INDIAN JOURNAL OF
ARID HORTICULTURE
2018, Vol. 13 (1-2):74-78

Effect of potassium and zinc on growth, yield and quality of garlic (*Allium sativum* L.)

Monu*, I. S Naruka .*, K. C Meena*, Ajay Haldar* and P. P. Singh**
*Department of Plantation, Spices, Medicinal and Aromatic Crops,
College of Horticulture, Mandsaur-458 001, (M. P.) India
**Principal Scientist, (Vegetable Science),ICAR,CIAH,Bikaner
(Received: 24.07.2018; Accepted: 3.09.2018)

Abstract

A field experiment was conducted during *Rabi* season 2017-18 at the Research Farm, College of Horticulture, Mandsaur (M.P.) to study the response of potassium and zinc on growth, yield and quality of garlic. The experiment was laid out in factorial RBD design with three replications including four levels of potassium (0, 25, 50 and 75 kg K_2O/ha) and three levels of zinc (0, 5 and 10 kg Zn/ha). Results showed that application of K_3Z_2 (75 Kg K_2O/ha + 10 Kg Zn/ha) significantly increased the plant height, number of leaves per plant, fresh weight of plant (g), dry weight of plant (g) fresh weight of bulb (32.4g), dry weight of bulb (10.22 g), polar diameter of bulb (4.73 cm), equatorial diameter of bulb (4.72 cm), bulb yield (146.7 q/ha), volatile oil content in bulb (0.40%) and non-significant effect showed in TSS content in bulb (42.51 ^{0}Brix). Therefore, the application of 75 Kg K_2O/ha and 10 Kg Zn/ha gave maximum growth, yield and quality attributes and of garlic.

Keywords: Garlic, potassium, zinc, growth, volatile oil

Introduction

Garlic (*Allium sativum* L.) is one of the important spice crop belong to family Alliaceae. The bulb is tunicate and is composed of disc-like stem, thin dry scales, which are the bases of the foliage leaves and smaller bulbs or cloves. The cloves are enclosed by the dry outer scales having cloves consist of a protective cylindrical sheath, a single thickened storage leaf sheath and small central bud (Farooqi *et al*., 2004). Potassium plays an important role in maintenance of cell water potential because it regulates opening and closing of stomata (Sinha, 1978), Biebl (1958) reported that potassium facilitates water uptake by plants from the soil solution is regulate by several factors including soil texture, moisture conditions, pH, aeration and temperature (Mengel and Kirkby, 1980).

Zinc is essential component and activator of many enzymes involved in auxin biosynthesis and photosynthesis (Romheld and Marscher, 1991) and their act as an important role in plant growth and yield of garlic. Zinc is most deficient among all the micronutrients in Indian soils condition. In many parts of India, zinc as a plant nutrient now stands third in importance next to nitrogen and phosphorus (Takkar and Randhawa, 1980). It plays an important role as a constituent of alcohol dehydrogenase and carbonic anhydrase in both microorganisms an higher plants. It helps the utilization of phosphorus and nitrogen in plants (Singh *et al*., 2002).

Materials and Methods

The experiment was laid out at the "Research Field of the Department of Plantation, Spices, Medicinal and Aromatic Crops", College of Horticulture, Mandsaur, RVSKVV, Gwalior, (M.P.) during *Rabi* season of 2017-18. Mandsaur is situated in Malwa Plateau in western part of Madhya Pradesh at North latitude of 23.45º to 24.13º and 74.44º to 75.18º East longitudes and an altitude of 435.02 meters above mean sea level. The soil of the experimental field was light black loamy in texture with low nitrogen (192 kg/ha), low phosphorus (7.6 kg/ha), medium potassium (145.0 kg/ha) soil having (pH 8.36) and EC (0.18 dS/m). The field experiment comprising 12 treatment combinations with the three replications was laid out in factorial randomized block design with two factors. The experiment consisted of four levels of potassium (0, 25, 50 and 75 kg K_2O/ha) and three levels of zinc (0, 5 and 10 kg Zn/ha). The crop variety G-282 were sown in spacing 15x10 cm with seed rate of 500 kg/ha. Uniform dose of nitrogen (150 kg/ha) through urea and phosphorus (60 kg/ha), through single super phosphate, potash and zinc nutrient were applied according to the treatment. Data were recorded for various growth, yield and quality parameters and statistically analyzed using the method of analysis of variance as described by Panse and Sukhatme (1985).

Results and Discussion

Effect of Potassium on growth attributes

Maximum plant height (30.84, 50.50, 71.13, 73.23 cm) at 30, 60, 90 and 120 DAS, number of leaves (3.87, 6.58, 8.71, 9.49) per plant at 30, 60, 90 and 120 DAS, fresh weight (2.72, 8.55, 28.57, 67.00 g) of plant (g) at 30, 60, 90 and 120 DAS, dry weight (0.53, 2.61, 7.08, 30.14, 28.13 g) of plant (g) at 30, 60, 90, 120 DAS and at harvest were recorded under application of potassium K_3 (75 kg K_2O ha^{-1}) followed by K_4

(50 kg K_2O ha^{-1}) and lowest in K_0 (0 kg K_2O ha^{-1}) at all the growth stages. It may be attributed to the fact that application of potassium improved not only availability of potassium but other nutrients also which are considered vitally important for growth and development of plants. The similar results have also been reported by Magray *et al.* (2017), Ismail *et al.* (2014), Arisha *et al.* (2017), Sayed *et al.* (2012), Sakarvadia *et al*. (2009) in garlic and Aftab *et al.* (2017) in onion.

Effect of Potassium on Yield attributes

Maximum fresh weight (28.5 g) of bulb, dry weight (9.57 g) of bulb, polar diameter (4.72 cm), equatorial diameter (4.42 cm) and bulb yield (139.3 q/ha) were recorded under application of potassium in K_3 (75 kg K_2O ha^{-1}) followed by K_2 (50 kg K_2O ha^{-1}) and lowest in K_0 (0 kg K_2O ha^{-1}) at all the stages of yield attributes. The similar results have also been reported by Sayed *et al.* (2012), Magray *et al.* (2017), Ismail *et al.* (2014), Arisha *et al.* (2017), Sakarvadia *et al*. (2009) in garlic and Aftab *et al.* (2017) in onion.

Effect of Potassium on quality attributes

Maximum TSS (41.63 ^{0}Brix) content and oil content (0.33 %) were recorded under application of potassium levels in K_3 (75 kg K_2O ha^{-1}) followed by K_2 (50 kg K_2O ha^{-1}) and lowest in K_0 (0 kg K_2O ha^{-1}). These may be due to potassium is essential for production of oil and fats. Similar results were also reported by Sayed *et al.* (2012), Arisha *et al*. (2017), Ismail *et al*. (2014) in garlic and Desuki *et al*. (2006) and Verma and singh (2012) in onion.

Potassium plays an important role in maintenance of cell water potential because it regulates opening and closing of stomata (Sinha, 1978). Biebl, 1958 reported that potassium facilitates water uptake by roots and reduces transpiration loss in plant.

Effect of zinc on growth attributes

Maximum plant height (30.44, 50.73, 71.22, 72.60cm) at 30, 60, 90 and 120 DAS , number of leaves (3.82, 6.48, 8.50, 9.34) per plant at 30, 60, 90 and 120 DAS, fresh weight (2.50, 7.65, 28.34, 64.46) of plant (g) at 30, 60, 90 and 120 DAS, dry weight (0.53, 2.65, 6.27, 26.91, 27.28) of plant (g) 30, 60, 90, 120 DAS and at harvest, were recorded under application of zinc Z_2 (10 kg Zn ha^{-1}) followed by Z_1 (5 kg Zn ha^{-1}) and lowest in Z_0 (0 kg Zn ha^{-1}) at all the growth stages. It might be due to better growth and development of plant parts in terms of plant height, no. of leaves. Application of zinc might have increased the availability and steady supply of nutrients for plant metabolism and photosynthetic activity resulting into optimum growth and development of the crop. In addition, zinc is important in the synthesis of tryptophan, a component of some proteins and a compound needed for production of growth hormones (auxins) like Indol-Acetic Acid. Such improvement under increased availability of zinc in rhizosphere might have resulted in greater uptake by the plant consequently leading to a favourable effect on various processes of plant".

The similar results have also been reported by Rohidas ***e****t al.* (2010), Chanchan *et al.* (2014), Islam *et al.* (2012), Sakarvadia *et al*. (2009) in garlic and Manna *et al.* (2014) in onion.

Effect of Zinc on Yield and yield attributes

Maximum fresh weight (28.8 g) of bulb, dry weight (9.32 g) of bulb, polar diameter (4.51 cm), equatorial diameter (4.31 cm) and bulb yield (136.7 q/ha) were recorded under application of zinc Z_2 (10 kg Zn ha^{-1}) followed by Z_1 (5 kg Zn ha^{-1}) and lowest in Z_0 (0 kg Zn ha^{-1}) at all thestages of yield attributes. Similar results were also reported by Chanchan *et al.* (2014), Rohidas *et al.* (2010), Islam *et al.* (2012), Nasreen *et al*. (2009) In garlic and Manna *et al.* (2014) and Trivedi and Dhumal (2013) in onion.

Effect of Zinc on quality attributes

Maximum TSS content (38.25 ^{0}Brix) in bulb and volatile oil content (0.32 %) in bulb were recorded under application of zinc Z_2 (10 kg Zn ha^{-1}) followed by Z_1 (5 kg Zn

Table 1. Effect of potassium and zinc on growth and yield of garlic

Treat.	Plant height (cm)				No of leaves per plant				Fresh weight of plant (g)				Dry weight of plant (g)				
	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	At harvest
Potassium																	
K_0	26.16	47.77	65.76	66.58	3.32	5.06	7.37	8.00	2.03	4.41	22.93	53.01	0.42	1.35	4.49	18.46	22.13
K_1	29.90	49.52	67.91	67.52	3.49	6.44	7.66	8.42	2.24	6.34	25.40	58.66	0.47	2.68	5.69	24.95	24.97
K_2	30.32	50.27	69.84	69.57	3.50	6.57	8.33	8.82	2.39	6.86	25.62	63.76	0.48	2.42	6.42	27.63	26.59
K_3	30.84	50.50	71.13	73.23	3.87	6.58	8.71	9.49	2.72	8.55	28.57	67.00	0.53	2.61	7.08	30.14	28.13
SEm±	0.36	0.42	0.72	1.52	0.09	0.10	0.15	0.18	0.12	0.32	0.61	1.11	0.02	0.07	0.10	0.31	0.37
CDat 5%	1.06	1.23	2.11	4.46	0.26	0.28	0.43	0.54	0.34	0.95	1.78	3.27	0.05	0.22	0.30	0.92	1.09
Zinc																	
Z_0	28.05	47.41	64.06	64.63	3.31	5.66	7.48	7.82	2.00	5.08	22.31	53.27	0.41	1.81	5.54	23.74	22.73
Z_1	29.43	50.41	70.71	70.45	3.51	6.35	8.07	8.89	2.53	6.89	26.24	64.09	0.49	2.34	5.95	25.24	26.36
Z_2	30.44	50.73	71.22	72.60	3.82	6.48	8.50	9.34	2.50	7.65	28.34	64.46	0.53	2.65	6.27	26.91	27.28
SEm±	0.31	0.36	0.62	1.32	0.08	0.08	0.13	0.16	0.10	0.28	0.53	0.96	0.02	0.06	0.09	0.27	0.32
CD at 5%	0.91	1.07	1.82	3.86	0.22	0.24	0.37	0.47	0.30	0.82	1.54	2.83	0.05	0.19	0.26	0.80	0.94

Table 2. Effect of potassium and on growth, yield and quality of garlic

Tret.	Fresh weight of bulb (g)	Dry weight of bulb (g)	Polar diameter(cm)	Equatorial diameter (cm)	Bulb yield (q $ha^{-1)}$	TSS conten t (^{0}Brix)	Volatile oil content (%)
Potassium							
K_0	23.3	8.40	3.94	3.63	114.6	33.28	0.22
K_1	26.7	8.66	4.33	4.10	131.1	36.20	0.26
K_2	27.0	9.12	4.50	4.36	134.8	38.83	0.31
K_3	28.5	9.57	4.72	4.42	139.3	41.63	0.33
SEm±	0.58	0.07	0.05	0.06	0.52	0.18	0.01
CD at 5%	1.70	0.20	0.14	0.17	1.53	0.54	0.02
Zinc							
Z_0	23.1	8.49	4.19	3.96	118.7	36.64	0.23
Z_1	27.2	9.00	4.43	4.11	133.3	37.57	0.29
Z_2	28.8	9.32	4.51	4.31	136.7	38.25	0.32
SEm±	0.50	0.06	0.04	0.05	0.45	0.16	0.01
CDat 5%	1.47	0.17	0.12	0.15	1.33	0.47	0.02

Table 3. Combined effect of potassium and zinc on growth parameter of garlic.

Treatment	Plant height (cm)				No of leaves per plant				Fresh weight of plant (g)			
	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS	30 DAS	60 DAS	90 DAS	120 DAS
K_0Z_0	23.17	46.50	63.33	62.90	3.07	5.00	7.07	7.50	1.76	3.91	21.97	51.87
K_0Z_1	27.01	48.20	66.17	66.60	3.17	5.02	7.10	8.10	2.00	4.26	23.10	54.82
K_0Z_2	28.30	48.37	67.20	68.00	3.73	5.17	7.20	8.40	2.33	5.07	23.73	52.33
K_1Z_0	28.87	49.33	64.33	65.30	3.47	5.67	7.80	7.83	2.08	5.77	22.20	51.11
K_1Z_1	29.61	51.50	70.13	70.80	3.37	6.73	7.93	8.63	2.55	6.20	26.07	62.42
K_1Z_2	30.13	50.67	69.27	69.27	3.67	6.74	7.97	8.80	2.11	7.03	27.93	62.44
K_2Z_0	30.15	47.07	63.39	65.13	3.23	5.97	7.77	8.10	2.10	4.86	22.37	55.33
K_2Z_1	30.33	50.40	73.33	70.27	3.60	6.73	8.30	8.87	2.80	7.35	25.67	68.89
K_2Z_2	30.48	51.10	72.87	69.40	3.63	6.82	8.83	9.50	2.28	8.37	28.83	67.06
K_3Z_0	30.00	46.73	64.67	65.17	3.47	6.00	8.00	7.83	2.07	5.77	22.70	54.77
K_3Z_1	30.77	51.53	73.20	74.13	3.90	6.83	8.93	9.97	2.80	9.77	30.13	70.22
K_3Z_2	31.75	52.77	75.53	83.73	4.23	7.00	9.30	10.67	3.29	10.13	32.87	76.00
SEm±	0.62	0.73	1.24	2.63	0.15	0.17	0.25	0.32	0.20	0.56	1.05	1.19
CD at 5%	1.83	2.14	3.65	7.72	NS	0.49	NS	0.93	NS	1.64	3.09	5.85

Table. 4. Combined effect of pot assium and zinc on yield and quality parameter of garlic.

Treatment	Dry weight of plant (g)					Fresh weight of bulb (g)	Dry weight of bulb (g)	Polar diameter of bulb (cm)	Equatorial diameter of bulb (cm)	Bulb yield (q\ha)	TSS content in bulb (^{0}Brix)	Volatile oil content in bulb (%)
	30 DAS	60 DAS	90 DAS	120 DAS	At harvest							
K_0Z_0	0.40	1.29	4.26	17.44	21.07	1.76	3.91	21.97	51.87	0.40	32.61	0.21
K_0Z_1	0.41	1.33	4.44	18.59	22.47	2.00	4.26	23.10	54.82	0.41	33.30	0.21
K_0Z_2	0.44	1.42	4.77	19.36	22.87	2.33	5.07	23.73	52.33	0.44	33.92	0.23
K_1Z_0	0.40	2.51	4.89	21.96	22.77	2.08	5.77	22.20	51.11	0.40	35.19	0.26
K_1Z_1	0.49	2.76	6.04	25.26	25.47	2.55	6.20	26.07	62.42	0.49	36.64	0.33
K_1Z_2	0.53	2.78	6.14	27.63	26.67	2.11	7.03	27.93	62.44	0.53	36.78	0.34
K_2Z_0	0.42	1.68	6.52	26.55	23.33	2.10	4.86	22.37	55.33	0.42	37.81	0.23
K_2Z_1	0.49	2.51	6.22	26.66	27.77	2.80	7.35	25.67	68.89	0.49	38.88	0.24
K_2Z_2	0.54	3.08	6.51	29.67	28.67	2.28	8.37	28.83	67.06	0.54	39.81	0.32
K_3Z_0	0.41	1.77	6.49	29.00	23.73	2.07	5.77	22.70	54.77	0.41	40.95	0.24
K_3Z_1	0.57	2.77	7.12	30.45	29.73	2.80	9.77	30.13	70.22	0.57	41.45	0.36
K_3Z_2	0.60	3.30	7.65	30.99	30.93	3.29	10.13	32.87	76.00	0.60	42.51	0.40
SEm±	0.03	0.13	0.18	0.54	0.64	0.20	0.56	1.05	1.19	0.03	0.32	0.10
CDat 5%	NS	0.38	0.52	1.6	1.89	NS	1.64	3.09	5.85	NS	NS	0.40

ha^{-1}) and lowest in Z_0 (0 kg Zn ha^{-1}). The increased in volatile oil content of garlic due to application of zinc has also been reported by Hatwal *et al.* (2015), Manna *et al.* (2014) Trivedi and Dhumal (2013) in onion.

Interaction effect of potassium and zinc

Combined effect of potassium and zinc exerted significantly influence on growth attributes *viz*., plant height, number of leaves per plant, fresh weight and dry weight of plant (g), at all the growth stages except number of leaves per plant, fresh weight dry weight at 30 DAS. Maximum plant height, number of leaves per plant, fresh weight and dry weight of plant (g), were recorded under treatment combination K_3Z_2. Minimum plant height, number of leaves per plant, fresh weight and dry weight of plant (g) were recorded under K_0Z_0. Similar results were also reported by Sakarvadia *et al.* (2009) in garlic.

Combined effect of potassium and zinc showed significantly influence on yield attributes *viz*., Maximum fresh weight of bulb (g), dry weight of bulb (g), polar diameter of bulb (cm), equatorial diameter of bulb (cm) and bulb yield (q ha^{-1}) were recorded under treatment combination K_3Z_2. Minimum fresh weight of bulb (g), dry weight of bulb (g), polar diameter of bulb (cm), equatorial diameter of bulb (cm), number of cloves per bulb and bulb yield (q ha^{-1}) were recorded under treatment combination K_0Z_0.

Combined effect of potassium and zinc showed significantly influence on quality attributes *viz*., TSS content in bulb (^{0}Brix) and volatile oil content in bulb (%). Maximum amount of TSS content in bulb (^{0}Brix) and oil content in bulb (%) were recorded under treatment combination K_3Z_2. Minimum amount of TSS content in bulb (^{0}Brix) and oil content in bulb (%) were recorded under treatment combination K_0Z_0 in garlic.

On the basis of one year research it could be concluded that application of potassium and zinc influence the growth, yield and quality of garlic. The growth, yield and quality of garlic can be increased by application of K_3Z_2 (75 Kg K_2O/ha + 10 Kg Zn/ha) should be advocated for garlic.

References

Aftab, S., Hamid, F. S., Farrukh, S., Waheed, A., Ahmed, N., Khan, N., Ali, S., Bashir, M., Mumtaz, S., Gul, H., and Younis, M.A. 2017. Impact of Potassium on the Growth and Yield Contributing Attributes of Onion (*Allium cepa* L.).*Asian Research Journal of Agriculture*, 7(3): 1-4.

Arisha, H. M. E., Ibraheim, S. K. A., and El-Sarkassy, N. M. 2017. Response of Garlic (*Allium sativum* L.) Yield, Volatile Oil and Nitrate Content to Foliar and Soil Application of Potassium Fertilizer under Sandy Soil Conditions. *Middle East Journal of Applied Sciences*, *7*(01): 44-56.

Beibl, R. 1958. Influence of K nutrition on the response to environmental stress. In. Potassium Research Review and Trends. *International Potash Institute Berne/Switzerland*, pp.189-222.

Chanchan, M. and Hore, J. K. 2014. Studies on the effect of micronutrients on growth and yield of garlic. *Research on Crops*, 15(3): 701-704.

Desuki- El, M., Abdel-Mouty, M. M., and Ali, A. H. 2006. Response of onion plants to additional dose of potassium application. *Journal of Applied Science Research*, 2(9): 592-597.

Farooqi, A. A., Sreeramu B. S. and Srinivaspa, K. N. 2004. Cultivation of spices crops. Universities press, pp-129-130.

Hatwal, P. K., Kavita, A., Choudhary, M. K. and Singh, B. 2015. Effect of vermicompost, sulphur and micronutrients on yield and quality of garlic (*Allium sativum* L.) var. 'G-282'. *Annals of Biology*, 31(1): 85-90.

Islam, M. A., Shamsuddoha, A. T. M., Bhuiyan, M. S. I. and Hasanuzzaman, M. 2008. Response of summer onion to potash and its application methods. *Amer-Euras J. Agron*, 1(1): 10-15.

Ismail, H. E. M., Bardisi, A. and El-Khair, E. E. A. 2014. Impact of potassium fertilization on growth, productivity and bulb quality of garlic plants. *Global Journal of Agriculture and Food Safety Sciences*, 1(2): 107-125.

Magray, M. M., Chattoo, M. A., Narayan, S. and Mir, S. A. 2017. Influence of Sulphur and Potassium Applications on Yield, Uptake & Economics of Production of Garlic. *Int. J. Pure App. Biosci*, 5(5): 924-934.

Manna, D., Maity, T. K. and Ghosal, A. 2014. Influence of foliar application of boron and zinc growth, yield and bulb quality of onion (*Allium cepa* L.). *Journal of Crop and Weed*, 10(1): 53-55.

Mengel, K. and Kirkby, E. A. 1980. Potassium in crop production. In *Advances in Agronomy*, 33: 59-110.

Nasreen, S., Yousuf, M. N., Mamun, A. N. M., Brahma, S. and Haquc, M. M. 2009. Response of garlic to zinc, boron and poultry manure application. *Bangladesh Journal of Agricultural Research*, 34(2): 239-245.

Pansey, V.G. and Sukhatme, P.V. 1985. Statistical Methods, for Agricultural Workers. Forth Enlarged Edition. *ICAR Publication*, New Delhi.

Rohidas, S. B., Bharadiya, P. S., Jature, S. D. and Ghate, K. B. 2010. Effect of micronutrient on growth and yield of garlic (*Allium sativum* L.) var. G-41. *Asian Journal of Horticulture*, 5(2): 517-519.

Romheld, V. and Marscher, H. 1991. Function of micronutrients in plants. (In) Mortredt J. (Eds.), Micronutrients in Agriculture No. 4, Soil Science Society of America, Madison, Wisconsin, pp. 277.

Sakarvadia, H. L., Polara, K. B., Parmar, K. B., Babariya, N. B. and Kunjadia, B. B. 2009. Effect of potassium and zinc on growth, yield and nutrient uptake by garlic. *An Asian Journal of Soil Science*, 4(1): 110-112.

Sayed- El-, H. E. A. and El-Morsy, A. H. A. 2012. Response of productivity and storability of garlic (*Allium sativum*

L.) to some potassium levels and foliar spray with mepiquat chloride (PIX). *International Research Journal of Agriculture and Soil Science*, 2(7): 298-305.

Singh.; Satpal., Jat, N.L. and Singh, S. 2002. Effect of zinc fertilizer on growth and yield of coriander. *Ann of Agri. Res.*, 23(4): 734-736.

Sinha, S.K. 1978. Influence of potassium on tolerance to stress. Indian experience. In. *Potassium in soil and crops* (Ed.). Sekhon, G.S., Potash Research Institute of India, Gurgaon, Haryana, India, pp. 223-240.

Takkar, P.N. and Randhawa, N.S. 1980. Zinc deficiency in Indian soils and plants. Seminar on zinc wastes and their utilization, 15-18, Oct. organized by Indian lead zinc information center anthe fertilizer Association of India, New Delhi.

Tondon, H.L.S.(1991. Sulphur research and agricultural production in India. pp. 477.

Trivedi, A. P. and Dhumal, K. N. 2013. Effect of soil and foliar applications of zinc and iron on the yield and quality of onion (*Allium cepa* L.). *Bangladesh Journal of Agricultural Research*, 38(1): 41-48.

Verma, D. and Singh, H. 2012. Response of varying levels of potassium and sulphur on yield and uptake of nutrients by onion. *Annals of Plant and Soil Research, Azadnaga*, 14(2): 143-146