

Fertilizer Requirements of Onion Crop

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ABSTRACT

A pot experiments was carried out during 2015 and 2016 winter season, outdoor at the Agricultural Experimental Station , Fac . Agric. Mansoura .University to determine the requirements of onion crops Onion (*Allium cepa* L, c.v red byhyre) from nitrogen fertilizers in combined with phosphatic and potash fertilizers . The obtained data revealed htat both fresh and dry weights of onion plants increased markedly due to the application of 50 kg N, 50 kg P₂O₅ and 100 kg K₂O.fed-1. The plant heigh values tended to increase also according to the sametrend. The effect of fertilization on N,P and K .uptake by the dry matter of onion plants was also discussed.

Keywords: Oninon, N, P and K Fertilization, plant growth, nutrient uptake.

INTRODUCTION

An estimation of the fertilizer requirements of onion and other plants is important for the development of agriculture and incorrect forecasts might result either in shortages for the farmer or in excess capacity and low profits for the producers and The recommended rates of N, P₂O₅ and K₂O for crops differ according to the species and variety, soil type as well as the area allocated to each crop in that year FAO (2005).

Onion is considered as an important crop in Egypt and needs certain requirements in fertilizer which of affect the productivity and growth of vegetation.

Onion being among the high nitrogen demanding vegetables, its productivity depends on use of optimum fertilizer rates and if not adequately fertilized, considerable yield losses are apparent, and Excessive use of N fertilizers is a concern, since large amounts of N can remain in the soil after crop harvesting also in a temperate climate, usually 50% of N applied is effectively used by plants (Fageria and Baligar, 2005).

Nitrogen fetlizers significantly affected yields of various onion bulb size categories. Onion fertilized with different N levels decreased the yield of small sized bulbs, but increased the yield of large sized bulbs. Small sized bulbs decreased by 61.8% when N application was increased from 0 to 138 kg ha⁻¹. On the hand, when N fertilization increased from 0 to 138 kg. ha⁻¹ the increased large size bulbs increased from 12.58 t ha⁻¹ to 25.67 t ha⁻¹, respectively, resulting in 104% increment (Negash *et al.*, 2009).

In soils that are moderately low in phosphorus, onion growth and yield can be enhanced by applied phosphorus. Results of long-term fertilizer trials on loamy sand soils have shown a strong response of onions to phosphorus fertilization in the range 0 to 52 kg ha⁻¹ phosphorus (Alt *et al.*, 1999).

Abou El-Nasr and Ibrahim (2011) reported that the highest potassium fertilization rate (75 kg K₂O fed⁻¹) gave the tallest shoot, the highest number of leaves per plant and the highest fresh weight of shoots as well as the highest total yield per fed.

Ibraheim *et al.* (2011) found that the application of N, P and K mineral fertilizers caused gradual and consistent increass in the growth rate , bulbing ratio, dry weight per plant, total nutrients uptake (N, P and K), as well as yield and its component.

Yogita and Ram.(2012) found that the maximum plant heights, number of leaves, neck thickness, bulb

diameter, bulb weight, number and yield were produced with the a plication of 100 kg N + 50 kg P + 70 kg K ha⁻¹.

Therefore, the aim of this study was to determine to requirements of onion crop to nitrogen fertilizer in combination with phosphatic and potash fertilizers. Investigating the effects of fertilization on plant growth, dry matter yield, N,P and K uptake were also included.

MATERIALS AND METHODS

The present investigation was carried out outdoor at the Agric..Experiment Station of Mansoura .University during 2015 and 2016 winter season to determine the requirements of onion crops (*Allium cepa* L, c.v red byhyre) from nitrogen fertilizers in combined with phosphatic and potash fertilizers .

Some important physical and chemical characteristics of the soil of the experimental field are shown in Table 1.

Table 1. Some characteristics of the experimental soil before Sowing.

Physical and Chemical properties	
0.42	EC dSm ⁻¹
8.50	pH (1:2.5)
2.48	CaCO ₃
2.59	OM %
Cations mq.L ⁻¹	
0.35	K ⁺
1.29	Na ⁺
0.40	Mg ⁺⁺
0.85	Ca ⁺⁺
Anions mq.L ⁻¹	
1.34	SO ₄ ⁻
0.55	CL ⁻
1.00	HCO ₃
Mechanical analysis	
37.00	sand
41.00	silt
22.00	clay
Available nutrients (mg kg.-1 soil)	
36.75	N
9.80	P
125.00	K

The Experimental design was complete randomized block, four levels of potash fertilizers and three levels of both nitrogenous and phosphatic fertilizers were used in this experiment . The fertilizer treatments, thus , consisted of 36 N,P and K combinations, the treatments were replicated three times , hence 108 pots were needed .

Nitrogen was applied at rates of 0, 50 and 100 kg N fed⁻¹, phosphorus at 0, 50 and 100 kg P₂O₅ fed⁻¹ and potassium at 0 , 50 , 100 and 150 kg K₂O fed⁻¹.

Ten kg of soil were placed in round pots having the diameter of 25 cm .Tap water was added to each pot to reach the field capacity and five onion seedlings were placed in the center of each pot in the 2 nd of December . 2015 .

Fertilizer application :

Determined amounts of urea (46 % N) , calcium superphosphate (15.5 % P₂O₅) and potassium sulphate (48% K₂O) were added in two split applications, before the first watering and after 50 days from sowing .

After emergence .the five seedling were thinned to three plants for each pot. The first sample was taken 50 day after sowing , while plants were harvested after 100 days from sowing . Plants sample were dried at 65 to 70 c ° and weighed

Methods of soil analysis

Some physical and chemical properties of the experimental soil were determined according to the methods described by (Page *et al.* 1984)

Plant analysis:

The N, P, and K concentrations were determined in oven dry plant samples.The oven dry plant samples were grinded and 0.2g. from each sample was weighted and wet digested Piper, (1950). N, P and K nutrients were measured in the digestive extract and their percentage were calculated on oven dry matter. Minerals estimation were performed as follow:

- Nitrogen was determined by the microkjeldahl method as aforementioned Hesse, (1971)
- Phosphorus was determined colorimetrically at a wavelength of 660nm using stannous chloride reduced molybdo phosphoric blue color method, described by Jackson, (1967).
- Potassium was determined using Flam photometer as described by Jackson, (1967).

.N, P and K uptake:

N, P, and K uptake values were calculated by multiplying the percentage of such elements by dry weight of the plants per pot.

- .Growth characters
- Fresh weight (g) of onion plants (g plot⁻¹)
- Dry weight (g) of onion plants (g plot⁻¹)
- Plant height (cm) of onion plants
- Bulb diameter (mm) of onion plants
- N uptake ,P and K uptake in the dry matter of onion plants

Statistical Analysis

The statistical analysis of the obtained data was done according to the method described by Gomez and Gomez, (1984). Using least significant differences (L.S.D) to compare the treatment values.

RESULTS AND DISCUSSION

Nitrogen, phosphorus and potassium fertilization levels and their interactions, reveal significant effects on average of fresh and dry weights of onion plants (g) after 50 and 100 days from sowing (Table 2) The highest value of fresh weight of plant (g) was obtain by the application 100 kg N.fed⁻¹ after 50 days from sowing 24.29 (g) compared otherN levels

Meanwhile, the levels of 50 kg P₂O₅ and 100 kg K₂O fed⁻¹ produced higher values than the other levels .

Table 2. Means of fresh and dry weights (g) of onion plant after 50 days and 100 days from sowing as affected by nitrogen, phosphorus , potassium fertilization levels and their interactions

Characters Treatments	Fresh weight of plant (g)		Dry weight of plant (g)	
	After 50 days	After 100 days	After 50 days	After 100 days
A: N-fertilization levels				
0 (control)	21.006	84.312	7.409	13.256
50 kg N. fed-1	21.162	115.983	7.392	13.639
100 kg N. fed-1	24.290	130.897	7.946	14.578
F test	**	**	**	**
LSD at 5%	1.478	4.289	0.371	0.522
LSD at 1%	1.963	5.696	0.493	0.694
B: P-fertilization levels				
0 (control)	17.383	116.268	7.088	13.739
50 kg P ₂ O ₅ .fed-1	26.444	113.724	8.002	13.906
100 kg P ₂ O ₅ . fed-1	22.631	101.202	7.656	13.827
F test	**	**	**	NS
LSD at 5%	1.478	4.289	0.371	-
LSD at 1%	1.963	5.696	0.493	-
C: K-fertilization levels				
0 (control)	21.973	99.363	7.393	11.541
50 K ₂ O.fed-1	21.651	116.063	7.406	13.637
100 K ₂ O.fed-1	26.266	123.770	7.943	14.595
150 Kg K ₂ O.fed-1	18.720	102.393	7.586	15.524
F test	**	**	*	**
LSD at 5%	1.706	4.952	0.429	0.603
LSD at 1%	2.266	6.577	-	0.801
Interactions:				
A X B	**	**	NS	*
A X C	**	**	*	NS
B X C	**	**	NS	NS
A X B X C	**	**	NS	**

Also, the highest values of average dry weight (g) of onion plants were obtained by the application of 100 kgN ,50 kg P₂O₅ and 150 kgK₂O fed⁻¹ after 100 days from sowing The record values were 14.57 ,13.90 and 15.52 (g), respectively .These results could be supported with those obtained by Yogita and Ram (2012) and Abou El-Nasr and Ibrahim (2011)

Also, Singh *et al.* (2010) reported that different levels of nitrogen and phosphoru significantly affected the growth characters of onion plant.

Plant height (cm) values of onion plants were increased significantly after 50 days and 100 days from sowing due to the cremental doses of N , P and K fertilizers (Table 3) .

Also, data in Table 3 show that the application of 100 kg N.fed⁻¹ after 100 days from sowing of onion plant increased plant height (cm) and pproduced the highest value of 70.17 (cm), while the control (without N-fertilization) gave the lowest value of 58.00 (cm). These results are in agreement with those reported by Messele (2016) .

Nitrogen and potassium fertilization levels and their interactions, reveal a significant influence on bulb diameter (mm) of onion plant after 100 days from sowing , while non-significant influences due to phosphorous fertilization levels was detected (Table 3). The highest value of bulb diameter (mm) was obtained

by the application of 100 K₂O .fed⁻¹ (18.555 mm) compared to the other levels.

Table 3. Means of plant height (cm) and bulb diameter (mm) of onion plants as affected by nitrogen, phosphatic, potash fertilization levels and their interactions.

Characters Treatments	Plant height (cm)		Bulb diameter(mm)
	After 50 days	After 100 days	After 100 days
A: N-fertilization levels			
0 (control)	49.500	58.000	17.314
50 kg N.fed ⁻¹	47.056	65.556	16.914
100 kg N.fed ⁻¹	51.222	70.167	18.478
F test	**	**	**
LSD at 5%	1.815	2.588	0.709
LSD at 1%	2.411	3.437	0.942
B: P-fertilization levels			
0 (control)	45.222	67.028	17.623
50 kg P ₂ O ₅ .fed ⁻¹	54.250	66.250	17.381
100 kg P ₂ O ₅ .fed ⁻¹	48.306	60.444	17.701
F test	**	**	NS
LSD at 5%	1.815	2.588	-
LSD at 1%	2.411	3.437	-
C: K-fertilization levels			
0 (control)	48.667	60.444	17.121
50 K ₂ O.fed ⁻¹	50.556	67.296	16.862
100 K ₂ O.fed ⁻¹	49.370	67.852	18.555
150 Kg K ₂ O.fed ⁻¹	48.444	62.704	17.736
F test	NS	**	**
LSD at 5%	-	2.988	0.819
LSD at 1%	-	3.969	1.088
Interactions:			
A X B	**	*	**
A X C	**	*	*
B X C	NS	*	**
A X B X C	**	*	**

Nitrogen, phosphorus and potassium fertilization levels and their interactions, reveal significantly affected N uptake (mg.pot-1) by onion plants after 50 and 100 days from sowing (Table 4) . The highest value of N uptake (mg.pot-1) of plant (g) was obtained by the application of 100 kg N.fed-1 after 50 days from sowing (283.5 0 mg.pot-1) compared with other levels .

Also, the application of 100 kg N.fed-1 recorded the value of 549.20 (mg/pot) of N uptake by onion plants. These result are in harmony with those obtained by Sharma, *et al* (2006) .

Nitrogen, phosphorus and potassium fertilization levels, revealsignificant effects on P uptake (mg.pot-1) of onion plant after 50 and 100 days from sowing (Table 4) . The highest values of P uptake (mg.pot-1) was obtained by the application 100 Kg P₂O₂. fed-1after 50 and 100 days from sowing (12.08 and 70.50 mg.pot-1 respectivley) compared to the other levels .

Shedeed *et al.*(2014) reported that application of chemical fertilizers to onion plants increased the amount of nitrogen, phosphorus and potassium adsorbed by bulb tissues .

Nitrogen, phosphorus and potassium fertilization levels and their interactions, reveal significant influences on K uptake (mg.pot-1) of onion plant after 50 and 100

days from sowing as shown in Table 4 . The highest value of K uptake (mg.pot-1) of plant was obtained by the application 100Kg K₂O .fed-1 after 50 days from sowing (26.44 g) .

Also, a significant influence of K uptake (mg.pot⁻¹) of onion plant was obtained by the application 150 Kg K₂O .fed⁻¹ after 100 days from sowing (467.8 mg.pot⁻¹) . These results could be supported by those obtained by Shedeed *et al.* (2014) . Also, Yoldas *et al.* (2011) reported that the application of N,P and K 120: 150: 100 improved the growth and increased total K content of onion crop. Shafeek, *et al* (2013) reported that application of potassium fertilizer at the highest rate gained the highest nutritional values of bulb tissues, protein and uptake N, P, K, of onion plant.

Table 4. Means of N,P and K uptake (mg/pot) of onion plants after 50 days and 100 days from sowing as affected by nitrogen, phosphorus potassium fertilization levels and their interactions

Characters Treatments	N uptake (mg/pot)		P uptake (mg/pot)		K uptake (mg/pot)	
	After 50 days	After 100 days	After 50 days	After 100 days	After 50 days	After 100 days
A: N-fertilization levels						
0 (control)	151.6	377.8	9.270	55.658	148.50	295.43
50 kg N.fed ⁻¹	207.1	478.3	9.346	56.668	153.22	381.26
100 kg N.fed-1	283.5	549.2	10.35	60.964	164.37	425.94
F test	**	**	**	**	**	**
LSD at 5%	12.89	26.91	0.612	3.369	8.64	15.91
LSD at 1%	17.11	35.74	0.813	4.474	11.47	21.13
B: P-fertilization levels						
0 (control)	193.4	466.0	7.106	45.440	135.10	368.36
50 kg P ₂ O ₅ .fed ⁻¹	229.2	473.4	9.782	57.356	162.17	364.92
100 kg P ₂ O ₅ .fed ⁻¹	219.6	465.8	12.08	70.495	168.83	369.34
F test	**	NS	**	**	**	NS
LSD at 5%	12.89	-	0.612	3.369	8.64	-
LSD at 1%	17.11	-	0.813	4.474	11.47	-
C: K-fertilization levels						
0 (control)	207.6	384.5	9.350	48.415	146.08	240.07
50 K ₂ O.fed ⁻¹	208.8	465.2	9.501	56.326	147.10	346.29
100 K ₂ O.fed ⁻¹	225.7	484.4	10.12	60.353	167.07	415.94
150 Kg K ₂ O.fed ⁻¹	214.1	539.5	9.652	65.960	161.22	467.86
F test	NS	**	NS	**	**	**
LSD at 5%	-	31.08	-	3.890	9.97	18.37
LSD at 1%	-	41.27	-	5.166	13.25	24.40
Interactions:						
A X B	NS	NS	NS	NS	NS	*
A X C	NS	**	NS	*	*	**
B X C	NS	**	NS	NS	NS	*
A X B X C	NS	**	NS	*	NS	NS

With regard to the interaction between nitrogenous, phosphatic and potash fertilizers on onion plants, the statistical analysis indicated that the effects were significant during 100 day growth stage .

CONCLUSION

It could be concluded that the highest values of growth parameters, dry matter yield and nutrient uptake

of onion crop, c.v. Red Behery, could be achieved by the application of NPK fertilizers at the rates of 100kg N, 50 kg P₂O₅ and 150 kg K₂O under the conditions of this investigation.

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الاحتياجات السمادية لمحصول البصل

خالد حسن الحامدي, محمود موسى عمر و محمود عمار محمود القبط
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أجريت تجربة اصص خلال موسم 2015 و 2016 في مشل كلية الزراعة - جامعة المنصورة لدراسة تأثير إضافة بعض الأسمدة المعدنية (نتروجين, فوسفور و بوتاسيوم) على نباتات البصل صنف بحيري احمر. النتائج اظهرت أهمية استخدام الأسمدة المعدنية (النتروجينية, الفوسفورية و البوتاسية) في تحسين خصائص النمو و محصول المادة الجافة وقد اتضح ان التفاعل بين الأسمدة المعدنية أعطي نتائج ايجابية من حيث تزويد البصل باحتياجاته الغذائية من الأسمدة المعدنية. كذلك تمت مناقشة اثر المعاملات المختلفة علي الكمية الممتصة من النتروجين و الفوسفور و البوتاسيوم.