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Effect of Natural And/or Chemical Potassium Fertilizers on Growth, Bulbs Yield and Some Physical and Chemical Constituents of Onion (*Allium cepa,* L.)

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Abstract: Two field experiments were carried out in the experimental station of National Research Centre at Shalakan (Kalubia Governorate) to study the response of onion productivity to the application of potassium at different forms and rates. The obtained results showed that the highest plant vegetation growth character (the tallest plant, the highest leaves number, the heaviest fresh, dry weight of whole plant, total bulbs yield per unit area and dimension of bulb as well as its average weight) were detected with using chemical form of K as potassium sulphate. The poorest vegetative plant growth characters were detected when used feldspar as source of natural potassium. The statistical analysis of the obtained data reveals that no significant variation within using potassium sulphate alone and that if mixed with feldspar at rate 1: 1. The application of chemical potassium fertilizer gained the highest nutritional values of N, P, K and Zn, but mixed potassium fertilizer, i.e. Chemical + Natural recorded the highest values of Fe and Mn. With increasing potassium fertilizer rate up to144 K_2O units/fed., the vigor onion plant growth, the heaviest bulbs yield as well as the best physical and chemical properties were recorded.

Key words:

INTRODUCTION

Onion is considered one of the most important vegetable crops in Egypt. Increasing productivity of onion with good quality is an important target by the growers for local and foreign consumptions. Chemical potassium fertilizer became a high expensive fertilizer in Egypt, so most of farmers ignored using it. Thus, the use of alternative indigenous resources such as feldspar (orthoclase) is gaining importance to alleviate the dependence of imported or costly commercial fertilizers. It known that, potassium is one of the most important elements in the plant nutrition. It plays an important role on promotion of enzymes activity and enhancing the translocation of assimilates sugars, starch and protein synthesis. Moreover, it increases root growth, improve drought resistance, builds cellulose, reduce loading, control plant turgidity.

Low levels of nutrients such as K is considered one of a major production constrains of all types of soil. Further more, potassium forms are the third most important plant nutrient limiting plant growth and consequently crop yield. Except nitrogen potassium is a mineral nutrient plants require in largest amount and assimilated in relatively large quantities by the growing crop as the yield and quality[1].

Potassium is absorbed by plants in larger amounts than any other mineral elements except nitrogen and phosphorus.

The main source of K for plants comes from K minerals and organic K-source, K-feldspar is one of the most important K minerals[2]. Several laboratory studies have shown that microbes can increase the dissolution rate of silicate and aluminum silicate minerals in laboratory patches experiments, primarily by generating organic and inorganic acids[3].

Microbes can enhance mineral dissolution rate by producing and excreting metabolic by-products that interact with the mineral surface. Complete microbial respiration and degradation of particulate and dissolved organic carbon can elevate carbonic acid concentration at mineral surfaces, in soils and in ground water[4,3], which can lead to an increase in the rates of mineral weathering by a proton-promoted dissolution mechanism. In addition to carbonic acid, microbes can produce and excrete organic ligands by a variety of processes such as fermentation and degradation of organic macromolecules, or as a response to nutrient stress[5,7].

It is well known that many organic compounds produced by microorganisms, such as acetate, citrate and oxalate can increase mineral dissolution rate[8]. Carboxylic acid groups which shown to promote dissolution of silicates are also common in extra cellular organic materials. Moreover, some microorganisms in soil environment contain enzymes that function in ways analogous to chitinase and celluloses, i.e. they specifically break down mineral

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structure and extract elements required for metabolism or structure purposes (e.g., mineralizes)[9]. This may be especially important for ions such as Fe^{3+} and Al^{3+}, which are expected to be rather insoluble.

Many investigators study the response of onion plant to the potassium sources and rates. Such as[10,15] The aim of this study is to investigate the effect of chemical and/or natural potassium which inoculated with silicate bacteria at various rates on onion plant growth, total bulbs yield and the nutritional values of onion bulb tissues.

MATERIALS AND METHODS

During the two successive seasons of 2003/2004 and 2004/2005, field experiments were conducted out at the station of agricultural experiments, of National Research Centre, at Kalubia Governorate. Chemical, natural and mixture of chemical and nature, i.e. 1:1 were used as a source of K at rates (48, 96 and 144 K_2O units/fed.) on onion plant growth, bulbs yield, and some physical and chemical features. Potassium sulphate (48% K_2O) used as chemical source, but feldspar (11.0 % K_2O) used as a natural source. Potassium fertilized requirements divided into two parts, where the first one was dressed during preparing the soil for plantation, and the second half applied 60 days after onion transplanting.
The physical and chemical properties of soil are presented in Table (1) for the two experiments.

Onion seedlings cv. Giza 20 were soaked in fermented liquid containing strain of silicate dissolving bacteria (*Bacillus cereus) and* planted on 11 th and 13 th January 1n 2003 and 2004 respectively, at distance of 20 cm apart within the rows of 15 cm within the plants.

Each experiment included 9 treatments which resulted from the interaction between 3 sources and 3 rates of potassium fertilizers.

A split-plot design with three replicates was used where; sources of potassium fertilizers were allocated to the main plots, while the different rates of k was randomly assigned to the sub-plot. Each sub-plot consisted of four rows, each of 5 meters in length and 3.2 m in width. The plot area was 16 m^2.

The normal cultural practices used for the onion production, i.e. irrigation, fertilization (nitrogen and phosphorus fertilizers were added as ammonium sulphate (20.5% N) and calcium super phosphate (15.5% P_2O_5, respectively.

Five plants were taken randomly from every experimental plot at 110 days after planting in both investigated seasons. Plant growth expressed as plant length (cm), number of leaves per plant, and diameter of neck and bulb (cm), as well as the whole fresh and dry weight of onion plant and its leaves, neck and bulb as g/plant were recorded in representative samples. (5 plants) which were taken randomly from every experimental plot at 110 days after planting in both investigated seasons.

At harvesting time, fresh onion yield and its components were calculated in terms of total bulbs yield as tons/ fed. in both two experimental seasons. Some physical properties of onion bulbs were recorded such as average bulb weight (g), length (cm), and diameter at harvesting time.

The chemical constituents as nutritional values (N, P, K, Fe, Mn, Zn and Cu). Total protein content in dry bulbs was accounted by multiplying nitrogen content by 6.25 and T.S.S. values in bulbs tissues were determined using hand refractometer, where total nitrogen was determined by microkjeldahl method Jackson,[16], total phosphorus was determined using ammonium vanidate method using spectrophotometer, while total potassium in the digest was determined using flame photometer Cottenie *et al.*[17]. Iron, Mn, Zn and Cu concentration were determined using flame ionization atomic absorption, spectrometer of Chapman and Pratt[18].

The obtained data were subjected to the analysis of variance procedure and treatment means were compared to the L.S.D. Test according to Gomez and Gomez[19].

RESULTS AND DISCUSSION

Vegetative Growth Characteristics: Data presented in Table (2) and fig (1) indicate a significant simulative influence of K application sources on the vigor of onion plants as expressed by plant length, average number of leaves/plant, diameter of bulb and neck, fresh and dry weight of whole plant and its different organs with the application of potassium during the two successive seasons.

It has been stated that, the tallest onion plant which carried the highest leaves number, the heaviest fresh and dry weight of leaves, neck and bulb were gained with plants which received the highest potassium rate, i.e. 144 K_2O units/fed. (Fig. 2). Also the diameter of onion bulb and its neck followed the same pattern. The increase of whole fresh weight was 59.5 and 26.0 % in 1st season and 77.7 and 33.9 % in 2nd season, respectively more in case using 48 and 96 K_2O units/fed. application rate. This superiority for total dry weight of whole plant was 80.7 and 33.6 %, respectively. This simulative effect may be due to the role of potassium on production of enzymes activity and enhance in the translocation of assimilate and protein synthesis El-Desuki, *et al.*,[14].

Generally, the increase in plant growth parameters caused by high rate of potassium fertilization might be due to its beneficial improvement effect of such level

Table 1: Some physical and chemical analysis of the experimental soils.

Physical properties	2003/2004	4004/2005
Soil texture	Clay	Clay
Clay (%)	44.33	46.07
Silt (%)	25.64	28.17
Fine sand (%)	22.85	22.46
Coarse sand (%)	2.68	2.475
Chemical analysis		
Available (K) (mg/100 g soil)	164	175
Available (P) (mg/100 g soil)	62.1	62.9
Total nitrogen (mg/100 g soil)	751	893
$CaCO_3$ (%)	133.5	133.8
Organic matter (%)	1.86	1.84
EC (mmhos/cm/25°C)	1.8	1.4
pH	7.88	7.76

Table 2: Effect of chemical and natural potassium fertilizer at different rates on onion plant growth characters during the experimental seasons of 2004/2005.

B- Second season														
Potassium Treatments Source	K_2o units/ Fed.*	Plant length (cm)	No. of leaves / plant	Diameter, cm.		Fresh weight, g. / plant.				Dry weight, g. / plant.			
				Bulb	Neck	Leaves	Neck	Bulb	Total	Leaves	Neck	Bulb	Total
Chemical (C)	48	33.33	5.00	3.77	1.20	13.42	5.22	24.91	40.33	3.61	1.91	3.56	9.09
	96	48.33	6.00	4.40	1.23	16.58	8.86	46.95	72.39	5.43	3.42	5.09	13.94
	144	58.67	8.33	5.00	1.73	28.90	14.23	60.76	103.89	6.84	6.26	8.65	21.74
Mean		46.78	6.44	4.39	1.39	19.64	9.44	44.20	72.20	5.29	3.86	5.77	14.92
Natural (N)	48	37.33	4.67	4.10	1.40	11.20	6.53	32.76	50.48	3.48	2.41	3.66	9.55
	96	42.00	5.33	4.17	1.43	15.98	6.80	34.10	56.88	4.96	2.14	4.13	11.24
	144	48.67	6.00	5.27	1.50	18.56	9.87	47.46	75.89	5.57	4.85	5.36	15.78
Mean		42.67	5.33	4.51	1.44	15.25	7.73	38.10	61.08	4.67	3.14	4.38	12.19
C+N (1:1)	48	40.33	5.67	4.07	1.37	10.21	6.84	33.14	53.41	4.36	3.77	3.68	11.80
	96	43.33	6.00	4.43	1.63	16.49	7.46	38.21	62.16	5.02	2.86	4.50	12.38
	144	52.67	6.33	4.90	1.57	19.25	8.43	48.92	76.60	6.86	5.22	5.83	17.91
Mean		45.44	6.00	4.47	1.52	15.31	7.58	40.09	64.05	5.41	3.95	4.67	14.03
Mean	48	37.00	5.11	3.98	1.32	11.61	6.20	30.27	48.07	3.82	2.70	3.63	10.15
	96	44.56	5.78	4.33	1.43	16.35	7.71	39.75	63.81	5.14	2.81	4.57	12.52
	144	53.33	6.89	5.06	1.60	22.24	10.84	52.38	85.46	6.42	5.44	6.61	18.48
L.S.D. at 5%	Sources	N.S.	0.59	N.S.	N.S.	N.S.	N.S.	N.S.	5.58	N.S.	N.S.	0.57	2.04
	Rates	2.51	0.49	0.18	0.14	2.19	2.83	6.02	8.85	0.51	0.89	0.69	1.42
	Interaction	4.34	0.58	0.32	0.23	3.79	N.S.	10.43	15.32	N.S.	N.S.	1.19	2.46

* Fed. = 4200 m²

on plant growth and the fundamental role of K in plant growth, which reflected to stimulate their absorption and utilization efficiency from soil nutrient solution. These trends of results are very much similar with Fatma, Rizk *et al.*,[11]; Sharma, *et al.*,[20]; Yadav *et al.*,[21] and Aisha, Ali, *et al.*,[15].

Applying potassium fertilizer in the form of potassium sulphate (as chemical form) showed the best plant growth criteria's during the two experimental seasons. However, the statistical analysis of the obtained data reveals that, the differences within application of potassium in the 3 forms, i.e. chemical,

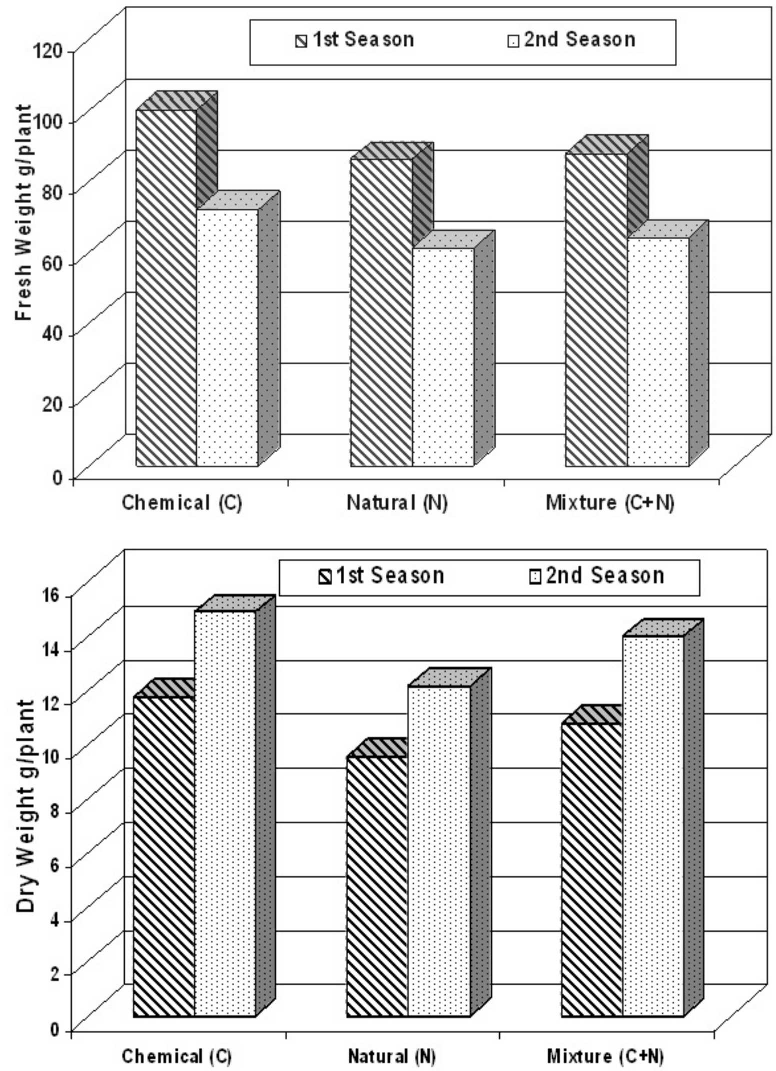


Fig. 1: Effect of using different sources of potassium fertilizers (chemical, natural and mixture) on fresh and dry weights (g/plant) of onion plant during both experimental seasons of 2003/2004 and 2004/2005.

natural and/or combined as 1:1 were great enough to reach the 5 % level of significant for all plant growth parameter in 1st season. On the contrary, in 2nd experiment the significant were only observed for average leaves number/plant, total fresh and dry weight of whole plant as well as its bulb. The data presented in Table (2) indicate that the simulative effect of the chemical potassium form was the best, followed in descending order by the mixture of chemical + natural as 1:1, and lastly, the natural potassium (feldspar). This might be attributed to the slow release of natural K, which needs a long time if compared to the chemical K. The chemical form of K is more available for plant requirement. Sanz-Scovino and Rowell, [22] reported that the potassium in feldspar form is not easily released and is therefore not suitable for direct application to the plants.

From the obtained data (Table 2) it could noticed that, the interaction treatments of potassium sources and rates had a great effect on the plant growth parameters in both two experiments. Whereas, the differences within different treatments were enough to reach the 5 % level of significant with the exception of plant length, number of leaves/plant, diameter of bulb in 1st season as well as fresh weight of neck, dry weight of leaves and neck in 2nd season. Generally, with different potassium forms, increasing the rate of application caused an enhancement in plant growth characters. However, the best vigor onion plant was recorded when chemical potassium form (potassium sulphate) with the application rate of 144 K_2O units/fed. These findings were true in both experiments.

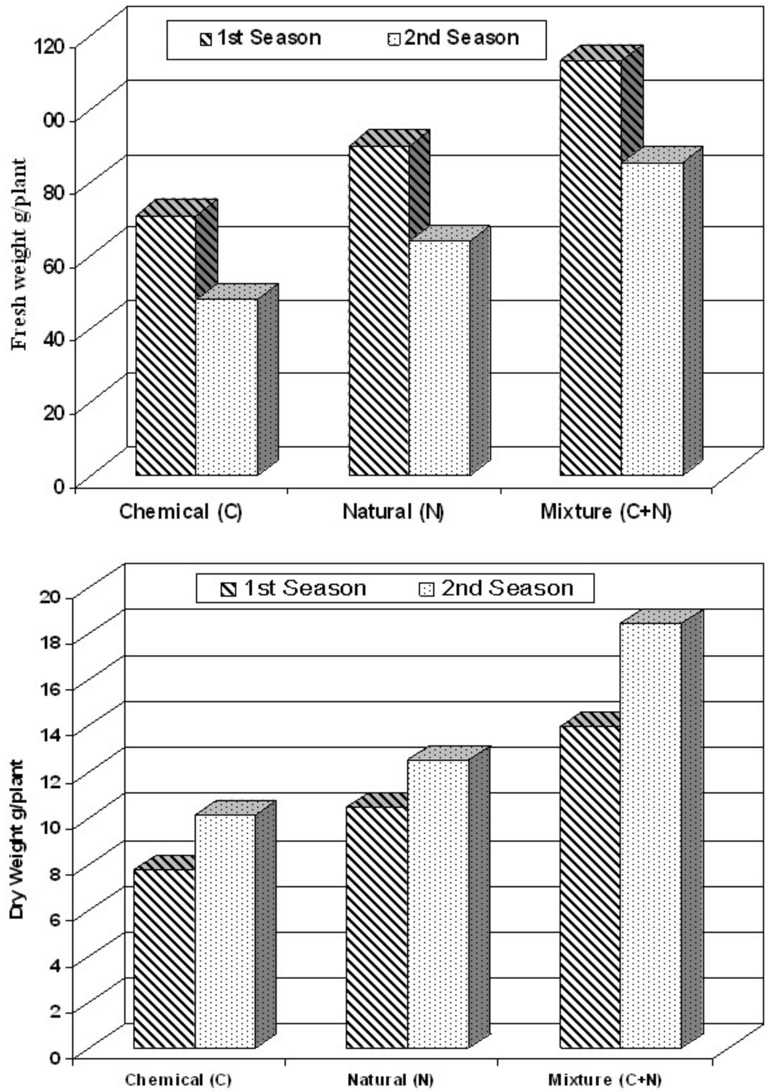


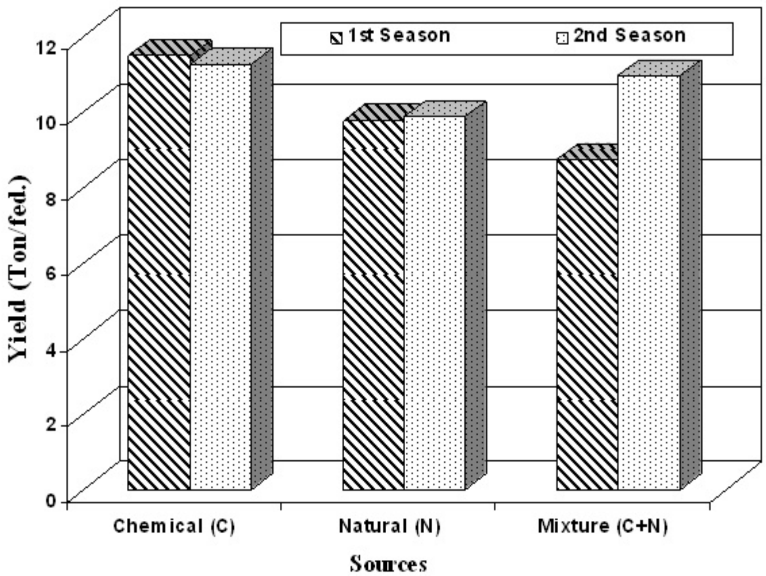
Fig. 2: Effect of using different rates of potassium fertilizers (48, 96 and 144 units/fed.) on fresh and dry weights (g/plant) of onion plant during both experimental seasons of 2003/2004 and 2004/2005.

Total Bulbs Yield and its Components: Data presented in Table (3) indicate that the heaviest tonnage of bulbs in both two seasons was recorded with onion plants which received its required potassium in the form of potassium sulphate, followed in descending order by that which received of natural form (1^{st} season) and/or mixture of chemical and natural as 1:1 (in 2^{nd} season). By other words, using potassium in the chemical form increased bulbs yield of onion by 17.75 and 31.7 % in 1^{st} season and by 14.2 and 9.3 % in 2^{nd} season over using the natural or combined mixture, respectively.

The response of onion bulb properties to the different potassium forms, fluctuated within the two experiments. Generally, the best values of bulb length, diameter and average weight obtained with potassium applied in chemical form as potassium sulphate and/or the mixed of potassium sulphate with feldspar at 1:1 ratio.

It could be concluded that, the less physical quality values of onion bulb were detected with the application of potassium in the natural form (feldspar). These were similar in the two seasons.

Increasing the application levels of K up to 144 K_2O units/fed. caused a gradual and constant enhancement in total bulbs yield (Fig. 3). Statistical analysis (Table 3) of the observed data reveals that, the differences within various K levels were enough to reach the 5 % level of significance during the two experimental seasons. It could be summarized that,



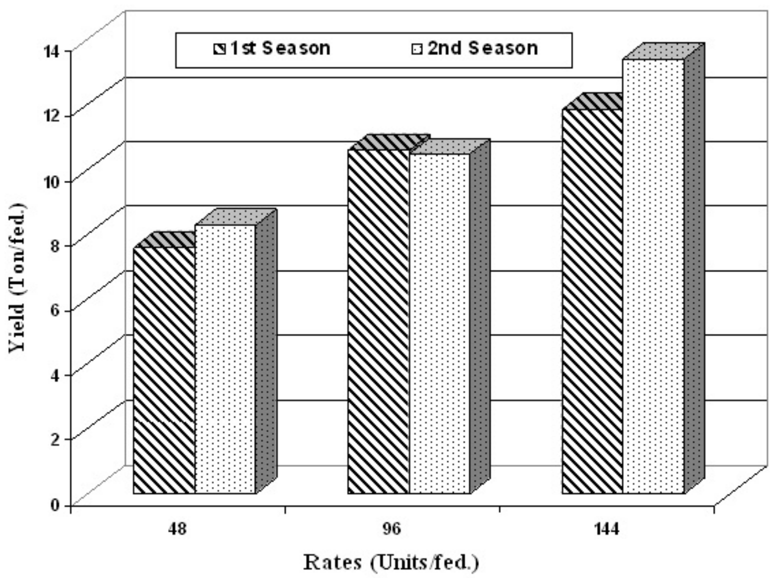


Fig. 3: Effect of using different sources (chemical, natural and mixture) and rates (48, 96 and 144 units/fed.) of potassium fertilizers on yield of onion plant during both experimental seasons of 2003/2004 and 2004/2005.

application of the highest K rate (144 K_2O units/fed.) gained the heaviest tonnage of bulbs yield, the increase in total bulbs yield was 55.8 and 62.1% over the application of the lowest K rate (48 K_2O units/fed.) in 1^{st} and 2^{nd}, respectively.

Concerning to the length, diameter and average weight of onion bulb as affected by the rates of potassium fertilizer, the presented data showed the same pattern of change similar to the response of onion bulbs yield which above mentioned during the two experiments.

The interaction treatments of potassium forms and rates significantly influenced the total onion bulbs yield and its physical properties in the two seasons 2003/2004 and 2004/2005. However, increasing the rate of potassium addition under the different sources gained an enhancement in the total bulb yield as tons/fed., as well as the physical bulb characters. Generally, the onion plant which cultivated by using potassium sulphate at the highest rate, i.e.144 K_2O units/fed., resulted the heaviest tonnage yield and the best physical quality in both experiments.

Table 3: Effect of chemical and natural potassium fertilizer at different rates on bulbs onion yield and its components during the experimental seasons of 2003/2004 and 2004/2005.

Potassium Treatments Source	K_2o units/ Fed.*	1st season: Bulb characters Length, cm.	Diameter, cm.	Average wt., gm.	Yield ton/fed.	2nd season: Bulb characters Length, cm.	Diameter, cm.	Average wt.,gm.	Yield ton/fed.
Chemical (C)	48	5.57	6.40	227.00	7.213	4.97	4.93	113.43	7.769
	96	6.97	6.83	253.23	12.727	6.57	5.40	190.20	11.701
	144	8.30	6.90	327.97	14.583	7.57	7.23	253.13	14.379
Mean		6.94	6.71	269.40	11.508	6.37	5.86	185.59	11.283
Natural (N)	48	5.97	5.13	97.30	7.462	5.47	6.13	140.13	8.527
	96	6.17	6.27	264.80	9.334	5.57	6.50	167.87	9.437
	144	7.53	7.50	329.77	12.523	7.07	6.70	202.00	11.665
		6.56	6.30	230.62	9.773	6.03	6.44	170.00	9.876
C+N (1:1)	48	6.27	6.10	156.13	8.095	5.63	6.87	158.93	8.491
	96	6.77	6.37	231.77	9.739	6.90	6.47	209.83	10.294
	144	7.57	7.30	311.03	8.380	7.17	6.83	222.77	14.155
Mean		6.87	6.59	232.96	8.738	6.57	6.72	197.18	10.980
Mean	48	5.93	5.88	160.14	7.590	5.36	5.98	137.50	8.262
	96	6.63	6.49	249.93	10.600	6.34	6.12	189.30	10.477
	144	7.80	7.23	322.92	11.829	7.27	6.92	225.97	13.400
L.S.D. at 5%	Sources	N.S.	N.S.	26.44	0.643	0.31	0.26	14.37	0.712
	Rates	0.35	0.30	29.51	0.145	0.28	0.24	10.17	0.822
	Interaction	0.61	0.52	51.11	0.251	0.48	0.42	17.62	1.423

* Fed. = 4200 m²

Table 4a: Effect of chemical and natural potassium fertilizer at different rates on some chemical properties of onion bulb tissues during the experimental seasons of 2003/2004.

A- First season

Potassium Treatments Source	K_2o units / Fed.*	T.S.S.	Protein	% N	% P	% K	ppm Fe	ppm Mn	ppm Zn	ppm Cu
Chemical (C)	48	8.27	12.44	1.99	0.216	2.53	2.69	25.47	34.03	11.34
	96	10.30	16.04	2.57	0.347	3.11	3.12	29.07	37.50	11.61
	144	10.50	19.60	3.14	0.527	3.25	2.89	30.73	43.33	12.44
Mean		9.69	10.03	2.56	0.363	2.96	2.90	28.42	38.29	11.80
Natural (N)	48	12.03	12.40	1.98	0.176	1.89	2.42	23.53	30.70	10.39
	96	11.33	16.38	2.62	0.205	2.68	2.86	25.30	33.33	12.82
	144	12.97	16.23	2.60	0.209	2.81	3.44	29.10	35.33	13.33
Mean		12.11	15.00	2.40	0.197	2.46	2.91	25.98	33.12	12.18
C+N (1:1)	48	10.67	14.40	2.30	0.217	2.25	2.70	25.33	34.43	11.75
	96	11.00	18.35	2.94	0.286	2.42	3.42	33.20	37.60	12.37
	144	12.00	16.88	2.70	0.288	3.44	2.82	32.73	40.33	12.88
Mean		10.32	16.54	2.65	0.264	2.70	2.98	30.42	37.46	12.34
Mean	48	10.32	13.08	2.09	0.203	2.23	2.60	24.78	33.06	11.16
	96	10.88	16.92	2.71	0.279	2.73	3.13	29.19	36.14	12.27
	144	11.82	17.57	2.81	0.341	3.17	3.05	30.86	3967	12.88
L.S.D. at 5%	Sources	0.78	0.71	0.11	0.085	0.27	N.S.	1.60	1.99	0.20
	Rates	0.95	1.53	0.25	0.048	0.14	0.18	1.06	1.11	0.31
	Interaction	N.S.	N.S.	N.S.	0.083	0.23	0.32	1.83	1.92	0.53

* Fed. = 4200 m²

Table 4b: Effect of chemical and natural potassium fertilizer at different rates on some chemical properties of onion bulb tissues during the experimental seasons 2004/2005.

B-Second season										
Potassium Treatments Source	K_2o units/ Fed.*	T.S.S.	Protein	% N	% P	% K	ppm Fe	ppm Mn	ppm Zn	ppm Cu
Chemical (C)	48	9.40	12.54	2.01	0.206	2.69	2.67	25.70	39.03	11.35
	96	11.00	16.73	2.68	0.380	3.32	3.09	27.80	40.30	11.82
	144	11.40	18.06	2.89	0.315	3.80	2.94	29.83	41.60	12.15
Mean		10.60	15.78	2.52	0.300	3.27	2.90	27.78	40.31	11.77
Natural (N)	48	11.67	13.56	2.17	0.193	1.72	2.67	17.10	32.77	10.59
	96	12.73	16.58	2.65	0.223	2.85	2.82	26.83	36.17	12.71
	144	13.53	15.02	2.40	0.218	2.86	3.42	29.37	39.23	13.12
Mean		12.64	15.06	2.41	0.211	2.48	2.97	24.43	36.06	12.14
C+N (1:1)	48	10.40	13.29	2.13	0.256	2.27	2.72	25.50	37.80	11.32
	96	12.00	17.98	2.88	0.242	2.38	3.31	33.97	38.50	8.98
	144	12.67	16.25	2.60	0.277	2.87	3.06	33.70	40.90	12.53
Mean		11.69	15.84	2.53	0.258	2.51	3.03	31.06	39.07	10.94
Mean	48	10.49	13.13	2.10	0.218	2.23	2.69	22.77	36.53	11.09
	96	11.91	17.10	2.74	0.282	2.85	3.07	29.53	38.32	11.17
	144	12.53	16.44	2.63	0.270	3.18	3.14	30.97	40.58	12.60
L.S.D. at 5%	Sources	1.01	N.S.	N.S.	0.059	0.16	N.S.	N.S.	0.96	N.S.
	Rates	1.00	0.86	0.14	0.052	0.12	0.13	4.89	0.93	N.S.
	Interaction	N.S.	1.49	0.24	N.S.	0.20	0.23	N.S.	1.61	N.S.

* Fed. = 4200 m²

Potassium is essential element for carbohydrate synthesis and translocation, the application of this element at adequate rate not only increases the yield, but also tends to stimulate its quality characters. In addition, it could be concluded that, the promoting effect of potassium fertilizer on the onion bulbs yield may be due to that potassium is the prevalent cation in plant and involved in maintenance of ionic balance in cells and its bounds ionically to the enzyme pyruvate kinase which is essential in respiration and carbohydrate metabolism.

The increases in onion bulbs yield in this script could be attributed to the response of all tested growth features of onion plant previously discussed, whereas, yield can be affected by all physical processes including growth and nutrient supply. Obtained results showing the superior effect of potassium fertilizer on onion yield and its some physical properties are in agreement with those reported on onion by Mohanty and Das,[23]; Sharma *et al.*,[20]; Yadav, *et al.*,[24]; Abd El-Al *et al.*,[25]; Badr,[12]; El-Bassiouny,[13]; El-Desuki *et al.*,[14] and Aisha, Ali *et al.*,[15].

Chemical Constituents: Table (4) illustrated the response of some nutritional values of onion bulb tissues to the different sources and rates of potassium application during the two successive seasons 2003/2004 and 2004/2005. It is evident that, the cultivated of onion plants with the application of chemical form of potassium gained the best values of P, K and Zn content in the two experiments as well as N content only in the 2nd experiment. However, application of K fertilizer in mixture form (1: 1) recorded the highest values of N, Fe, and Mn in the two experiments and Cu content only in 1st one. On the contrary, the application of feldspar as a natural K source caused an enhancement in values of T.S.S. (in both experiments) and Cu contents only in 2nd experiment. Generally, it could be summarized that, the best chemical quality of onion bulb tissues resulted with the application of potassium sulphate as a chemical fertilization followed by decreasing order with that plants which received their needed K as a mixture of chemical and natural form (1: 1). Moreover, the statistical analysis of the obtained data reveals that the differences within various K forms were enough to reach 5 % level of significant particularly in 1st experiment with exception of Fe content. In the second season, the nutritional values, i.e. protein, N, Fe, Mn and Cu contents recorded no significant effect by the K sources.

With increasing the rate of potassium application the nutritional values, i.e. (protein, N, P, K, Fe, Mn, Zn and Cu) of onion bulb tissues were increased to reach their peaks with that plants which supplied the highest K rate, i.e., 144 K_2O units/fed. These finding are in good accordance with the two experimental seasons with slow exception.

Also, the presented data showed that, the differences within the application of the higher two K rates, i.e., 96 and 144 K_2O units/fed., were no great enough. It might be attributed to the more K-application in soil may be changing into fixing form which no available for plant absorptions. This result was agree with those reported by Baloch *et al*.,[26]; Vachhani and Patel,[27]; Singh and Verma,[28]; Mohanty and Das,[23]; Sharma *et al*.,[20] and El-Desuki *et al*.,[14].

The interaction within the different potassium sources and rates significantly affected the nutritional values of onion bulb tissues in both experiments with exception of T.S.S. (Both experiments); protein (1st one); P, Mn and Cu (only in 2nd experiment).

Generally, in spite of the no significant effect, the best chemical quality of onion bulb as expressed by the highest values of protein, N, P, K and Zn were detected when that onion plants supplied the potassium sulphate as chemical K source at the highest rate, i.e. 144 K_2O units/fed. On the contrary, the poorest chemical quality was showed with that onion plants which applied the natural potassium (feldspar) at the lowest rate, i.e. 48 K_2O units/fed.

It is known that, the natural form of potassium such as feldspar is a slow release material over a period time. However, natural materials are broken down by soil microorganisms which are very sensitive for the environmental conditions (Fatma, Rizk *et al*.,[11] and Aisha, Ali, *et al*.,[15]).

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