Effect of Nitrogen Fertigation in Comparison With Soil Application on Onion Production in Sandy Soils

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ABSTRACT

This work was carried out during the two winter seasons of 2008/2009 and 2009/2010 at a private farm in Bostan area, in Hosh-Issa region, El-Behera Governorate. This work was about the response of onion (*Allium cepa L.*) crop to nitrogen fertigation compared to soil application frequencies at different levels of N; i.e., 60, 80, 100 and 120 kg N/fed under sandy soil conditions.

The results, generally, indicated that fertigation method significantly increased the dry weight of different parts of onion plant, i.e., leaves, bulb and whole plant, chlorophylls concentration in leaves, N, P and K concentrations in the different onion organs as well as yield and its components compared to soil application method.

Fertigation of the highest dose of N (120 kg N/fed) being the best treatment recorded the highest significant increases in all the above mentioned parameters, i.e., dry weight, chlorophyll, NPK concentration, protein, reducing sugar and yield and its components compared to low fertilizer level, i.e., 60 kg N/fed.

Generally the interaction between the two factors of this study indicated that, fertigation of the highest dose of N (120kg N/fed) had a significant effect on chlorophyll contents, dry weight /plant and quality properties under drip irrigation system in new reclaimed sandy soil.

Keywords: Onion, Fertigation, Drip irrigation, Soil application, nitrogen fertilizers, yield and its components.

INTRODUCTION

The basic measures of soil improvement are required to overcome crop yield limiting factors and on this basis to apply a reasonable fertilization regime. Sandy soils are the soils with light texture and poor in nutrient with low CEC, therefore applied fertilizers can easily be leached. So, many researchers indicated the beneficial effect of fertigation that increasing the efficiency of nutrients utilization under drip irrigation system (Paramasivam *et al.* 2001 and Neilsen *et al.*, 2004).

Drip irrigation system is the newest of all practices of water applications. It is the system where water and fertilizer can be applied directly to individual plants rather than irrigating the entire field areas as in the case of surface and sprinkler irrigation systems .

One of the major features of drip irrigation is its capability to apply water and fertilizers to the soil in small quantities as compared with other irrigation techniques.

Fertigation is the inclination of soluble fertilizers through the irrigation water modern system. Hence, chemical fertilizers elements are directly applied to the top root zone and most of the plant needs are efficiently used without too much consumption by competing with or losses in the subsurface of the soil. Fertigation presents number of advantages such as saving of labor and fertilizer, higher efficiency of two factors of production(water and fertilizers) and reduction of ground water pollution, it is not as dependent upon the weather or time of day, it can reduce the amount of multiple applications of small amounts of plant nutrients that are subjected to leaching, particularly nitrogen and thus allow reduction of the quantity applied to the crop, as well as, the rate of applied certain herbicides and insecticides may be reduced.

Generally, crop response to fertilizer application through drip irrigation has been excellent and frequent nutrient applications that have improved the fertilizer-use efficiency (Malik *et al.*, 1994). Furthermore, in sandy loam soil, Hebbar *et al.*, (2004) revealed that fertigation resulted in lesser leaching of NO_3-N and K to deeper layer of soil. The advantage of fertigation technique is reducing the amount of fertilizer and interval between application through this technique to maintain uniform level of nutrients and to control the nutrient supply in the soil in accordance with changing plant needs during the growth season (Sterling, 1983).. Application of fertilizers through drip irrigation system (Fertigation) reduced leaching of added fertilizer (Janings and Martin, 1990). Fertigation technique improved onion plant growth (Chopade *et al*, 1997) and increased yield of different parts. Selim (2003) indicated that the growth characters, yield and its components of potato were improved with fertigation method compared to traditional soil fertilizer application.

Nitrogen is an essential element for both growth and productivity of all plants and onion crop. The beneficial effect of nitrogen application on onion yield was noted by Devi *et al.*, (2003) and Abdel-Mawgoud. *et al.*, (2005). Application of 120 kg

N/fed increased plant growth, bulb yield and yield components (El-Gamili *et al.*, 2000). Applied N significantly increased vegetative growth and yield parameters of garlic (El-Seifi *et al.*, 2004). Fatma *et al.*, (2002) reported that an increase in total uptake of NPK at different parts of onion plants is a result of increasing nitrogen fertilizer levels. Zahran and Abdoh (1998) found that the response of onion plants to nitrogen fertilizers significantly increased plant height, number of leaves, fresh and dry weights (total yield) and nitrogen, phosphorus and potassium uptake of onion plant after 100 days from sowing.

The objective of this work was to study the effect of nitrogen fertigation compared to soil application frequencies at different levels of N; i.e., 60, 80, 100 and 120kg N/fed on onion crop in sandy soil using drip irrigation system.

MATERIALS AND METHODS

Two field experiments were carried out in new reclaimed sandy soil at a private farm in Bostan area in Hosh-Issa region, El-Behera Governorate, Egypt in 2008/2009 and 2009/2010 seasons, The physical and chemical analyses of soil are shown in Table (1) The experiment included eight treatments which were the combinations of two methods of fertilizer application; i.e. soil application and fertigation and four N-levels (60, 80, 100 and 120 kg N/fed).

The split plot design with three replicates was followed. The application methods were arranged as a main plot, while the rates of N fertilizer were arranged as a sub plots. The plot area was 10.5m^2. The used drip irrigation lines were GR with built-in drippers spaced 50 cm apart with a flow capacity of 4 liters $hour^{-1}$ at 1.5 bar working pressure and the spacing between lateral lines was 1 m.

Seeds of onion cv Giza 20 were sown in nursery on October 15th and 18th in the first and second season, respectively and transplanted at 10 cm apart on both sides of the dripper line on December 15th and 18th in 2008/2009 and 2009/2010 seasons respectively.

Compost at a rate of 20 m^3/fed was applied to all plots during soil preparation. Ammonium sulphate (20.6% N) was used as a source of N fertilizer. One fourth of mineral fertilizer (N) was added to all plots as soil application during soil preparation time in the center of rows and covered with sand. The rest amount of nitrogen fertilizer was divided into 10 equal portions, and added as soil application or through irrigation water (fertigation) every 7 days starting from 30 days after transplanting. In addition potassium fertilizer was added to all plots at a rate of 100 kg K_2O/fed as potassium sulphate (48% K_2O); 50% of this amount was added preplanting, while the other amount (50%) was added with irrigation water (fertigation). Also, phosphorus fertilizer was added to all plots at the rate of 50 kg P_2O_5 /fed., 50% of this amount was added preplanting as calcium superphosphate (15 % P_2O_5); while the other amount (50%) was added as phosphoric acid (85% P_2O_5) and divided into equal doses and added at the same time with N or K in irrigation water. In addition, all standard cultural practices of planting onion were carried out as commonly used in the district.

At 120 days after transplanting, a random sample of 5 plants was taken from each subplot and the following data were recorded:

1. Plant growth:
   Plant growth was determined as plant height, number of leaves /plant, neck and bulb diameters, dry weight of different organs of plant; i.e. leaves, bulb and whole plant.
2. Photosynthetic pigments:
   Chlorophyll a,b and total chlorophyll were determined colorimetrically according to Wettestein method (1957)
3. Plant nutritional status:
   Total nitrogen, phosphorus and potassium in different plant parts were determined according to the methods described by Chapman and Pratt (1961).
4. Yield and its components:
   After 150 days from transplanting, bulbs were harvested, then the following data recorded: average bulb weight (gm), bulb and neck diameter (cm), bulb yield of each plot (kg) was weighted, and then it was estimated as ton/fed.
5. Bulb quality at harvest:
   Total soluble solids in onion bulbs at harvesting, was determined by Carlzeis refractometer, N, P and K contents in onion bulbs were determined and the protein content was calculated by multiplying N% by 5.75. Reducing sugars content were determined according to the procedures described by A.O.A.C.(1980) as a percentage of dry matter. All data were subjected to the statistical analysis according to the procedures outlined by Snedecor and Cochran (1980). Treatments means were compared by the revised L.S.D test at 5% level.

RESULTS AND DISCUSSION

I-Plant Growth:

1-Effect of application method

Data presented in Table (2) showed significant difference between the two application methods (soil application and fertigation) for most the studied items; i.e., plant height, bulb diameter as well as dry weight of different plant organs after 120 days from transplanting whereas, the maximum values in this respect were achieved by using fertigation method compared to soil application method.

Table 1: Some soil physical and chemical properties of the experimental soil.

Soil characteristics	Data
Particle size distribution (%):	
Coarse sand	91.5
Silt	5.4
Clay	3.1
Soil textural	Sandy
O.M (%)	0.29
Chemical analysis:	
EC_e (µs/cm)	1.7
pH (1:2.5,soil:water)	8.55
Soluble ions (*meq/L*):	
Ca^{+2}	5.6
Mg^{+2}	4.4
Na^{+}	2.6
K^{+}	1.5
HCO_3^-	2.3
$CO_3^=$	0.0
Cl^-	6.1
$SO_4^=$	5.7

The promoting effect of fertigation method on the vegetative growth characters of onion plant might be due to the following reasons: fertilizer availability is fitted to nutritional needs of the plant during its growth cycle; fertilizer elements already in solution become available to the plant roots faster than the soil application, and to high uniformity of fertilizers distribution which improved the efficiency of fertilization, as opposed to the traditional method Thompson *et al.*, (2002) came to similar conclusion. Generally, all fertilizer that injected through drip irrigation system gave higher values than the others. These results are in harmony with those reported by Selim (2003) on potato and Jan *et al.*, (2004) on onion. They indicated that application of fertilizers through irrigation water (fertigation) enhanced plant growth.

2-Effect of N fertilizer rate

Data presented in Table (2) showed significant increment in all the studied vegetative growth characters of onion plants with increasing the level of nitrogen fertilizer. The increase in plant growth of onion (plant height, number of leaves/plant, both neck and bulb diameters as well as dry weight of different plant organs) after 120 days from transplanting as a result of N-application could be explained as follows: since nitrogen plays a major role in the protein and nucleic acids synthesis and protoplasm formation, it exerted a beneficial effect in stimulating meristemic activity and producing more tissues and organs. Also, nitrogen plays a main role in the photosynthesis, consequently the net dry matter accumulation. These results are in agreement with those obtained by Abd El-Maksoud and El-Swaff (2000) who reported that plant height, number of leaves/plant and bulb weight of onion were the highest with 150 kg N/ha. Also, Oukal (1999) found that the growth characters of onion plant were increased with increasing the application of nitrogen fertilizer up to the highest applied level (150 Kg N/fed) and application of 120 kg N/fed increased plant growth (El-Gamili *et al.*, 2000).

Table 2: Effect of N application method and N-levels on the growth characters of onion plants at 120 days after transplanting (combined analysis of 2008/2009 and 2009/2010 growing seasons).

Treatments		Plant height (cm)	No. of leaves/plant	Diameter (cm)		Dry weight /plant (g)		
Application methods	N-levels kg N/fed			Bulb	Neck	Leaves	Bulb	Total
Soil application	60	68.70	7.70	2.63	1.40	5.17	8.37	13.54
	80	73.60	9.30	2.86	1.60	6.27	9.62	15.89
	100	75.40	10.70	3.17	1.73	6.49	9.71	16.20
	120	78.20	11.70	3.29	1.90	6.66	11.74	18.40
	Mean	73.98	9.85	2.99	1.66	6.15	9.86	16.01
Fertigation	60	70.50	8.70	2.77	1.54	5.36	9.78	15.14
	80	76.20	9.70	3.15	1.67	7.35	10.42	17.77
	100	79.90	11.70	3.27	1.88	7.59	12.60	20.19
	120	82.50	12.70	3.37	2.00	7.74	13.57	21.31
	Mean	77.28	10.70	3.14	1.77	7.01	11.59	18.60
Mean of N-levels	60	69.60	8.20	2.70	1.47	5.27	9.08	14.34
	80	74.90	9.50	3.01	1.64	6.81	10.02	16.83
	100	77.70	11.20	3.22	1.81	7.04	11.16	18.20
	120	80.40	12.20	3.33	1.95	7.20	12.66	19.86
L.S.D at 0.05								
Application methods		1.55	n.s	0.01	n.s	0.07	0.01	0.07
N rates Interaction		0.74	0.65	0.04	0.07	0.21	0.10	0.30
N rates x methods		n.s	n.s	0.04	n.s	0.26	0.10	0.31

From the aforementioned results, it could be recommended that the application of 120 kg N/fed, through irrigation water under drip irrigation system is more favorable for the growth of onion plants grown in new reclaimed sandy soil.

II-Photosynthetic pigments.

1-Effect of application method

Concerning the effect of the two methods of fertilizers application used on chlorophyll a, b and total chlorophyll in onion leaves (Table 3). The obtained results indicate that there were significant differences between two application methods on photosynthetic pigments. Fertigation method exerted significant and marked increase in chlorophyll a, b and total content in onion leaves compared to the traditional method. Such increase may be due to improving the plant growth as a result of more water absorption and more uptake of N, Mg and Fe. Such elements have close association in chlorophyll biosynthesis (Mengel and Kirkby ,1987) Also, it may be attributed to the increasing of photosynthesis rate as a result of more absorption of available nutrients, which causes increases in growth and photosynthesis efficiency. The present results are in harmony with that of Selim (2003).

2- Effect of N fertilizer rates

With respect to the effect of N fertilizer on chlorophyll a, b and total chlorophyll in onion leaves (Table 3), the listed results indicated that there was gradual and progressive significant increase in total chlorophyll with increasing of N fertilizer up to the highest used level; 120 kg N/fed The promoted effect of N fertilizer on chlorophyll contents might be attributed to the fact that N is a constituent of chlorophyll molecule. Moreover, nitrogen is the main constituent of all amino acids in proteins and lipids that acting as a structural compounds of the chloroplast. These results are in agreement with that obtained by Abd El-Kader *et al.,* (2007) who reported that, nitrogen application increased chlorophyll content. Also, Moustafa *et al.,* (2005) reported that increasing nitrogen fertilization level up to 110 kg N/fed increased chlorophyll a,b, and total chlorophyll in onion leaves.

Table 3: Effect of N application method and N-levels on the photosynthetic pigments (mg/gm fresh weight of leaves) of onion plants at 120 day after transplanting (combined analysis of 2008/2009 and 2009/2010 growing seasons).

Treatments		Chlorophyll (mg/gm fresh weight)		
Application methods	N-levels kg N/fed	a	b	Total (a+b)
Soil application	60	2.74	1.62	4.36
	80	2.88	1.91	4.79
	100	3.07	2.44	5.51
	120	3.25	2.62	5.87
	Mean	2.99	2.15	5.13
Fertigation	60	2.90	2.06	4.96
	80	3.28	2.21	5.49
	100	3.35	2.46	5.81
	120	3.52	2.67	6.19
	Mean	3.26	2.35	5.61
Mean of N-levels	60	2.82	1.84	4.66
	80	3.08	2.06	5.14
	100	3.21	2.45	5.66
	120	3.39	2.65	6.03
L.S.D at 0.05				
Application methods		0.01	0.04	0.11
N rates Interaction		0.09	0.02	0.01
N rates x methods		0.10	0.04	0.08

III-Nutritional status in onion plants

1. Effect of application methods

It is quite clear from data in Table (4) that, N, P and K concentrations in different organs of onion plant were significantly affected by the methods of fertilizer application except, the concentration of P in leaves. The highest values were recorded by fertigation method compared to the traditional method. The favorable effect of fertigation method on mineral concentration might be attributed to the solubility of fertilizers in solution which become more available to roots and absorption. Also, these results may be attributed to the highest capacity of the plants received N fertilizer in building metabolites which reflect on more vigorous plant growth and strong rooting system which in turn contributes to increase in macro concentration in tissues. These results are in harmony with those reported by Jan *et al*, (2004) and Abouel-Magd *et al*., (2009).

2. Effect of N fertilizer rates

Data presented in Table (4), generally indicate significant differences among the N fertilizer levels for N, P and K concentration in different organs of onion plant with increasing the dose of N fertilizer up to the highest used level, i.e. 120 kg N/fed. These results are in conformity with those found by El-Gamili and Abd El-Hadi (1996) who reported that N-addition at the highest used rate positively affected NPK in leaves and bulb. Moreover, Moustafa *et al.*, (2005) indicated that N contents of onion bulb and foliage were significantly increased by increasing N application rate up to 110 kg N/fed. Rizk (1997) also reported that application of N, P and K fertilizers increased the N% and total uptake by onion plant. Similarly, Oukal(1999) found that application of 120 kg N + 60 kg P_2O_5 + 45 kg K_2O/fed recorded the maximum values of N, P and K percentages and their total uptake of different onion plant parts. With regard to the interaction effect, the results showed in general, that application of relatively high rate of N fertilizer; i.e. 120 Kg N/fed through irrigation water (fertigation) was the most effective and favorable treatment for N, P and K concentration of onion plants.

IV- Yield and its components

1-Effect of application method

Data in Table (5) indicate that fertilizers application method exerted a marked and significant effect on bulb weight, total yield (Ton/fed), bulb diameter, neck diameter and TSS whereas, fertigation method recorded the highest values compared to the traditional one. Moreover, the fertigation method increased bulb weight, total yield, bulb diameter, neck diameter and TSS by 7.12, 14.21, 10.50, 9.96 and 8.91%, respectively compared to the traditional method. Generally, all treatments that fertilized through drip irrigation system also were higher values than the others. The increase in yield and its components by fertigation method might be mainly due to the increase in average weight of bulb and also owing to the vigorous vegetative growth and more dry weight of onion plants. In this connection, some workers came to similar conclusion Badwi, 1999 on potato, Ravi, *et al*, 2007 on areca nut and Abouel-Magd *et al.*, (2009) on Broccoli crop). They reported that fertigation increased yield comparing with traditional method of fertilizer application.

2. Effect of N fertilizer rates

Data recorded in Table (5) indicated that increasing the rate of N fertilizer significantly affected bulb weight, total yield, bulb diameter, neck diameter and TSS. The highest total yield, i.e.17.51 t/fed was obtained from the treatment which received 120 kg N/fed. Moreover, increasing N-fertilizer level from 60 to 120 kg N/fed resulted in increasing yield and yield components.

This might be due to that applying nitrogen improved the vegetative growth and accelerated the photosynthates in storage organs of bulbs resulting in an increased diameter and weight of bulb (Sharma, 1992). These results are in agreement with those of Patel *et al.*, (1992) and Vetayasuporn, (2006). Similar findings were also reported by (El-Gamili *et al.*, 2000) who found that high nitrogen rate (120 kg N/fed) increased yield and its components. El-Seifi *et al.*, (2004) on garlic came to similar results. Also, nitrogen addition increased TSS in bulb juice, this increase might be due to increasing building the amino acids and other organic metabolic compounds, which could be translocated directly from tubular blades to storage organ (bulb) and caused in turn an increase in the total soluble solids in bulb. These results are in agreement with Abd El-Kader *et al.*, (2007)

Regarding the interaction effect, the results indicated, generally, that application of relatively high level of N fertilizer (120 kg N/fed.) through irrigation water (Fertigation) under drip irrigation system in new reclaimed sandy soil are favourable and beneficial for onion production. This superiority is according to the stimulative effect of fertigation on vegetative growth, dry weight, chlorophyll and plant nutritional status.

V- Chemical composition of onion bulbs

1-Effect of application method

It is quite clear from data in Table (6) that, NPK, protein and reducing sugars content in onion bulbs were significantly affected by the method of fertilizers application. The highest values were recorded by fertigation method compared to the traditional method. The maximum values of these attributes were obtained from drip fertigation with 120 kg N/fed in contrary, the minimum values of the same attributes were produced from the soil addition with 60 kg N/fed. The favorable effect of fertigation method on minerals, protein and reducing sugars

content in onion bulbs might be attributed to the solubility of fertilizers in solution which become more available to roots and absorption. These results are in agreement with those obtained by Abouel Magd *et al.*(2009).

Table 4: Effect of N application method and N-levels on the N, P and K concentrations of onion plant organs at 120 days after transplanting (combined analysis of 2008/2009 and 2009/2010 growing seasons).

Treatments		Macronutrients in Leaves (%)			Macronutrients in bulbs (%)		
Application methods	N-levels kg N/fed	N	P	K	N	P	K
Soil application	60	2.40	0.29	2.42	1.35	0.24	1.28
	80	2.60	0.31	2.49	1.55	0.26	1.33
	100	2.70	0.32	2.52	1.64	0.27	1.45
	120	2.80	0.34	2.60	1.72	0.29	1.58
	Mean	2.63	0.32	2.51	1.57	0.27	1.41
Fertigation	60	2.50	0.30	2.51	1.57	0.26	1.37
	80	2.70	0.32	2.57	1.69	0.29	1.46
	100	2.80	0.34	2.66	1.77	0.31	1.59
	120	2.90	0.35	2.72	1.85	0.32	1.64
	Mean	2.73	0.33	2.62	1.72	0.30	1.52
Mean of N-levels	60	2.45	0.30	2.47	1.46	0.25	1.33
	80	2.65	0.32	2.53	1.62	0.28	1.40
	100	2.75	0.33	2.59	1.71	0.29	1.52
	120	2.85	0.35	2.66	1.79	0.31	1.61
L.S.D at 0.05							
Application methods		0.06	n.s	0.09	0.04	0.01	0.05
N rates Interaction		0.10	0.01	0.05	0.05	0.02	0.03
N rates x methods		n.s	n.s	n.s	0.07	n.s	n.s

Table 5: Effect of N application method and N-levels on the yield and its components of onion plant (combined analysis of 2008/2009 and 2009/2010 growing seasons).

Treatments		Bulb weight	Total yield	Diameter (cm)		TSS %
Application methods	N-levels kg N/fed	(g/plant)	(Ton/fed.)	Bulb	Neck	
Soil application	60	68.80	8.92	5.57	2.10	10.44
	80	76.90	11.60	6.52	2.29	11.52
	100	84.70	13.88	6.68	2.37	11.70
	120	99.30	15.43	7.52	2.49	12.59
	Mean	82.43	12.46	6.57	2.31	11.56
Fertigation	60	71.90	10.85	6.35	2.40	11.65
	80	82.70	12.95	7.00	2.52	12.77
	100	94.50	15.59	7.55	2.60	12.84
	120	104.10	17.51	8.12	2.64	13.11
	Mean	88.30	14.23	7.26	2.54	12.59
Mean of N-levels	60	70.35	9.89	5.96	2.25	11.05
	80	79.80	12.28	6.76	2.41	12.15
	100	89.60	14.74	7.12	2.49	12.27
	120	101.70	16.47	7.82	2.57	12.85
L.S.D at 0.05						
Application methods		3.30	0.75	0.25	0.003	0.01
N rates Interaction		3.04	0.20	0.14	0.08	0.05
N rates x methods		n.s	n.s	0.38	0.08	0.06

Table 6: Effect of N application method and N-levels on chemical composition of onion bulbs (combined analysis of 2008/2009 and 2009/2010 growing seasons).

Treatments		Minerals contents (%)			Protein content	Reducing sugars
Application methods	N-levels kg N/fed	N	P	K	%	%
Soil application	60	1.69	0.31	1.62	9.72	5.53
	80	1.88	0.33	1.69	10.81	5.80
	100	1.98	0.34	1.72	11.39	6.56
	120	2.16	0.35	1.79	12.42	6.73
	Mean	1.93	0.33	1.71	11.09	6.16
Fertigation	60	1.72	0.33	1.71	9.89	5.67
	80	1.94	0.35	1.75	11.16	6.50
	100	2.08	0.36	1.80	11.96	7.41
	120	2.31	0.37	1.86	13.28	7.61
	Mean	2.01	0.35	1.78	11.57	6.80
Mean of N-levels	60	1.71	0.32	1.67	9.83	5.60
	80	1.91	0.34	1.72	10.98	6.15
	100	2.03	0.35	1.76	11.67	6.99
	120	2.24	0.36	1.83	12.88	7.17
L.S.D at 0.05						
Application methods		0.05	0.01	0.06	0.28	0.07
N rates Interaction		0.07	0.01	0.08	0.38	0.03
N rates x methods		n.s	n.s	n.s	n.s	0.08

2-Effect of N-fertilizer rates

Results presented in Table (6) indicate that, the highest increase in macronutrients, protein and reducing sugars content in onion bulbs were increased with increasing the dose of N fertilizer up to the highest used level; i.e. 120 kg N/fed. These results may be attributed to the highest capacity of the plants received 120kg N/fed in building metabolites which reflect on more vigorous plant growth and strong rooting system which in turn contributes to increase macronutrients, protein and reducing sugars content in onion bulbs. These results are in conformity with those found by El-Gamili and Abd El- Hadi (1996) who reported that N-addition at the highest used rate positively affected NPK in bulbs.

Also, nitrogen application at rate 120 kg N/fed recorded the highest protein and reducing sugars content on onion bulbs compared with the other levels of nitrogen fertilizer. This could be attributed to the fact that plant expends at many steps of N metabolism, a large of amount of the energy it receives primarily in the course of photosynthetic phosphorylation and oxidative degradation of carbohydrate. In addition to that, during vigorous N uptake most of carbon fixed in photosynthesis is spent in the biosynthesis of various protein compounds rather than carbohydrates (El-Sissy, Laila, 2000) With regard to the interaction effect, the results showed, in general, that application of the relatively high rate of N fertilizer; i.e. 120kg N/fed through irrigation water (fertigation) was the most effective and favorable treatment for NPK, protein and reducing sugars content in onion bulbs. Therefore, using drip fertigation with 120 kg N/fed under phenomena of this study could be recommended for onion productions.

CONCLUSION

It could be concluded that the possibility of producing high and good yield and its components of onion bulbs under sandy soil condition could be achieved by using N rates of 120 kg N/fed through fertigation method under drip irrigation system.

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الملخص العربى

تأثير التسميد النيتروجينى من خلال مياه الري مقارنة بالإضافة الأرضية على إنتاج محصول البصل في الأراضي الرملية

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أجرى هذا البحث خلال موسم الزراعة الشتوى ٢٠٠٨/٢٠٠٩،٢٠٠٩/٢٠١٠ فى مزرعة خاصة فى منطقة البستان حوش عيسى (محافظة البحيرة). ويهدف هذا البحث إلى دراسة إستجابة محصول البصل لإضافة السماد النيتروجينى مع الرى مقارنة بالإضافة الأرضية لمستويات النيتروجين وهى ٦٠، ٨٠ ، ١٠٠ و١٢٠ كجم ن/فدان تحت ظروف الاراضى الرملية.

وقد أوضحت النتائج المتحصل عليها ما يلي:

-إن استخدام طريقة التسميد مع الري أدى إلى زيادة معنوية في الوزن الجاف لمختلف أجزاء النبات وهى الأوراق والبصلة والنبات الكامل -تركيز الكلوروفيل في أوراق النبات والمحتوى من العناصر الكبرى في أجزاء نباتات البصل المختلفة وكذلك المحصول ومكوناته مقارنة بطريقة الإضافة الأرضية للتسميد المعدني

- زيادة معدل إضافة النيتروجين (١٢٠ كجم ن/ فدان) من خلال نظام الرى بالتنقيط أدى إلى زيادة معنوية في جميع الصفات السابق ذكرها مثل الوزن الجاف لمختلف أجزاء النبات – الكلوروفيل– تركيز العناصر الكبرى – البروتين– السكريات المختزلة وكذلك المحصول ومكوناته مقارنة بالمعدل المنخفض ٦٠كجم ن/فدان.
- أظهرت نتائج التأثير المتداخل لعاملى التفاعل لهذه الدراسة أن أفضل معاملة هى إضافة ١٢٠ كجم نيتروجين للفدان مع ماء الرى (الرى بالتنقيط) والذى كان له تأثير معنوى على الكلوروفيل والوزن الجاف / نبات وصفات الجودة .