.66	3.10	2.77	3.31	3.31	2.88	2.74	3.16
Giza White	3.47	2.10	2.90	2.98	2.82	3.61	2.94	2.61	2.98	3.04	2.34	2.96	2.80
Comp . 16 White	3.44	2.92	3.21	3.16	2.84	3.61	3.05	2.82	3.20	3.04	2.81	3.05	3.13
Comp. 16 oblong	3.85	2.91	3.26	3.11	2.92	4.07	3.39	2.88	2.99	3.03	2.81	3.10	2.94
L.S.D at 5%	0.53												

Fertilization Treatments 2015 / 2016

Genotypes	90kg N/fed.(control) = (100%)	$20m^3$FYM /fed.	$20m^3$ FYM +67.5kg N/fed. (75%)	$20m^3$ FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	3.34	2.02	3.06	3.00	2.34	3.62	3.15	2.68	3.02	3.03	2.78	2.72	2.73
Giza White	3.40	2.06	2.93	2.95	2.42	3.17	2.87	2.57	2.93	2.91	2.32	2.83	2.71
Comp . 16 White	3.38	2.84	3.15	3.04	2.82	3.54	3.02	2.70	3.11	2.97	2.68	2.95	3.03
Comp. 16 oblong	3.76	2.50	3.11	3.07	2.90	3.83	3.20	2.84	2.90	3.30	2.70	3.02	2.85
L.S.D at 5%	0.36												

Table9 : Averages bulb weight (g) at harvesting as affected by interaction between some onion genotypes and fertilization treatments in 2014 /2015 and 2015 / 2016 seasons

Fertilization Treatments 2014 / 2015

Genotypes	90kg N/fed.(control) = (100%)	$20m^3$FYM /fed.	$20m^3$ FYM +67.5kg N/fed. (75%)	$20m^3$ FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	134.33	96.00	121.66	117.00	101.66	130.33	124.66	92.66	110.00	115.66	91.33	111.33	114.00
Giza White	120.33	89.00	109.33	105.00	92.00	120.00	111.66	93.66	111.33	104.66	87.66	113.33	111.00
Comp . 16 White	124.00	94.33	108.66	109.33	88.00	130.66	117.66	90.66	116.33	110.33	91.66	115.33	110.00
Comp. 16 oblong	141.33	100.00	125.00	120.00	98.66	144.73	128.66	88.00	118.33	111.00	97.00	116.00	117.33
L.S.D at 5%	8.07												

Fertilization Treatments 2015 / 2016

Genotypes	90kg N/fed.(control) = (100%)	$20m^3$FYM /fed.	$20m^3$ FYM +67.5kg N/fed. (75%)	$20m^3$ FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	131.00	119.66	119.66	113.66	99.33	127.33	121.33	90.66	106.66	115.33	88.33	115.00	111.33
Giza White	122.33	112.33	112.33	109.33	91.66	119.00	111.00	88.66	109.00	110.00	87.00	112.00	113.66
Comp . 16 White	125.66	110.00	110.00	107.66	94.33	132.00	118.00	88.00	113.00	107.33	89.66	113.66	110.33
Comp. 16 oblong	139.00	122.56	122.56	119.00	97.66	140.39	125.33	90.00	112.66	110.00	91.66	113.00	117.00
L.S.D at 5%	8.02												

Table 10: Averages marketable yield (t/fed) at harvesting as affected by interaction between some onion genotypes and fertilization treatments in 2014 /2015 and 2015 / 2016 seasons

Genotypes	Fertilization Treatments 2014 / 2015												
	90kg N/fed.(control) = (100%)	20m^{3}FYM /fed.	20m^3 FYM +67.5kg N/fed. (75%)	20m^3 FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	13.541	8.730	13.234	12.980	7.904	14.589	10.576	8.058	11.920	11.568	7.492	11.600	11.506
Giza White	12.726	6.373	10.021	10.216	8.444	12.522	10.848	8.392	11.760	10.189	8.624	11.258	11.485
Comp . 16 White	12.776	8.170	12.893	11.631	8.074	13.517	11.096	9.288	11.520	11.242	7.382	9.306	9.781
Comp. 16 oblong	14.208	8.210	12.341	11.794	8.024	15.806	13.282	7.685	11.301	10.802	8.682	12.122	12.828
L.S.D at 5%	1.631												

Genotypes	Fertilization Treatments 2015 / 2016												
	90kg N/fed.(control) = (100%)	20m^{3}FYM /fed.	20m^3 FYM +67.5kg N/fed. (75%)	20m^3 FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	12.973	8.440	12.982	12.542	7.571	13.899	10.216	7.754	11.717	10.777	7.240	11.130	10.667
Giza White	12.063	6.887	9.653	10.408	8.804	12.268	11.110	8.000	11.458	10.141	8.004	10.995	11.899
Comp . 16 White	12.246	7.786	12.596	11.535	7.813	13.079	11.566	9.038	11.068	10.766	7.120	9.041	9.544
Comp. 16 oblong	14.133	8.032	11.421	10.506	7.928	15.573	12.329	7.496	10.432	10.333	8.476	11.626	11.546
L.S.D at 5%	1.820												

Table 11 : Averages total yield (t/fed) at harvesting as affected by interaction between some onion genotypes and fertilization treatments in 2014 /2015 and 2015 / 2016 seasons

Genotypes	Fertilization Treatments 2014 / 2015												
	90kg N/fed.(control) = (100%)	20m^{3}FYM /fed.	20m^3 FYM +67.5kg N/fed. (75%)	20m^3 FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	16.511	11.168	16.071	15.382	10.228	17.064	12.879	10.165	14.016	13.975	9.778	13.720	13.776
Giza White	15.463	8.653	12.894	13.786	11.850	14.847	13.268	10.602	13.550	12.489	10.771	13.759	13.445
Comp . 16 White	15.619	9.907	14.407	13.688	10.618	14.521	13.63	11.142	13.453	13.711	8.889	11.349	12.348
Comp. 16 oblong	16.184	10.184	14.091	14.665	9.917	17.236	15.743	9.753	13.721	12.762	10.516	13.942	14.783
L.S.D at 5%	2.121												

Genotypes	Fertilization Treatments 2015 / 2016												
	90kg N/fed.(control) = (100%)	20m^{3}FYM /fed.	20m^3 FYM +67.5kg N/fed. (75%)	20m^3 FYM + 45kg N/fed. (50%)	5ton compost /fed.	5ton compost + 67.5kg N/fed. (75%)	5ton compost +45kg N/fed. (50%)	4kgnitrobein/fed	4kg nitrobein + 67.5kg N/fed.(75%)	4kg nitrobein+ 45kg N/fed. (50%)	4kg microbein / fed.	4kg microbein +67.5kg N/fed.(75%)	4kg microbein +45kg N/fed. (50%)
Giza 20	15.856	9.967	15.582	15.238	9.751	16.626	12.281	10.251	14.647	13.043	9.806	13.156	12.970
Giza White	14.506	8.027	12.223	13.078	11.537	14.558	12.647	10.057	13.014	12.148	9.828	13.096	13.617
Comp . 16 White	14.703	9.997	13.360	12.828	10.147	15.522	13.198	10.789	12.834	12.211	8.922	10.947	11.923
Comp. 16 oblong	16.518	10.894	13.097	12.574	10.456	17.071	14.434	9.294	12.349	11.673	10.277	13.380	13.340
L.S.D at 5%	1.850												

Number of leaves/plant was significantly affected by interaction between onion genotypes and fertilization treatments at 90 days from transplanting in the first and second seasons (Table 6). It is clear from Table 5 that the highest number of leaves/plant 8.90 and 8.88 was recorded with Composite 16 Oblong genotype when received the combination of 5 ton compost + 67.5N/fed. (75% of recommended). on the other hand, the lowest number of leaves/plant 7.30 and 7.22 were resulted from composite 16 white genotype treated onion by 4kg microbein/fed. as compared with all other interaction treatments at 90 days from transplanting in 2014/2015 and 2015/2016 seasons, respectively.

The interaction effect between onion genotypes and fertilization treatments on bulbing ratio was significant at 90 and 120 days from transplanting in both seasons as presented in Tables 7 and 8. The highest bulbing ratio 2.85 and 2.81 as well as 4.07 and 3.83 was obtained when composite 16 oblong genotype fertilized with 5 ton compost + 67.5kgN/fed (75%). On the other hand, Giza 20 genotype fertilized when with $20m^3$ farmyard manure/fed. gave the lowest bulbing ratio 1.14 and 1.12 as well as 2.06 and 2.02 as compared with all other treatments in this interaction at 90 and 120 days from transplanting In 2014/2015 as well as 2015/2016 seasons, respectively. Results in Tables 9,10 and 11 show that bulb weight (g), marketable and total yield per feddan were significantly affected by the interaction between genotypes and fertilization treatments in the both seasons.

Results in Table 9,10 and 11 indicated that, Composite 16 Oblong genotype onion plants fertilized with 5 ton compost + 67.5kgN/fed. gave the highest bulb weight 144.73 and 140.39 g, marketable yield 15.805 and 15.573 t/ fed. and total yield 17.236 and 17.071 t/fed. as compared with all other this interaction treatments in 2014/2015 and 2015/2016 seasons, respectively. This treatment Composite 16 Oblong genotype onion plants fertilized with 5 ton compost + 67.5kgN/fed. gave 11.25 and 10.19% increase in marketable yield per feddan as compared with fertilized Composite 16 Oblong genotype by 90 kg N/feddan (recommended) in 2014/2015 and 2015/2016 seasons, respectively.

It could be recommended thatfrtilized composite 16 oblong onion genotype by 5 ton compost plus 67.5 kg N/feddan (75% of recommended dose) gave the highest marketable and total yield per feddan at Middle Delta, Gharbeia Governorate as well as decreasing soil erosion, soil compaction, environmental pollution, public health risk and decreased production costs.

Data cited in Table 12 showed that the beneficial cost ratio of application of 5 ton compost + 67.5 kg N/fed (75% of recommended) could be attributed to the fact that more marketable yield were produced per unit area, higher gross and net returns 32462 and 19824.5 L.E./fed, respectively compared with other treatments. Also, from the economic point of view, the revenue of L.E. is higher when application of 5 ton compost + 67.5 kg N/fed. which give the best benefit cost ratio 2.56.

Table 12: Average cost cultivation gross return and net return (L.E./fed.) as well as benefit cost ratio of onion yield as influenced by fertilization treatments through the two growing seasons.

Fertilization treatments	Cost of cultivation (L.E./fed)	Gross return (L.E./fed)	Net return (L.E./fed)	B.C ration
90kg N/fed. (control) = (100%)	12610	30890	18280	2.44
$20m^3$ FYM /fed.	11837.5	21534	9696.5	1.81
$20m^3$ FYM +67,5kg N/fed. (75%)	12437.5	28426	15986.5	2.28
$20m^3$ FYM + 45kg N/fed. (50%)	12362.3	27751	15388.7	2.24
5ton compost /fed.	11937.5	20031	8093.5	1.69
5ton compost + 67.5kg N/fed. (75%)	12637.5	32462	19824.5	2.56
5ton compost +45kg N/fed. (50%)	12462.5	26536	14073.5	2.12
4kg nitrobein /fed	11465.5	20520	9054.5	1.78
4kg nitrobein + 67.5kg N/fed. (75%)	12165.5	27642	15476.5	2.27
4kg nitrobein+ 45kg N/fed. (50%)	11995.5	25765	13774.5	2.14
4kg microbein / fed.	11465.5	19633	8167.5	1.71
4kg microbein +67.5kg N/fed. (75%)	12165.5	25912	13746.5	2.12
4kg microbein +45kg N/fed. (50%)	11995.5	26963	14972.5	2.24

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