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ONION PRODUCTIVITY AND SOIL FERTILITY STATUS AS INFLUENCED BY INTEGRATED USE OF INORGANIC, COMPOST TEA AND N_2-FIXING BACTERIAI FERTILIZERS

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ABSTRACT

Two field experiments were carried out at the Experimental Farm of Sakha Agricultural Research Station in Kafr El-Sheikh Governorate at North Nile Delta Region. The experiments were conducted to study the response of onion to nitrogen fertilizer levels under different bio-organic fertilizers (compost tea and biofertilizer) as well as their interaction, on the growth and onion bulbs yield and its quality as well as storability of onion bulbs during the two successive winter seasons of 2010/2011 and 2011/2012. A split-split plot design with three replicates was used in this study. The main plots were designated to the three mineral nitrogen fertilizer levels (60, 90 and 120 kg N fad.$^{-1}$), whereas foliar spraying treatments with compost tea at the same dose, 20 L fad.$^{-1}$ (spraying with water; foliar spraying at 40 days after transplanting (DAT); foliar spraying at 40 and 60 DAT; foliar spraying at 40, 60 and 80 DAT and soil application, 30 DAT at rate of 30 L fad.$^{-1}$) were randomly distributed in sub plots. While uninoculated and Inoculation with di-nitrogen fixing bacteria (Azotobacter and Azospirilium) were randomly distributed in the sub-sub plots.

The obtained results could be summarized as follow:

The two higher nitrogen levels (90 and 120kg N fad.$^{-1}$) achieved a significant increase in vegetative growth characters (plant height, plant fresh weight, leaves dry weight/plant, bulb dry weight, plant dry weight and bulb diameter) as well as bulbs yield and quality (marketable and total bulbs yield as well as bulb diameter) as compared to the lower nitrogen rate (60 kg N fad.$^{-1}$) in both seasons. The lower level of nitrogen (60 kg N fad.$^{-1}$) resulted in a significant increase in TSS and dry matter % in addition to decrease weight loss% of onion bulbs at different storage periods in the two seasons.

Growth and onion bulbs yield and its quality were highest due to application of compost tea on thrice than twice batches at the same dose and other treatments. The lowest values of bulbs weight loss% at 6 months were obtained under the application of compost tea on thrice batches.

The effect of bio-fertilizer in plant height, Leaves dry weight/plant, bulb dry weight, plant dry weight, bulb diameter and bulb weight as well as bulb quality was evident in both seasons. In general, inoculation with *Azotobacter* and *Azospirilium* possitively increased all the previous characters. Total bulbs yield increased above 4.2 % in the plots treated by bio-fertilizer as compared with uninoculated treatment. Bio-fertilizer exert a significant effect on total weight loss of onion bulbs during different storage periods in the two seasons, where the lowest values were recorded with *Azotobacter* and *Azospirilium* inoculation.

The interaction between mineral nitrogen and compost tea treatments had a significant effect on most studied characters. It is clear that the application of 90kg N fad.$^{-1}$x foliar spraying with compost tea at 40, 60 and 80 DAT treatments produced the highest values of these traits in both seasons.

Data cited that 90 kg N fad.$^{-1}$ plus biofertilizer gave the highest growth, marketable yield, total yield of onion bulbs and ranked first, while 60 kg N fad.$^{-1}$ treatment and uninocualted plants gave the lowest values and ranked last.

The maximum values of plant height, plant dry weight, average bulb weight, marketable and total bulbs yield and dry matter % were obtained from the combination of foliar spraying with compost tea treatment on thrice batches with di-nitrogen fixing bacteria.

Inoculated plants under 90 kg N fad.$^{-1}$ and foliar spraying with compost tea, 40, 60 and 80 DAT at a rate of 20 L fad.$^{-1}$ gained the best plant growth and yield if compared with the other treatments.

Based on the results of the current study, the combinations of mineral N and compost tea or biofertilizers could be considered as an integrated nutrient management to improve the growth and yield of onion plants. It also confirmed that compost tea can be used as organic substrate additives in plant cultivation and substitute for chemical nitrogen fertilizers.

Keywords: N-fertilizer; Compost tea; Biofertilizer; Bulbs; Combinations; Onion; Nile Delta

INTRODUCTION

Onion (*Allium cepa* L) is extremely important vegetable crop in Egypt, which is cultivated in a large scale not only for internal consumption but also as highest foreign exchange earner among the fruits and vegetables. The total area planted in 2007/2008 was 102,703 fad. (1 faddan = 4200 m^2) and produced 1,259,007 tons with an average yield of 12.6 t fad.$^{-1}$†. The average of exports reached 340,000 tons‡.

Inorganic fertilizers have significant effects on world crop production and are essential components of today's agriculture. Estimates show that agricultural production is raised by 50% as a result of chemical fertilizers and 60% of the population owes its nutritional survival to nitrogen (N) fertilizers (Fixon and West, 2002). However, of the total applied N, less than 50% is recovered in the soil–plant system, while the remainder is lost to the environment (Abbasi *et al.,* 2003). Hence, growing concerns about the negative impact of inorganic fertilizers on the environment and their future cost make it expedient to integrate a greater use of organic materials in cultivation practices to enhance crop yields. There are intensive efforts worldwide to use organic manures to provide the same amount of food with less fossil fuel-based inorganic fertilizers.

Production of horticultural crops has undergone significant changes in recent years due to development of innovative technologies including integrated nutrient management practices involving biofertilizers, which include phosphate-solubilizing bacteria, symbiotic and non-symbiotic N_2-fixing bacteria and arbuscular mycorrhizal (AM) fungi. The use of biofertilizers in enhancing plant growth and yield has gained momentum in recent years because of higher cost and hazardous effect of chemical fertilizers. Microbial

†(Central Administration of Agricultural Statistics)

‡ (General Organization for Export and Import Control)

inoculants are promising components for integrated solutions to agro-environmental problems because inoculants possess the capacity to promote plant growth, enhance nutrient availability and uptake, and support the health of plants (Dobbelaere *et al*., 2001; Kloepper *et al*., 2004; Han and Lee, 2005; Weller, 2007and Adesemoye *et al.*, 2008). Nitrogen-fixing bacteria were found to enhance the growth and production of onion plants significantly (Geries, 2007; Ahmed, 2009 and Sridevi and Ramakrishnan, 2010), besides improving the microbiological activity in the rhizosphere (Kohler *et al.,* 2008).

The use of microbe-enriched compost tea for nutrient mobilization is becoming popular, and new systems are being developed to meet the requirements of different crops and cropping systems. Several studies have reported benefits from the use of compost and compost teas as organic substrate additives in plant cultivation and in the suppression of soil-borne diseases. It has been reported that compost teas obtained from agro-wastes were able to enhance the growth and yield of okra when sprayed weekly at full strength (Siddiqui *et al*., 2008, 2009).

Integrating nutrient management with organic manures and inorganic fertilizers has been reported to increase yields and chemical constituents in onion (Geries, 2007 and Nyangani, 2010); *Plantago arenaria* (Kolodziej, 2006). The conjunctive use of organic nutrient sources with inorganic fertilizers was shown to improve the efficiency of inorganic fertilizer, increase crop yield, reduce inputs of chemical fertilizers and minimize environmental risks (Siddiqui *et al.,* 2011).

The information on role of mineral nitrogen, compost tea and biofertilizers and their combinations on production of onion are very scanty. Therefore, there is an urgent need to study the influence of mineral, organics, biofertilizers and their combinations to improve productivity, quality and storability of onion under the conditions of Kafr El-Sheikh Governorate.

MATERIALS AND METHODS

Experimental treatments

Two field experiments were carried out during the two successive seasons of 2010/2011 and 2011/2012 at the Experimental Farm of Sakha Agricultral Research Station in Kafr El-Sheikh Governorate at North Nile Delta Region. The soil of the experimental fields and compost tea analysis were shown in Table (1). Compost tea and biofertlizers were prepared in Sakha Agriculture Station–Bacterial Lab according to the method, which described by El-Gizawy (2005).

The experimental design was split-split-plot with three replications. The main plots included three mineral nitrogen levels (N) i.e., 60, 90 and 120 kg N fad.$^{-1}$. While compost tea (B) were allocated in sub– plots; B_0: foliar spray with water (Control); B_1: foliar spray, 40 days after transplanting (DAT), at a rate of 20 L fad.$^{-1}$; B_2: foliar spray, 40 and 60 DAT, at a rate of 20 L fad.$^{-1}$; B_3: foliar spray, 40, 60 and 80 DAT, at a rate of 20 L fad.$^{-1}$ as well as B_4: soil application, 30 DAT, at a rate of 30 L fad.$^{-1}$. Inoculation treatments (C); uninoculated and co-inoculation with *Azotobacter spp.* and *Azospirilium spp.* as biofertilizer were allocated in sub-sub-plots. The plot area was 10.5 m^2

(3.5 m length and 3 m width) included five ridges with 60 cm apart between ridges. Uniformed seedling was transplanted after hardening on the sides of ridges 10 cm apart. The onion seed was sown in the nursery on October 5th in both seasons. Transplanting took place on December 18th and 23rd in the first and second seasons, respectively. Phosphorus fertilizer was applied in the form of calcium super phosphate at the rate of 45 kg P_2O_5fad.$^{-1}$ during land preparation. Nitrogen fertilizer as ammonium nitrate at the above mentioned levels was added in the two equal doses (after 30 and 60 DAT). All cultivation practices were done according to the common practices in onion growing.

Table (1): Physiochemical properties of compost tea and the study soil under growing seasons.

Nutrients/heavy metals	Units	Compost tea	Soil	
			2010/2011	2011/2012
Smell (odor)		Good smell	-	-
Color		Dark	-	-
Total Solid materials	g l^{-1}	1.21	-	-
Organic matter	%	-	1.86	1.80
Coarse sand	%	-	5.24	4.92
Fine sand	%	-	14.2	15.1
Silt	%	-	31.8	30.0
Clay	%	-	45.0	46.3
Textural class		-	**Silty clay**	
pH		5.08	7.83	7.91
EC	dSm^{-1}	1.57	1.83	2.11
Total Nitrogen	ppm	6260	-	-
Ammonium Nitrogen	ppm	1800	-	-
Nitrate Nitrogen	ppm	3250	-	-
Available nitrogen	ppm	-	16.8	17.6
COD	ppm	690	-	-
BOD	ppm	340	-	-
Total phosphorus	ppm	4150	-	-
Available phosphorous	ppm	-	7.2	7.12
Total Potassium	ppm	5100	-	-
Available potassium	ppm	-	200	217
Calcium carbonate	%	-	3.14	2.60
Available Fe	ppm	-	9.4	11.5
Available Zn	ppm	-	7.45	6.23
Available Mn	ppm	-	12.1	13.3
Total Bacterial Counts	Cell ml^{-1}	117 x 107	-	-
Total *actinomycetes* Counts	Cell ml^{-1}	88 x 105	-	-
Total Fungus Counts	Cell ml^{-1}	56 x 103	-	-
Feacal Coliform	Cell ml^{-1}	nil	-	-
Escherichia coli	Cell ml^{-1}	nil	-	-
Salmonella& Shigella	Cell ml^{-1}	nil	-	-

Data recorded:

A. Plant growth measurements:

A representative samples, each five plants were randomly taken from the 2nd row of each plot at 120 DAT to estimated plant height (cm), number of leaves/plant, bulb diameter (cm) as well as fresh and dry weights of leaves/plant, bulb and whole plant (g).

B. Onion bulbs yield and its quality:

At harvesting time, all the remaining bulbs in each plot were uprooted and bulbs yield of onion expressed as: average bulb weight (g), marketable bulbs yield (t fad.$^{-1}$), culls bulb weight (t fad.$^{-1}$) and total bulbs yield (t fad.$^{-1}$). In the same time, sample of 5 bulbs were randomly taken for recording the bulb quality properties, i.e. bulb diameter (cm), total soluble solids (TSS%) and dry matter content (%).

C. Storability:

After curing, random samples (each of 10 kg) were taken from every treatment, stored at normal room conditions and weight loss percentage was recorded after each 60 days (3 storage periods). Weight loss% of bulb was estimated after 2, 4 and 6 months of storage according to the formula of Wills *et al.* (1982) as follow:

$$\text{Weight loss \%} = \frac{\text{Initial weight - weight after storage}}{\text{Initial weight}} \times 100$$

D. Soil analysis:

Soil samples (0-30 cm) were taken before and after harvesting and chemically analyzed for the main soil characteristics such as N,P and K. Total soluble salts (TSS) were measured as ECe (dS/m) electrical conductivity apparatus in the saturated soil past extract. Soluble ions and organic matter were determined according to Page (1982). Available nitrogen was extracted by K_2SO_4 (1%) and determined by micro-Kjeldahl methods. Available phosphorus was extracted with 0.5 N sodium bicarbonate and determined by spectrophotometer according to Olsen *et al*. (1954). Available potassium was extracted by ammonium acetat1 N and determined photometrical according to Page (1982).

Statistical analysis:

All data collected were subjected to statistical analysis as described by Snedecor and Cochran (1980) and the means were compared using L.S.D. test at 5% significance level. Treatments means were compared according to Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Effect of nitrogen fertilizer on growth, yield and weight loss percentage of onion plants.

Plant growth measurements:

It is clear that applying of 90 kg N fad.$^{-1}$ (N_2) significantly increased plant height, number of leaves, bulb diameter as well as fresh and dry weight of bulbs, leaves/ plant and whole plant of onion at 120 days after transplanting (DAT) without significant difference with 120 kg N fad.$^{-1}$ (N_3) on most studied characters. Therefore, bulb and plant dry weight significantly increased with N applied, especially in the plots treated with N_2 treatment in the two seasons (Tables 2 and 3). The highest values of plant growth measurements under higher rate of nitrogen reflect the role of nitrogen in enhancing biochemical process, which in turn enhanced the vegetative growth of onion plants. The same results were recorded by Geries (2007) and Geries *et al*. (2012) are supported the obtained results.

Onion bulbs yield and its quality:

Data cited in Tables (4 and 5) show that the nitrogen fertilizer at 90 kg Nfad.$^{-1}$ (N_2) resulted in the heaviest bulb weight, marketable yield fad.$^{-1}$, total yield fad.$^{-1}$ and highest bulbs diameter. 120 kg N fad^{-1} (N_3) gave the lowest values of culls yield fad.$^{-1}$, TSS and dry matter percentage, if compared with applying 60 and 90 kg N fad.$^{-1}$(N_1 and N_2) in the two seasons. The reduction in TSS and dry matter with 90 and 120 kg N fad.$^{-1}$ may be explained as the dilute effect, which accompanied the increment in the growth and weight of whole onion bulb, consequently, decreased the T.S.S and dry matter content. So it is clear from these results that an increase in N application beyond 90 kg N fad.$^{-1}$ is merely an increase in the cost of production. The trends of the obtained results are in good accordance with that reported by many investigators such as Shaheen *et al.,* (2011). Also, many researchers reported bulb yields improvement in response to N fertilization (Geries, 2007; Marey 2009; Abdissa *et al.*, 2011; Geries *et al*. 2012 and Morsy *et al*. 2012).

Storability:

Bulbs weight loss% were significantly affected by the levels of N fertilization at storage period for 2, 4 and 6 month. Onion bulbs weight loss% significantly decreased with decreasing N levels in both seasons (Table 6). While, excessive N application contributes to increase storage losses. The highest values of bulbs weight loss% at 6 months were obtained under higher N fertilization level (N_3) in the first and second seasons. These results mean that keeping quality of marketable yield improved with decreasing the mineral nitrogen fertilization. This may be attributed to the negative relation between T.S.S and dry matter in bulbs and sprouting percentage of bulbs during the storage period, which resulted from the highest N-level. The same trend was found by Geries, 2007; Marey, 2009; Geries *et al.,* 2012 and Morsy *et al.,* 2012, who reported that extensive application especially of nitrogen fertilizers causes adverse effect on storability of onion bulbs.

Effect of compost tea and bio-fertilizer on growth, yield and weight loss percentage of onion.

Plant growth measurements:

Onion growth significantly improved with application of compost tea and bio-fertilizer when it used alone (Tables 2 and 3). Application of compost tea and bio-fertilizer produced an almost equal growth as that of N - inorganic fertilization in terms of plant height, number of leaves, bulb diameter and fresh and dry weight of bulbs, leaves/ plant and whole plant of onion plants at 120 DAT. This fact was true in both seasons. Onion growth was higher under the application of compost tea on thrice (B_3) than twice batches at the same dose compared to control treatment (B_0). Application of B_3 (foliar spraying with compost at 40, 60 and 80 DAT) increased bulb and plant dry weight by (31.59 and 32.05%) and (40.10 and 30.29%) during both seasons, respectively.

2

3

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The application of compost tea as foliar treatments on onion plants was higher in onion growth than compost tea applied as soil application. The highest growth of onion plants was obtained in the plots treated by compost tea under B_3 treatment compared with other organic fertilization in both seasons. Inoculation with di-nitrogen fixing bacteria (*Azotobacter* and *Azospirilium*) significantly improved growth of the onion plants compared with uninoculation treatment (Tables 2 and 3). Considering inoculation treatment increased bulb dry weight and plant than uninoculation treatment by (18.57 and 12.20%) and (19.20 and 11.72%) during 2010/2011 and 2011/2012 seasons, respectively. This data indicated that inoculation had the highest effect on onion growth. These increases may be due to the effect of nitrogen, which produced by inocullated bacteria in addition to cytokinens, GA_3 and IAA, which increase vegetative growth. These results were coinciding with those of Khalid *et al.* (2006) and Gharib *et al.* (2008). They all showed that compost tea increased vegetative growth and essential oil content of *Ocimum basilicum* and *marjoram* plants, respectively. The beneficial effect of compost tea on herb dry matter may be due to both supply nutrients and microbial functions (as useful microorganisms increase the time stomata stay open, then reducing loss from the leaf surface). It can provide chelated microelements and make them easier for plants to absorb and increasing soil aeration and acidity (Ebid *et al*., 2008). This decrease of compost tea applied as soil application on onion growth due to soil components (i.e., organic matter, Al- and Fe-(hydr) oxides, variable charge clays, ect.), which probably interacted with the humic and fulvic acids and phenolic compounds that in compost tea contents. In case compost tea as foliar, there are increasing permeability of cellular membranes in plants to vitamins within the cell (Kaya *et al*., 2005), which increased plant growth. And also, when compost teas are applied to foliage, there may be direct effects on the pathogen and indirect effects through improvement in plant resistance (Litterick *et al*., 2004), which probably increased plant growth.

Onion bulbs yield and its quality:

It is clear from the present data in Tables (4 and 5) that foliar nutrients with compost tea significantly affected onion bulb yield and quality in the two seasons. Application of compost tea and bio-fertilizer when it used alone was effective in increasing the onion bulb yield in both seasons. Maximum average bulb weight, marketable and total bulbs yield (t fad.$^{-1}$), bulb diameter, TSS % and dry matter % were achieved by foliar spraying with compost tea at 40, 60 and 80 DAT (B_3).On the other hand, the lowest values were obtained from spraying with water (B_0), while it gave the highest values of culls yield fad.$^{-1}$ in the two seasons. Application of B_3 increased marketable yield, total yield and TSS % by (31.88 and 18.13 %), (27.00 and 8.32%) and (16.13 and 11.92 %) during 2010/2011and 2011/2012 seasons, respectively.

Co-inoculation with *Azotobacter and Azospirilium* significantly increased marketable bulb yield as well as total bulbs yield, TSS and dry matter of onion in comparison to uninoculated plants in both seasons. The increase in onion bulbs yield and quality from inoculation may be attributed to the nitrogen, which released by fixing bacteria. Increasing nitrogen in the soil increased the synthesis of the endogenous phytophormones, which plays an important role in formation of a largest active root system, that allow more nutrients uptake, and hence may promote photosynthesis and translocation as well as accumulation of dry matter within different plants parts. Application of liquid organic fertilizer over the mulch was effective in increasing the onion bulb yield (Lee, 2010). Compost teas have been also found to increase crop yields and produce quality (Haggag and Saber, 2007). Nitrogen fixation has been proposed as a mechanism involved in enhanced N uptake of inoculated plants. A specific example is *Azospirillum spp*. enhanced plant N uptake and plant growth promotion in which nitrogen fixation was the first reported mechanism as reviewed by Dobbelaere *et al.* (2001) and Bashan *et al.* (2004). It must be emphasized that nitrogen fixation is not the only mechanism; other mechanisms that have been proposed in *Azospirillum* include production of phytohormones leading to improved root growth, water adsorption, and mineral uptake (e.g., phosphate solubilization), proton, and organic acid extrusion. It is well reported that uptake of N, P, K, and micronutrients are significantly enhanced in plants inoculated with *Azospirillum* in both the greenhouse and field. And also, nitrogen-fixing bacteria and arbuscular mycorrhizal fungi were found to enhance the growth and production of various fruit plants significantly (Bashan *et al.,* 2004), besides improving the microbiological activity in the rhizosphere (Kohler *et al*., 2008).

Table (6): Total weight loss of onion bulbs as affected by different nitrogen rates, compost tea, biofertilizer and their interaction in 2010/2011 and 2011/2012 seasons.

Treatment	2010/2011			2011/2012		
	Storage period (Month)			Storage period (Month)		
	2	4	6	2	4	6
N-Level (N):						
60	9.78 **c**	10.38 **c**	13.66 **c**	9.53 **c**	10.44 **c**	12.92 **c**
90	10.85 **b**	11.53 **b**	14.31 **b**	11.39 **b**	11.85 **b**	14.44 **b**
120	12.23 **a**	12.69 **a**	15.00 **a**	13.20 **a**	12.67 **a**	15.34 **a**
F-test	**	**	**	**	**	**
Comp. Tea (B):						
Control	11.61 **a**	11.85 **a**	15.38 **a**	12.50 **a**	12.35 **a**	15.46 **a**
Foliar at 40 DAT	10.81 **b**	11.58 **a**	14.80 **b**	11.41 **c**	11.87 **b**	14.94 **b**
Foliar at 40and 60 DAT	10.70 **b**	11.51 **a**	14.48 **c**	10.93 **d**	11.45 **c**	13.75 **c**
Foliar at 40 , 60 and 80 DAT	10.29 **c**	11.11 **b**	12.07 **d**	10.12 **d**	10.56 **d**	11.90 **d**
Soil application at30 DAT	11.35 **a**	11.62 **a**	14.90 **b**	11.91 **b**	12.03 **b**	15.10 **ab**
F-test	**	**	**	**	**	**
Bio-fertilizer (C):						
Uninoculated	11.39	11.75	14.58	11.99	12.04	14.49
Inoculated with (z+s)	10.51	11.32	14.07	10.76	11.26	13.97
F-test	**	**	**	**	**	**
Interaction:						
Nx B	*	NS	**	**	NS	**
Nx C	NS	NS	N.S	N.S	NS	N.S
B x C	N.S	NS	N.S	N.S	NS	N.S
N x B xC	NS	NS	N.S	N.S	NS	N.S

***, ** and NS indicated P<0.05, P<0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

Storability:

Data presented in Table (6) clear that weight loss% of stored bulbs for 2, 4 and 6 months were significantly decreased with application of compost tea in the two seasons. The lowest values of bulbs weight loss% at 6 months (12.07 and 11.90%) were obtained under foliar application of compost tea at 40 , 60 and 80 DAT(B_3), while the highest values (15.38 and 15.46%) were obtained from spraying with water (B_0, control), in the first and second seasons, respectively. Biofertilizer exerted a significant effect on total weight loss of onion bulbs during storage period (6 months). The lowest values for weight loss during the different months of storage were resulted from the inoculation of onion plants with *Azotobacter spp.* and *Azospirilium spp.* as compared with untreated plants (control). These results may be attributed to the main effect of biofertilizer application on the increment of total soluble solids and dry matter percentage consequently decreased the weight losses of bulbs and improved the storability of onion bulbs. Abdel-Razzak and El-Sharkawy (2013) found that sprayed inoculated plants for three times via humic acid gave best results for garlic longevity throughout increasing bulbs weight and decreasing bulbs loose after four months of storage

Effect of the interaction between N-fertilizer level, compost tea and bio-fertilizer:

According to the data in Table (7), it is clear that the combination between 90 kg N (t fad.$^{-1}$) and spraying with compost tea at 40, 60 and 80 DAT (N_2B_3) resulted in the highest values of plant height, plant dry weight, average bulb weight, marketable yield as well as total yield and bulb diameter, while the highest value of dry matter % was recorded when fertilized with 60 kg N fad.$^{-1}$. (N_1B_3). Adding 120 kg N fad.$^{-1}$ with soil application of compost tea at 30 DAT attained the highest mean values of weight loss% at all storage periods in both seasons, except for that at 6 months storage period in the second season (N_3B_4). Siddiqui *et al.* (2011) found that the interaction between compost tea and an inorganic fertilizer has led to an increase in macronutrient content. This increase might be related to the positive effect of compost tea and an inorganic fertilizer in increasing the root surface area per unit of soil volume, water use efficiency and photosynthetic activity, which directly affect physiological processes. These elements improve the yield and growth of onion. Also, the organic sources of nitrogen, as well as their combinations with inorganic sources, have been reported to significantly improve plant height, fresh and dry weight of both above-ground parts and roots, and increase oil yield in basil compared to plots receiving only inorganic N (Sifola and Barbieri, 2006).

Effects of the interaction between N- fertilizer level and bio-fertilizer are shown in Table (8). Plant fresh weight, average bulb weight, marketable and total yield were increased in all plots which received 90 kg N fad.$^{-1}$ with applying biofertilizer in comparison to all other treatments. Whereas,

7

application of 60 Kg N. fad.$^{-1}$ recorded the highest values of dry matter % (16.26 and 17.23%) under inoculation treatment in the first and second seasons, respectively.

Effects of the interaction between compost tea and bio-fertilizer are shown in Table (9). The maximum plant height and plant dry weight at 120 DAT, average bulb weight, marketable yield and percentage of dry matter were noticed from the treatment included bio-fertilizer application and spraying with compost tea at 40, 60 and 80 DAT followed by foliar application of compost tea at 40 and 60 DAT, while the lowest one was obtained with the combination of control (without both compst tea and inoculation treatment).

There was a significant effect due to the interaction among N-fertilizer level, compst tea treatment and bio-fertilizer on average bulb weight, marketable yield and total yield in the two seasons. Data in Table 10 show that added of 90 kg N fad.$^{-1}$, compost tea spraying 3 times and inoculation by bacterial di-nitrogen fixers ($N_2B_3C_2$) compared to ($N_2B_0C_2$) led to an increase in average bulb weight, marketable yield and total yield in both 2010/2011 and 2011/2012 seasons were 58.6 and 47.5%, 39.2 and 25.4% and 30 and 15%, respectively.

Table (8): Plant fresh weight (g), average bulb weight (g), marketable and total yield (t fad.$^{-1}$) and dry matter % as affected by the interaction between N-fertilizer level and bio-fertilizer in 2010/2011 and 2011/2012 seasons.

N- level (Kg fad.$^{-1}$)	2010/2011		2011/2012	
	Bio-fertilizer			
	Uninoc.	Inoc.	Uninoc.	Inoc.
Plant fresh weight (g)				
60	155.31 **f**	165.40 **e**	145.40 **e**	180.60 **d**
90	205.96 **c**	236.21 **a**	195.12 **c**	219.03 **a**
120	194.84 **d**	221.34 **b**	194.87 **c**	208.45 b
Average bulb weight (g)				
60	68.35 **f**	79.86 **e**	64.33 **e**	72.95 **d**
90	103.04 **c**	114.62 **a**	101.53 **b**	107.76 **a**
120	97.33 **d**	111.20 **b**	93.53 **c**	104.20 **b**
Marketable yield (t fad.$^{-1}$)				
60	10.92 **e**	11.79 **d**	9.10 **f**	9.93 **e**
90	15.15 **b**	16.20 **a**	12.12 **d**	13.09 **a**
120	14.81 **c**	16.07 **a**	12.38 **c**	12.86 **b**
Total yield (t fad.$^{-1}$)				
60	12.98 **e**	13.67 **d**	11.83 **e**	12.20 **d**
90	16.99 **b**	17.90 **a**	14.54 **c**	15.21 **a**
120	16.05 **c**	17.03 **b**	14.71 **bc**	14.75 **b**
Dry matter (%)				
60	14.85 **c**	16.26 **a**	15.29 **c**	17.23 **a**
90	13.39 **d**	15.78 **b**	14.29 **d**	16.54 **b**
120	12.43 **e**	13.80 **d**	13.18 **f**	13.95 **e**

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test

9

Table (10): Average bulb weight (g), marketable yield (t fad.$^{-1}$) and total yield (t fad.$^{-1}$) as affected by the interaction among N-fertilizer level, compost tea and biofertilizer in 2010/2011 and 2011/2012 seasons.

N-level	Compost tea	Bio-fertlizers	Average bulb weight (g)		Marketable yield (t fad.$^{-1}$)		Total yield (t fad.$^{-1}$)	
			2010/11	2011/12	2010/11	2011/12	2010/11	2011/12
N_1	B_0	C_1	54.86	51.32	9.77	8.07	12.43	11.00
		C_2	68.05	53.34	10.17	9.03	12.51	11.70
	B_1	C_1	66.63	56.51	10.85	9.40	12.61	12.14
		C_2	80.89	80.28	11.82	10.04	13.47	12.23
	B_2	C_1	76.02	72.70	10.77	9.68	12.75	12.14
		C_2	82.45	82.66	12.43	10.11	14.20	12.23
	B_3	C_1	83.06	83.39	11.96	10.12	14.18	12.51
		C_2	86.49	87.39	12.66	10.68	14.71	12.68
	B_4	C_1	61.16	57.73	11.25	8.21	12.91	11.35
		C_2	81.41	61.06	11.85	9.80	13.45	12.16
N_2	B_0	C_1	70.40	62.73	10.88	10.70	13.28	13.70
		C_2	82.01	81.27	12.68	11.20	14.84	13.73
	B_1	C_1	97.79	111.78	16.41	12.74	18.06	14.96
		C_2	120.98	114.69	16.93	13.41	18.52	15.29
	B_2	C_1	121.24	111.92	16.25	12.86	17.94	15.03
		C_2	127.62	116.08	17.04	13.72	18.63	15.66
	B_3	C_1	123.51	116.03	16.83	13.03	18.61	15.09
		C_2	130.08	119.94	17.66	14.05	19.32	15.81
	B_4	C_1	102.27	105.17	15.39	11.29	17.09	13.89
		C_2	112.43	106.83	16.68	13.04	18.19	15.57
N_3	B_0	C_1	75.06	71.20	12.80	11.80	13.80	14.60
		C_2	85.64	84.71	13.73	12.10	14.00	14.67
	B_1	C_1	101.01	98.25	15.15	12.41	16.42	14.75
		C_2	118.02	107.70	16.58	12.58	17.71	14.06
	B_2	C_1	102.34	107.60	15.52	12.73	16.75	14.67
		C_2	121.36	111.04	16.73	13.46	17.92	15.21
	B_3	C_1	117.20	113.10	16.19	12.76	17.67	14.90
		C_2	125.49	117.96	17.06	13.63	18.21	14.98
	B_4	C_1	91.02	77.52	14.39	12.18	15.59	14.61
		C_2	105.46	99.61	16.25	12.54	17.33	14.82
L.S.D. at 0.0 5			2.755	7.134	0.330	0.346	0.402	0.441

N_1: 60, N_2: 90 and N_3: 120 Kg N fad.$^{-1}$ – B_0: Without compost tea, B_1: Foliar at 40 DAT, B_2: Foliar at 40 and 60 DAT, B_3: Foliar at 40, 60 and 80 DAT and B_4: Soil application at 30 DAT – C_1: Uninoculated and C_2: Inoculated by free living (z+s).

Generally data in Table 11 show that the increase in the availability of phosphorus and potassium was increased with soil application of compost tea and inoculation treatment at the two seasons of study (B_4C_2), especially at the second level of mineral nitrogen (90 kg N fad.$^{-1}$) . While the soil availability of nitrogen was increased according to continues additions of mineral nitrogen fertilizers. In this connection, Jayathilake *et al*. (2006) found similar results in onion plants.

Table (11): Available N, P and K (ppm) in the experimental soil after onion crop harvesting as influenced by mineral nitrogen level, compost tea and biofertilizers applications in 2010/2011 and 2011/2012 seasons.

N-level	Compost tea	Bio-fertlizers	Nitrogen (ppm)		Phosphorus (ppm)		Potassium (ppm)	
			2010/2011	2011/2012	2010/2011	2011/2012	2010/2011	2011/2012
N_1	B_0	C_1	18.4	18.6	7.9	8.1	218	209
		C_2	23.1	19.4	7.9	8.3	220	213
	B_1	C_1	23.0	20.0	7.6	8.1	200	204
		C_2	24.3	22.6	8.1	8.3	218	220
	B_2	C_1	28.1	25.1	8.2	7.6	209	211
		C_2	28.7	30.2	9.2	8.0	231	209
	B_3	C_1	33.2	30.6	8.3	8.3	207	204
		C_2	34.1	38.1	9.1	8.2	221	209
	B_4	C_1	44.5	43.0	9.1	9.1	251	244
		C_2	46.8	44.6	9.6	9.4	260	271
N_2	B_0	C_1	38.1	36.2	8.7	8.1	204	213
		C_2	40.6	35.5	7.9	8.3	209	224
	B_1	C_1	39.6	36.7	7.1	8.0	212	220
		C_2	38.1	36.2	9.1	8.4	208	228
	B_2	C_1	42.2	36.4	8.4	7.6	2.1	214
		C_2	39.1	38.0	9.1	7.9	218	234
	B_3	C_1	46.7	32.1	9.2	8.1	216	221
		C_2	36.1	43.0	8.8	8.3	220	231
	B_4	C_1	51.6	46.7	9.4	10.2	248	251
		C_2	55.8	52.4	9.8	11.1	266	264
N_3	B_0	C_1	51.0	53.6	7.2	8.2	198	204
		C_2	51.1	54.1	7.3	8.6	204	209
	B_1	C_1	52.6	56.7	8.0	7.8	206	211
		C_2	53.0	60.1	8.1	9.2	214	224
	B_2	C_1	61.3	60.3	8.3	8.3	220	231
		C_2	62.1	61.0	9.1	9.0	217	224
	B_3	C_1	59.8	58.2	8.9	8.6	208	231
		C_2	60.2	60.3	9.2	8.4	221	234
	B_4	C_1	64.8	62.1	10.6	10.0	238	248
		C_2	65.0	63.4	11.0	10.8	249	274

N_1: 60, N_2: 90 and N_3: 120 Kg N fad.$^{-1}$ – B_0: Without compost tea, B_1: Foliar at 40 DAT, B_2: Foliar at 40 and 60 DAT, B_3: Foliar at 40, 60 and 80 DAT and B_4: Soil application at30 DAT – C_1: Uninoculated and C_2: Inoculated by free living (z+s).

REFERENCES

Abbasi, M.K.; Z. Shah and W.A. Adams (2003). Effect of the nitrification inhibitor nitrapyrin on the fate of nitrogen applied to the soil incubated under laboratory condition. J. Plant Nutr. Soil Sci., 166:513-518.

Abdel-Razzak,H.S. and G.A.El-Sharkawy (2013). Effeect of biofertilizer and humic acid applications on growth, yield, quality and storability of two garlic(Allium sativum L.) cultivars. Asian J. of Crop Sci., (5):48-64.

Abdissa, Y.; T. Tekalign and L. M. Pant (2011). Growth, bulb yield and quality of onion (*Allium cepa* L.) as influenced by nitrogen and phosphorus fertilization on vertisol. I. growth attributes, biomass production and bulb yield. African Journal of Agricultural Research 6 (14): 3252-3258.

Adesemoye, A.O.; H.A. Torbert and J.W Kloepper (2008) Enhanced plant nutrient use efficiency with PGPR and AMF in an integrated nutrient management system. Can J Microbiol 54:876–886

Ahmed, M.E.M. (2009). Effect of some bio and mineral fertilization levels on the growth, productivity and storability of onion. Annals Agric. Sci., Ain Shams Univ., Cairo, 54(2), 427-436.

Bashan,Y.; G. Holguin and L.E.de-Bashan(2004). *Azospirillum*-plant relationships: physiological, molecular, agricultural, and environmental advances (1997–2003). Can J Microbiol 50:521–577

Dobbelaere, S.; A. Croonenborghs; A. Thys; D. Ptacek and J. Vanderleyden (2001). Responses of agrinomically important crops to inoculation with Azospirillum. Aust. J. Plant Physiol., 28: 871-879.Duncan, B. D. (1955). Multiple rang and multiple F-test Biometrics 11: 1- 42.

Duncan, B. D. (1955). Multiple rang and multiple F-test Biometrics 11: 1- 42.

Ebid, A.;H. A Ueno and Ghoneim, N. Asagi (2008). Nitrogen uptake by radish, spinach and "Chingensai" from composted tea leaves, coffee waste and kitchen garbage. Compost Sci & Utilization, 16(3): 152-158.

El-Gizawy, E.S. (2005). The role of compost quality and compost tea to enhance organic agriculture system. Ph.D. Thesis, Soil Science Dept., Fac. of gric. Alex. Univ. Egypt.

Fixon, P.E. and F.B. West (2002). Nitrogen fertilizers: meeting contemporary challenges. Ambio 31 (2), 169–176.

Geires, L.S.M. (2007). Effect of different fertilizer sources on growth and yield of onion (*Allium cepa*, L.). Ph.D. Thesis, Fac. of Agric., Kafrelsheikh Univ., Egypt.

Geries, L.S.M.; A.M.A. Abo-Dahab and S.S. Karam (2012). Response of onion productivity and storability to some sources, rates and time of application of nitrogen fertilizers. Alex. j. Agric.Res.,57(2):153-162.

Gharib, F.A., L.A. Moussa and O.N. Massoud (2008). Effect of compost and bio-fertilizers on growth, yield and essential oil of sweet marjoram (*Majorana hortensis*) plant. Inter. J. of Agric. &Biol., 10(4): 381-387.

Haggag, Wafaa, M. and M. Saber (2007). Suppression of *Alternaria* blighton tomato and onion by foliar spray of aerated and non aerated compost teas. *Journal of Food, Agriculture and Environment* (Finland). 5: 2, 302-309.

Han, H.S.and K.D.Lee (2005). Phosphate and potassium solubilizing bacteria effect on mineral uptake, soil availability, and growth of egg plant. Res J Agric Biol Sci 1:176–180

Jayathilake , K.S.and I.P. Reddy; D. Srihari and K.R.Reddy (2006). Productivity and soil fertility status as influenced by integrated use of N-fixing biofertilizers, organic manures and inorganic fertilizers in onion. The j. of Agric. Sci, 2 (1):46-58.

Kaya, M.; M. Atak, K. Mahmood, C.Y. Cefci and S. Ozcan (2005). Effect of pre-sowing seed treatment with zinc and foliar spray of humic acid on yield of common bean (*Phaseolus vulgaris* L.). Int. J. Agric. Biol., 7: 875-878.

Khalid, K.H.A.; S.F. Hendawy, and E. El-Gezawy (2006). *Ocimum basilicum L.* production under organic farming. Res. J. Agric. Biol. Sci., 2(1): 25-32.

Kloepper, J.W.; C.M. Ryu and S. Zhang (2004). Induced systemic resistance and promotion of plant growth by *Bacillus spp*. Phytopathol 94:1259–1266

Kohler, J.; J.A. Hernandez; F. Caravaca and A. Roldan (2008). Plant growth promoting rhizobacteria and arbuscular mycorrhizal fungi modify alleviation biochemical mechanisms in water-stressed plants. Function Plant Biol 35:141–151

Kolodziej, B.(2006). Effect of mineral fertilization on ribwort plantain (*Plantago lanceolataL.*) yielding. Acta Agrophys. 8, 637–647.

Lee, J.(2010). Effect of application methods of organic fertilizer on growth, soil chemical properties and microbial densities in organic bulb onion production. Scientia Horticulturae 124 (2010) 299–305

Litterick, A.M.; L. Harrier; P. Wallace; C.A., Watson and M.Wood (2004).The role of uncomposted materials, composts, manures and compost extracts in reducing pest and disease incidence and severity in sustainable temperate agricultural and horticultural crop production—areview. Crit. Rev. Plant Sci. 23, 453–479.

Marey, R.A. (2009). Post-harvest attributes of onion bulbs as affected by NPK fertilization under Souther Egypt condition. Egypt. J. of Appl. Sci., 24(9): 239-250.

Morsy, M.G.; R.A. Marey; S.S. Karam and A.M.A. Abo-Dahab (2012). Productivity and storability of onion as influenced by the different levels of NPK fertilization. Agric. Res. Kafer El-Sheikh Univ., 38(1):171-187.

Nyangani,E.T.(2010). Effect of combined application of organic manure and chemical fertilizers on coil properties and crop yield: Revew. Nigerian J. of Sci., Techno. and Environ.Education (NIJOSTEE), 3(1): 0331-9873

Olsen,S.R; C.V Cale; F.S. Watenable and L.A. Dean (1954). Estimation of available phosphorus in soil by extraction with sodium bicarbonate U,S,Dept., Agric. Circ., 939.

Page, M. A. (1982). Methods of Soil Analysis. Part 2. Academic press, New York.

Shaheen, A.M.; Fatma A. Rizk, A.M. M. El- Tanahy and E. H. abd El-Samad (2011). Vegetative Growth and Chemical Parameters of Onion as Influenced by Potassium as Major and Stimufol as Minor Fertilizers. Australian J. of Basic and Applied Sciences, 5(11):518-525.

Siddiqui, Y.; S. Meon; R. Ismail and M.Rahmani (2009). Bio-potential of compost tea from agro-waste to suppress Choanephora cucurbitarum L. the causal pathogen of wet rot of okra. Biol. Control 49, 38–44.

Siddiqui, Y.; S. Meon; R. Ismail; M. Rahmani and A. Ali (2008). Bio-efficiency of compost extracts on the wet rot incidence, morphological and physiological growth of okra (Abelmoschus esculentus [(L.) Moench]). Sci. Horti. 117, 9–14.

Siddiqui, Y.; S. Meon; R.Ismail and Y.Naidu (2011). The conjunctive use of compost tea and inorganic fertiliser on the growth, yield and terpenoid content of *Centella asiatica (L.)* urban. Sci. Horti. 130, 289–295

Sifola, M.I. and G. Barbieri (2006). Growth, yield and essential oil content of three cultivars of basil grown under different levels of nitrogen in the field .Scientia Horticulturae, 108: 408–413.

Snedecor, G.V. and W.G. Cochran (1980). Statistical methods, 12th Ed. Iowa State Univ. Press, Amer. Iowa, USA.

Sridevi, S.and K. Ramakrishnan (2010). Effects of combined inoculation of AM fungi and *Azospirillum* on the growth and yield of onion *(Allium cepa L.)* . *Journal of Phytology, 2(1): 88-90*.

Weller, D.M.(2007). *Pseudomonas* biocontrol agents of soilborne pathogens: looking back over 30 years. Phytopathology 97: 250–256

Wills, R. H.; T. H. Lee; D. Gerham; W. B. Mc-Gllasson and E. G. Hall (1982). Postharvest and introduction to physiology and handling of fruit and vegetable. The AVF Publishing Comp. Inc. Westport. Conn. PP. 35.

إنتاجية البصل وخصوبةَ الأرض وتأثرها بالإستعمالِ المتكاملِ من السماد المعدني و شاي الكومبوست وبكتريا تثبيت الازوت الجوي

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أجرى هذا البحث التطبيقى خلال الموسمين ٢٠١٠/٢٠١١و ٢٠١١/٢٠١٢ بالمزرعة البحثية لمحطة البحوث الزراعية بسخا – محافظة كفرالشيخ وذلك لدراسة تأثير إستخدام شاى الكومبوست بمواعيد إضافة مختلفة و معدلات مختلفة من التسميد النيتروجينى المعدنى والحيوى على القدرة الإنتاجية والتخزينية وجودة محصول البصل صنف جيزه أحمر.تم استخدام تصميم القطع المنشقة مرتين فى ثلاث مكررات حيث وزعت معاملات التسميد النيتروجينى المعدنى بثلاث معدلات (٦٠، ٩٠ ، ١٢٠ كجم نيتروجين /فدان) على القطع الرئيسية ، ومواعيد الرش بشاى الكومبوست بمعدل٢٠لتر/فدان في كل مرة (الرش الورقى بالماء العادي للمقارنة - الرش الورقى عند ٤٠يوم من الشتل ، الرش الورقى عند ٦٠،٤٠ يوم، الرش الورقى عند ٨٠،٦٠،٤٠ يوم من الشتل ،واضافة شاي الكمبوست الي التربة بمعدل ٣٠لتر/فدان عند ٣٠يوم من الشتل) على القطع الشقية الأولى أما التسميد الحيوى (شتلات غير ملقحة - شتلات ملقحة ببكتريا الازوتوباكتروالأيوزسبريليم) فقد وزعت عشوائيا على القطع الشقية الثانية.

ويمكن تلخيص أهم النتائج فيما يلى:

- ادى التسميد المعدنى بمعدل٩٠،١٢٠ كجم نتروجين/فدان للحصول على اعلى القيم من ارتفاع النبات ، الوزن الغض للنبات , الوزن الجاف لكل من الاوراق والابصال والنبات عدد الأوراق/نبات ، قطر البصلة ، متوسط وزن البصلة ،المحصول الصالح للتسويق والكلي مع اقل محصول نقضة/فدان. بينما زادت كل من المواد الصلبة الذائبة والنسبة المئوية للمادة الجافة بالأبصال والقدرة التخزينية للأبصال مع إضافة ٦٠ كجم نيتروجين/فدان.
- أشارت النتائج الى الحصول علي أعلى القيم من صفات النمو الخضربوالمحصول وجودة الأبصال والقدرة التخزينية للأبصال تم الحصول عليها عند الرش الورقي بشاي الكومبست ثلاث مرات بعد٤٠،٦٠،٨٠ يوم من الشتل. فى حين تم الحصول على اقل القيم من صفات النمو الخضربوالمحصول وجودة الأبصال والقدرة التخزينية عند الرش بالماء, وذلك فى كلا الموسمين.

- أيضـا كـان هنـاك تـأثيراً معنويـاً واضـحا للتسـميد الحيـوى بالموسـمين، حيـث أدى تلقـيح شـتلات البصـل بالأزوتوباكتروالأيزوسـبريليم إلـى زيـادة فـى ارتفـاع النبـات, الـوزن الغـض و الجـاف لكـل مـن الاوراق والابصال والنبات و قطر ووزن البصلة، وكذلك متوسط وزن البصلة ،المحصول الصـالح للتسويق والكلي مع اقل محصول نقضة/فدان وتحسين القدرة التخزينية للأبصال.
- أوضحت النتـائج أن صفات النمو الخضربوالمحصول وجودة الأبصـال قد زادت زيـادة معنويـة خاصـة مـع إضافة شاى الكومبوست ثلاث مرات بالرش الورقى بمعدل٢٠لتر/فدان في كل مرة مع إضافة ٩٠ كجم نيتروجين للفدان عن باقى المعاملات حتى مع التسميد العالى للنيتروجين المعدنى ١٢٠ كجم / فدان.
- اظهرت النتائج أن التفاعل بين معدلات التسميد النيتروجينى المختلفة و التلقيح الحيوي كـان لـه تـاثير معنوى على صفات النمو الخضرى والمحصول الكلي والتسويقى فى كلا الموسمين٠ حيث أعطت إضـافة ٩٠ كجم نيتروجين للفدان مع تلقيح الشتلات بالأزوتوبـاكتر والأيزوسبريليم أعلي النتـائج ، بينمـا أعطـت المعاملـة٦٠ كجم نيتروجين /فدان مع عدم التلقيح أقل القيم.
- وقد تحققت أعلى القيم فى ارتفـاع النبـات, الـوزن الجـاف للنبـات , متوسط وزن البصـلة ،المحصـول الصـالح للتسـويق والكلـي , نسـبة المحتـوى مـن المـادة الجافـة عنـد الـرش بشـاي الكمبوسـت ثـلاث مـرات بمعدل٢٠لتر/فدان في كل مرة مع التلقيح الحيوي بينما كانت أقل القيم مع الكنترول(بدون شاي الكمبوست و التلقيح الحيوي)
- عمومـا ومـن الناحيـة الاقتصـادية وتحـت ظـروف هـذة الدراسـة يمكـن أن نوصـى بـالرش الـورقى بشـاى الكومبوست ثلاث مرات بمعدل٢٠لتر/فدان في كل مرة وتسميد نباتات البصل بمعدل ٩٠كجم نيتروجين (معدنى)/فدان مع تلقيح شتلات البصل بالأزوتوباكتر والأيزوسبيريليم لزيادة إنتاجية محصول البصل وتقليل التلـوث البيئـى نتيجـة لتقليل استخدام النيتروجين فـى الصـورة المعدنيـه٠ و مـن هـذة النتـائج المحققـة يمكـن إستخدام شـاى الكومبوسـت كبـديل لجـزء كبيـر مـن الأسـمدة المعدنيـة وبالتـالى تقليـل تكـاليف الإنتـاج وتحسـين الجودة والحد من التلوث البيئى .

قام بتحكيم البحث

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Table (2): Effect of different nitrogen rates, compost tea, biofertilizer and their interaction on some onion growth characters at 120 DAT in 2010/2011 season.

Treatment	Plant height (cm)	No. of green leaves /plant	Bulb diameter (cm)	Leaves fresh Weight /plant (g)	Bulb fresh weight (g)	Plant fresh weight (g)	Leaves dry weight /plant (g)	Bulb dry weight (g)	Plant dry weight (g)
N-Level (N):									
60	65.61 **c**	7.16 **b**	3.97 **b**	81.91 **c**	78.44 **c**	160.35 **c**	4.48 **c**	12.81 **b**	17.28 **c**
90	74.06 **a**	8.67 **a**	4.33 **a**	98.40 **a**	122.69 **a**	221.09 **a**	6.47 **a**	16.71 **a**	23.17 **a**
120	69.63 **b**	8.80 **a**	4.25 **a**	90.41 **b**	117.68 **b**	208.09 **b**	5.82 **b**	16.23 **a**	22.05 **b**
F-test	**	**	**	**	**	**	**	**	**
Comp. Tea (B):									
Control	64.85 **d**	7.38 **c**	3.98 **d**	76.67 **e**	85.70 **e**	162.37 **e**	4.31 **e**	13.58 **e**	17.89 **e**
Foliar at 40 DAT	70.22 **b**	8.30 **ab**	4.10 **c**	89.21 **c**	105.78**c**	194.98 **c**	5.85 **c**	14.90 **c**	20.48 **c**
Foliar at 40 and 60 DAT	72.03 **a**	8.52 ab	4.30 **b**	95.38 **b**	120.52**b**	215.89 **b**	6.35 **b**	15.87 **b**	22.22 **b**
Foliar at 40 , 60 and 80 DAT	73.20 **a**	8.71 **a**	4.63 **a**	105.87**a**	128.00**a**	233.88 **a**	7.19 **a**	17.87 **a**	25.06 **a**
Soil application at30 DAT	68.53 **c**	8.12 **b**	3.91 **d**	84.06 **d**	91.37 **d**	175.43 **d**	4.52 **d**	14.02 **d**	18.53 **d**
F-test	**	**	**	**	**	**	**	**	**
Bio-fertilizer (C):									
Uninoculated	67.88	7.95	3.94	84.19	101.18	185.37	5.06	13.95	19.01
Inoculated with (z+s)	71.65	8.46	4.42	96.29	111.36	207.65	6.12	16.54	22.66
F-test	**	**	**	**	**	**	**	**	**
Interaction:									
Nx B	**	N.S	N.S	N.S	N.S	N.S	N.S	N.S	**
Nx C	N.S	N.S	N.S	N.S	N.S	**	N.S	N.S	N.S
B x C	**	N.S	N.S	N.S	N.S	N.S	N.S	N.S	**
N x B Xc	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

*, ** and NS indicated P<0.05, P<0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.

Table (3): Effect of different nitrogen rates, compost tea, biofertilizer and their interaction on some onion growth characters at 120 DAT in 2011/2012 season.

Treatment	Plant height (cm)	No. of green leaves /plant	Bulb diameter (cm)	Leaves fresh Weight /plant (g)	Bulb fresh weight (g)	Plant fresh weight (g)	Leaves dry weight /plant (g)	Bulb dry weight (g)	Plant dry weight (g)
N-Level (N):									
60	59.77 **c**	7.28 **b**	3.28 **b**	86.11 **b**	76.89 **b**	163.00 **b**	4.66 **b**	13.59 **c**	18.24 **c**
90	63.42 **a**	8.59 **a**	4.21 **a**	98.96 **a**	108.12 **a**	207.08 **a**	6.58 **a**	15.93 **a**	22.51 **a**
120	62.62 **b**	8.31 **a**	4.34 **a**	94.46 **ab**	107.19 **a**	201.66 **a**	6.45 **a**	14.82 **b**	21.27 **b**
F-test	**	**	*	*	**	**	**	**	**
Comp. Tea (B):									
Control	57.34 **d**	7.32 **d**	3.57 **c**	86.18 **c**	90.17 **c**	176.35 **c**	5.18 **d**	13.01 **e**	18.19 **e**
Foliar at 40 DAT	63.21 **b**	7.91 **c**	4.02 **b**	92.98 **bc**	95.42**abc**	188.40 **bc**	5.97 **bc**	14.36 **c**	20.33 **c**
Foliar at 40 and 60 DAT	64.58 **a**	8.72 **b**	4.13 **ab**	96.16 **ab**	102.14**ab**	198.31 **ab**	6.16 **ab**	15.60 **b**	21.76 **b**
Foliar at 40 , 60 and 80 AT	64.77 **a**	9.17 **a**	4.31 **a**	101.06 **a**	106.23 **a**	207.30 **a**	6.51 **a**	17.18 **a**	23.70 **a**
Soil application at 30 DAT	59.78 **c**	7.19 **d**	3.70 **c**	89.50b **c**	93.03 **bc**	182.53 **c**	5.66 **c**	13.73 **d**	19.40 **d**
F-test	**	**	**	**	*	**	**	**	**
Bio-fertilizer (C):									
Uninoculated	60.24	7.60	3.76	85.90	92.56	178.46	5.60	13.93	19.53
Inoculated with (z+s)	63.63	8.52	4.13	100.45	102.24	202.69	6.19	15.63	21.82
F-test	**	**	**	**	**	**	**	**	**
Interaction:									
Nx B	**	N.S	N.S	N.S	N.S	N.S	N.S	N.S	**
Nx C	N.S	N.S	N.S	N.S	N.S	*	N.S	N.S	N.S
B x C	**	N.S	N.S	N.S	N.S	N.S	N.S	N.S	*
N x B xC	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

***, ** and NS indicated P<0.05, P<0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

Table (4): Effect of different nitrogen rates, compost tea, biofertilizer and their interaction on bulb yield and quality of onion in 2010/2011 season.

Treatment	Yield				Quality		
	Average bulb weight(g)	Marketable yield (t fad.$^{-1}$)	Culls yield (t fad.$^{-1}$)	Total yield (t fad.$^{-1}$)	Bulb diameter (cm)	TSS (%)	Dry matter (%)
N-Level (N):							
60	74.10 **c**	11.35 **c**	1.97 **a**	13.32 **c**	5.31 **c**	12.77 **a**	15.55 **a**
90	108.57 **a**	15.67 **a**	1.77 **b**	17.45 **a**	7.05 **a**	12.10 **b**	14.58 **b**
120	104.26 **b**	15.44 **b**	1.10 **c**	16.54 **b**	6.65 **b**	11.86 **c**	13.12 **c**
F-test	**	**	**	**	**	**	**
Comp. Tea (B):							
Control	72.67 **e**	11.67 **e**	1.81 **a**	13.48 **e**	5.77 **d**	11.47 **d**	12.59 **e**
Foliar at 40 DAT	97.55 **c**	14.62 **c**	1.51 **b**	16.13 **c**	6.42 **b**	12.10 **c**	14.22 **c**
Foliar at 40 and 60 DAT	105.17 **b**	14.79 **b**	1.57 **b**	16.36 **b**	6.55 **b**	12.48 **b**	15.68 **b**
Foliar at 40, 60 and 80DAT	110.97 **a**	15.39 **a**	1.72 **a**	17.12 **a**	6.76 **a**	13.32 **a**	16.46 **a**
Soil application at 30 DAT	92.30 **d**	14.30 **d**	1.46 **b**	15.76 **d**	6.21 **c**	11.85 **d**	13.14 **d**
F-test	**	**	**	**	**	**	**
Bio-fertilizer (C):							
Uninoculated	89.57	13.62	1.71	15.34	6.17	11.93	13.56
Inoculated with (z+s)	101.89	14.69	1.52	16.20	6.51	12.56	15.28
F-test	**	**	**	**	**	**	**
Interaction:							
Nx B	**	**	N.S	**	**	NS	**
Nx C	*	**	N.S	*	N.S	N.S	**
B x C	**	*	N.S	**	N.S	N.S	**
N x B xC	**	**	N.S	**	N.S	NS	N.S

***, ** and NS indicated P<0.05, P<0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

Table (5): Effect of different nitrogen rates, compost tea, biofertilizer and their interaction on bulb yield and quality of onion in 2011/2012 season.

Treatment	Yield				Quality		
	Average bulb weight(g)	Marketable yield (t fad.$^{-1}$)	Culls yield (t fad.$^{-1}$)	Total yield (t fad.$^{-1}$)	Bulb diameter (cm)	TSS (%)	Dry matter (%)
N-Level (N):							
60	68.64 **c**	9.52 **b**	2.50	12.02 **b**	4.61 **b**	12.88 **a**	16.26 **a**
90	104.64 **a**	12.60 **a**	2.27	14.88 **a**	6.60 **a**	12.24 **b**	15.42 **b**
120	98.87 **b**	12.62**a**	2.11	14.73 **a**	6.54 **a**	12.10 **b**	13.56 **c**
F-test	**	**	N.S	**	**	**	**
Comp. Tea (B):							
Control	67.43 **e**	10.48 **e**	2.75 **a**	13.23 **d**	5.40 **d**	11.66 **d**	13.49 **e**
Foliar at 40 DAT	94.87 **c**	11.76 **c**	2.14 **b**	13.91 **bc**	5.98 **bc**	12.46 **bc**	15.19 **c**
Foliar at 40 and 60 DAT	100.33 **b**	12.09 **b**	2.06 **b**	14.16 **ab**	6.13 **ab**	12.66 **b**	15.76 **b**
Foliar at 40, 60 and 80DAT	106.30 **a**	12.38 **a**	1.95 **b**	14.33 **a**	6.36 **a**	13.05 **a**	16.91 **a**
Soil application at 30 DAT	84.65 **d**	11.18 **d**	2.56 **a**	13.73 **c**	5.71 **c**	12.23 **c**	14.05 **d**
F-test	**	**	**	**	**	**	**
Bio-fertilizer (C):							
Uninoculated	86.46	11.19	2.49	13.69	5.73	12.00	14.25
Inoculated with (z+s)	93.97	11.96	2.09	14.05	6.10	12.81	15.91
F-test	**	**	**	**	**	**	**
Interaction:							
Nx B	**	**	N.S	**	*	NS	**
Nx C	*	**	N.S	**	N.S	Ns	**
B x C	*	**	N.S	**	N.S	Ns	**
N x B xC	**	**	N.S	**	N.S	NS	NS

***, ** and NS indicated P<0.05, P<0.01 and not significant, respectively. Means within the same column for each factor designed by the same letter are not significantly different at 5% level according to Duncan's multiple range test.**

Table (7): Effect of the interaction between N-fertilizer level, and foliar nutrients with compost tea on onion growth, onion bulbs yield and storability in 2010/2011 and 2011/2012 seasons.

Season	N-Level	Compost tea	Plant height (cm)	Plant dry weight (g)	Average bulb weight (g)	Marketable yield (t fad.$^{-1}$)	Total yield (t fad.$^{-1}$)	Bulb diameter (cm)	Dry matter (%)	Storability 2 month	Storability 6 month
2010/2011	N_1	B_0	61.30 i	14.51 j	61.45 l	9.97 j	12.47 k	5.05 j	13.50 e	9.92 f	14.46 f
		B_1	65.83 gh	17.68 h	73.76 j	11.34 i	13.04 j	5.35 i	15.54 c	9.82 f	14.22 g
		B_2	67.17 efg	17.63 h	79.24 h	11.60 h	13.48 i	5.40 i	16.85 ab	9.82 f	13.62h
		B_3	69.17de	21.39 e	84.78 g	12.31 g	14.44 g	5.63 h	17.42 a	9.50 f	11.77 k
		B_4	64.58 h	15.21i	71.29 k	11.55 hi	13.18 j	5.16 ih	14.45 d	9.83 f	14.26fg
	N_2	B_0	66.58 fgh	19.17 g	76.21 i	11.78 h	14.06 h	6.03 g	12.75 fg	11.64 bc	15.20c
		B_1	75.67 b	22.30 d	109.39 e	16.67 b	18.29 b	7.31 ab	15.24 gh	10.66 de	14.71e
		B_2	77.68 ab	26.26 b	124.43 b	16.64b	18.28 b	7.38 a	15.56 c	10.63 de	14.67 e
		B_3	78.02 a	28.18 a	126.79 a	17.24 a	18.96 a	7.53 a	16.20 bc	10.18 ef	12.01 j
		B_4	72.35 c	19.97 f	107.35 e	16.03 cd	17.64d	7.01 cd	13.18 ef	11.12 cd	14.96 d
	N_3	B_0	66.67fgh	19.99 f	80.35 h	13.27f	13.90 h	6.23 fg	11.52 h	13.28 a	16.48a
		B_1	69.17 de	21.46 e	109.51 e	15.87 d	17.07 e	6.59 e	11.87gh	11.94 b	15.47a
		B_2	71.23 cd	22.76 d	111.85 d	16.13 c	17.33 e	6.86 d	14.64 d	11.64bc	15.16cd
		B_3	72.42 c	25.61c	121.34 c	16.62 b	17.94c	7.13 bc	15.75 c	11.19cd	12.43 i
		B_4	68.67 ef	20.42 f	98.24 f	15.32 e	16.46 f	6.45 ef	11.80 h	13.10 a	15.48 b
2011/2012	N_1	B_0	54.92 j	15.77 i	52.33 l	8.55 j	11.35 g	4.16 f	14.40 g	10.69 e	14.10 e
		B_1	62.67 de	17.82 gh	68.39 g	9.72 h	12.19 ef	4.69 ef	16.70 c	9.83 f	13.54 e
		B_2	62.00 def	18.25 g	77.68 f	9.89 h	12.19 ef	4.76 e	17.05 b	9.15 g	11.73fg
		B_3	63.00 cd	22.20 d	85.39 e	10.40 g	12.59 e	4.97 e	17.92 a	8.22 h	11.38 g
		B_4	56.27 i	17.19 h	59.39 h	9.01 i	11.75 fg	4.49 ef	15.22 f	9.77 f	13.85 e
	N_2	B_0	57.67 h	19.20 f	72.00 g	10.95 f	13.72 d	5.98 d	14.02 h	12.24 c	15.67bc
		B_1	64.08 bc	22.19 d	113.23 b	13.08 b	15.13 ab	6.71 abc	15.68 e	11.55 d	15.08 cd
		B_2	66.92 a	24.37 b	114.00 b	13.29ab	15.34 a	6.82 abc	16.23 d	10.93 e	14.32de
		B_3	66.67 a	25.57 a	117.99 a	13.54 a	15.45 a	7.20 a	16.62 c	10.57 e	11.92 fg
		B_4	61.75 ef	21.21 e	106.00 cd	12.16de	14.73 bc	6.28 cd	14.52 g	11.68 d	15.20 c
	N_3	B_0	59.42 g	19.60 f	77.95 f	11.95 e	14.63 bc	6.07bcd	12.07 k	14.57 b	16.60 a
		B_1	62.87 de	20.98 e	102.97 d	12.49 c	14.40 c	6.54bcd	13.19 i	12.86 b	16.21 c
		B_2	64.83 b	22.67 cd	109.32 c	13.10 b	14.94 abc	6.81abc	14.00 h	12.72 bc	15.21 c
		B_3	64.83 b	23.33 c	115.52 ab	13.19 b	14.94 abc	6.90 ab	16.18 d	11.55 d	12.40 f
		B_4	61.33 f	19.79 f	88.56 e	12.36cd	14.72 bc	6.38bcd	12.39 j	14.29 a	16.25 b

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test. N_1: 60, N_2: 90 and N_3: 120 Kg N fad.$^{-1}$ – B_0: without compost tea, B_1: Foliar at 40 DAT, B_2: Foliar at 40 and 60 DAT, B_3: Foliar at 40, 60 and 80 DAT and B_4: Soil application at 30 DAT.

Table (9): Plant height (cm), plant dry weight (g), average bulb weight (g), marketable and total yield (t fad.$^{-1}$) and percentage of dry matter as influenced by the interaction between foliar nutrients with compost tea and biofertilizer in 2010/2011 and 2011/2012 seasons.

Season	Compost tea	Bio-fertlizers	Plant height (cm)	Plant dry weight (g)	Average bulb weight (g)	Marketable yield (t fad.$^{-1}$)	Total yield (t fad.$^{-1}$)	Dry matter (%)
2010/2011	B_0	C_1	64.11 **f**	16.45 **i**	66.78 **h**	11.15 **g**	13.17 **h**	12.19 **g**
		C_2	65.59 **e**	19.33 **f**	78.57 **g**	12.19 **f**	13.79 **g**	12.98 **ef**
	B_1	C_1	68.09 **d**	18.86 **g**	88.47 **e**	14.14 **d**	15.70 **e**	13.37 **e**
		C_2	72.36 **b**	22.10 **d**	106.63 **c**	15.11 **c**	16.57 **c**	15.06 **c**
	B_2	C_1	69.92 **c**	19.87 **e**	99.87 **d**	14.18 **d**	15.82 **e**	14.31 **d**
		C_2	74.13 **a**	24.56 **b**	110.48 **b**	15.40 **b**	16.91 **b**	17.06 **b**
	B_3	C_1	71.37 **b**	22.75 **c**	107.92 **c**	14.99 **c**	16.82 **b**	15.15 **c**
		C_2	75.03 **a**	27.38 **a**	114.02 **a**	15.79 **a**	17.41 **a**	17.77**a**
	B_4	C_1	65.92 **e**	17.12 **h**	84.82 **f**	13.68 **e**	15.20 **f**	12.76 **f**
		C_2	71.14 **bc**	19.95 **e**	99.77 **d**	14.93 **c**	16.32 **d**	13.52 **e**
2011/2012	B_0	C_1	56.11 **g**	17.41 **h**	61.75 **g**	10.19 **i**	13.10 **e**	13.09
		C_2	58.56 **f**	18.96 **f**	73.11 **f**	10.78 **g**	13.37 **e**	13.90 **f**
	B_1	C_1	61.02 **e**	19.18 **f**	88.85 **d**	11.52 **f**	13.95 cd	14.27 **e**
		C_2	65.39 **b**	21.48 **d**	100.89 **bc**	12.01 **c**	13.86 **d**	16.11 **c**
	B_2	C_1	62.56 **d**	20.24 **e**	97.41 **c**	11.76 **e**	13.95 cd	14.44 de
		C_2	66.61 **a**	23.29 **b**	103.26 **b**	12.43 **b**	14.37 **ab**	17.08 **b**
	B_3	C_1	63.37 **c**	22.51 **c**	104.17 **b**	11.97 cd	14.17 **bc**	15.96 **c**
		C_2	66.17 **a**	24.88 **a**	108.43 **a**	12.79 **a**	14.49 **a**	17.85 **a**
	B_4	C_1	58.16 **f**	18.29 **g**	80.14 **e**	10.56 **h**	13.28 **e**	13.49 **g**
		C_2	61.41 **e**	20.50 **e**	89.16 **d**	11.79 **de**	14.19 **bc**	14.59 **d**

Means designed by the same letter are not significantly different at 5% level, using Duncan's multiple range test. B_0: without compost tea, B_1: Foliar at 40 DAT, B_2: Foliar at 40 and 60 DAT, B_3: Foliar at 40, 60 and 80 AT and B_4: Soil application at30 DAT – C_1: uninoculated and C_2: Inoculated by free living (z+s)