



Article

Enhancing Growth and Yield of Garlic Plants by Using Potassium Silicate and Ascorbic Acid as Foliar Spray

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Abstract: Garlic cloves of Balady cultivar were sown at Fac. Tech. Develop. Farm, Zagazig Univ., Egypt during the two winter seasons of 2021/ 2022 and 2022/ 2023. This experiment was done to enhance garlic growth and its productivity as well as N, P and K percentages by utilizing different potassium silicate rates (2 and 4 ml/l) in combination with ascorbic acid at different concentrations (150 and 300 ppm) beside a control (sprayed with tap water) to obtain nine treatments. The achieved results cleared that spraying garlic plants three times per season with potassium silicate at 4 ml/l + 300 ppm of ascorbic acid gave the highest values of plant height (65.00 and 65.67 cm), number of leaves per plant (8.33 and 8.67 leaves), plant fresh weight (403.33 and 424.67 g) and leaves dry weight per plant (19.33 and 22.00 g) in the 1st and 2nd seasons, respectively. Likewise, the largest bulb diameter and more cloves number as well as NPK percentages were noticed with 300 ppm ascorbic acid combined with 4 ml/l potassium silicate compared to the other treatments under study. In general, the highest bulb yield per feddan (9.680 and 10.192 ton) was obtained with the highest rate of potassium silicate and highest concentration of ascorbic acid compared to individual or and mixture effect under study.

Key words: Garlic, height, branches, bulb diameter, cloves, yield.

1. Introduction

Garlic (*Allium sativum* L.), a member of the Alliaceae family, is one of the oldest vegetable crops currently grown worldwide. Garlic cloves, which contain allicin in the form of di allyle di sulfide, are used as a spice or condiment and for a number of therapeutic purposes. It is now essential to increase garlic output in order to meet the continuously increasing demand for both domestic and export use. (El-Hifny, 2010). Garlic is a bulb composed of several cloves that has a high nutritional value (62.8% moisture, 13g⁻¹ vitamin C, 6.3% proteins, 0.0031% iron, 0.03% calcium, 29% carbohydrates and 0.31%

phosphorus) in addition to its medicinal and therapeutic uses (Magray *et al.*, 2017). The total sole garlic cultivated area in 2022/ 2023 in Egypt was 72,000 feddan (15.903 fed. in new reclaimed land and 38.018 fed. in ancient agricultural land) which produced 563.887 tons (168,356 tons from new reclaimed land and 405,531 tons from ancient agricultural land) with average 10.408 ton/fed. (10.667 tons / feddan in new reclaimed land and 9.958 tons/ feddan in ancient agricultural land) as reported by **Statistics of the Ministry of Agriculture (2022)**.

As an antioxidant, ascorbic acid reduces the inhibitory effects of salt stress and has a stimulatory effect on some development indices (Amer *et al.*, 2018). When ascorbic acid was applied, garlic bulbs lost the least amount of weight (Shalaby and El-Ramady, 2014). In the both seasons, respectively, the combination between the rate of 3% of yeast extract and garlic plants sprayed with 200 ppm ascorbic acid increased overall yield by approximately 148.9 and 151.3 percent compared to the control treatment (Ali, 2017).

As an exchangeable ion in the soil, potassium can be actively absorbed by plants through their leaves. This crucial component for all soil types has most recently been created by the weathering of parent materials in the soil, such as potassium-aluminum silicates (Wiedenhoeft, 2006). According to Hafsi *et al.* (2014), potassium affects the rates and activity of the enzymes that make carbohydrates. Moreover, in comparison to the control, Abdel-Latif *et al.* (2019) found that foliar application of potassium silicate at 4000 ppm after 120 days of planting produced the highest garlic plant length, number of leaves, fresh, dry weight/plant, neck diameter, bulb diameter, and chlorophyll content. Potassium is essential for controlling water movement in water stress situations because it controls the absorption of nutrients and water.

This study aimed to study the effects of spraying potassium silicate and ascorbic acid on vegetative growth and yield components of *Allium sativum* grown under Sharkia Governorate conditions.

2. Materials and Methods

A field experiment in the winters of 2021–2022 and 2022–2023, garlic cloves of the Balady cultivar were planted at Fac. Tech. Develop. Farm, Zagazig Univ., Egypt. This work was done to enhance garlic growth and its productivity by utilizing various potassium silicate rates (2 and 4 ml/l) in combination with ascorbic acid at various concentrations (150 and 300 ppm) beside control which sprayed with tap water to obtain nine treatments. According to Chapman and Pratt's (1978) methodology, Table 1 displays the physical and chemical characteristics of the experimental farm soil site (average of both seasons).

Table (1). Physical and chemical properties of experimental farm soil (average of two seasons)

Physical analysis										Soil texture		
Clay (%)		Silt (%)		Fine sand (%)			Coarse sand (%)			Clay		
46.73		8.80		14.32			30.15					
Chemical analysis												
pH	Organic matter (%)	E C m.mohs/cm	Soluble cations (meq. / l)				Soluble anions (meq. / l)			Available (ppm)		
			Mg ⁺⁺	Ca ⁺⁺	K ⁺	Na ⁺	Cl ⁻	HCO ₃ ⁻	SO ₄ ⁻⁻	N	P	K
7.76	1.24	1.04	3.1	1.7	2.4	4.1	4.7	2.3	4.2	19.0	8.6	34.1

2.1. Experimental unit and fertilization

Each 9 m² experimental plot had three ridges, each measuring 4 m in length and 75 cm in width. Fertilizers high in potassium and phosphorus were applied at rates of 50 kg/feddan of potassium sulphate (50% K₂O) and 200 kg/feddan of calcium super phosphate (15.5% P₂O₅) during the soil preparation process. Meanwhile, three equal doses of ammonium sulfate (20.5% N) nitrogen fertilizer were added at a rate of 200 kg/feddan 30, 60 and 90 days after sowing.

2.2. Experimental design

The experiments were set out in a randomized complete blocks design with three replications.

2.3. Chemical source and its application

GSMAA fertilizer company in Egypt was the source of the potassium silicate a commercial compound named GSMAA Silicate LQ (27% silicon and 15% potassium). Ascorbic acid (C₆H₈O₆) source was Algomhoria Company Egypt. Foliar applications of the nine treatments were made 30, 50 and 70 days after cloves sowing. Three letters of solution were given to each experimental unit using Super Film as a spreading agent at a rate of 1 milliliter per liter. Tap water was sprayed on the untreated control plants. When necessary, all garlic plants were given regular agricultural treatments.

2.4. Data recorded

Plant growth

Plant height (cm) as well as number of leaves/plant and total plant fresh weight (g) was recorded. In addition, different parts of garlic plants were dried at 70°C to constant weight and the dry weight of leaves/plant (g) were listed.

Yield components

Bulb diameter (cm) after 90 and 120 days from planting date were determined. At proper maturity stage of bulbs (about 200 days after planting), bulbs in every plot were harvested, then trans located to a shady place in the same day for curing, number of cloves per bulb and bulb dry matter (g) were recorded then total yield (ton/ feddan) was calculated.

NPK percentages in cloves

At harvest time, five bulbs were selected at random from each treatment and oven-dried at 65°C until their weight remained constant. The NPK percentages of the bulbs were then determined utilizing the methods outlined by **Jackson (1970)**, **Olsen and Sommers (1982)** and **Bremner and Mulvaney (1982)**, respectively.

Statistical analyses

All the data were subjected to statistical analysis of variance according to the methods described by **Snedecor and Cochran (1991)**. The means between the treatments were done by Duncan multiple range test (**Duncan, 1955**) of probability with the Statistix 9 software (**Analytical software, 2008**).

3. Results and Discussion

3.1. Plant growth

Results of both seasons in Table 2 demonstrate that, utilizing potassium silicate at 4 ml/l + ascorbic acid at 300 ppm as foliar spray significantly increased garlic plant height (65.00 and 65.67 cm) as well as number of leaves per plant (8.33 and 8.67) compared to the other treatments and control

in both seasons. Moreover, increasing each potassium silicate or / and ascorbic acid concentrations gradually increased plant height and leaves number per garlic plant. Also, using the highest rate (4 ml/l) of potassium silicate combined with 300 ppm concentration of ascorbic acid gave the highest values in plant fresh weight and leaves dry weight per plant compared to control and the lowest rates in individual or combination type under study (Table 3). The increases in plant fresh weight were about 91.06 and 99.07 % for 4ml/l potassium silicate + 300 ppm ascorbic acid over untreated plants (control treatment) in the 1st and 2nd seasons, respectively.

Table (2). Impact of potassium silicate, ascorbic acid and their combinations on plant height (cm) and number of leaves /plant of garlic plant during both seasons

Treatments	Plant height (cm)		Number of leaves/plant	
	1 st season	2 nd season	1 st season	2 nd season
Control	40.33 g	40.33 g	3.33 f	2.67 e
Potassium silicate (PS) at 2ml/l	44.33 f	46.33 f	4.00 ef	3.67 de
Potassium silicate (PS) at 4ml/l	46.00 e	48.67 ef	4.67 de	4.33 cd
Ascorbic acid (AA) at 150 ppm	47.33 de	50.00 de	4.67 de	5.00 c
Ascorbic acid (AA) at 300 ppm	48.00 d	51.67 d	5.33 cd	5.00 c
PS at 2 ml/l + AA at 150 ppm	50.67 c	52.67 cd	6.00 c	6.33 b
PS at 2 ml/l + AA at 300 ppm	51.33 c	54.67 c	7.00 b	7.67 a
PS at 4 ml/l + AA at 150 ppm	60.00 b	61.67 b	7.33 b	8.00 a
PS at 4 ml/l + AA at 300 ppm	65.00 a	65.67 a	8.33 a	8.67 a

Table (3). Impact of potassium silicate, ascorbic acid and their combinations on plant fresh weight (g) and leaves dry weight /plant (g) of garlic plant during both seasons

Treatments	Plant fresh weight (g)		Leaves dry weight/plant (g)	
	1 st season	2 nd season	1 st season	2 nd season
Control	210.00 i	213.33 h	10.00 g	9.33 f
Potassium silicate (PS) at 2ml/l	238.00 h	236.67 g	11.33 f	11.67 e
Potassium silicate (PS) at 4ml/l	255.00 g	259.00 f	12.00 f	13.00 de
Ascorbic acid (AA) at 150 ppm	271.33 f	270.00 f	13.33 e	13.67 d
Ascorbic acid (AA) at 300 ppm	303.33 e	313.67 e	14.33 de	14.00 d
PS at 2 ml/l + AA at 150 ppm	330.00 d	333.33 d	15.33 d	17.00 c
PS at 2 ml/l + AA at 300 ppm	355.67 c	354.67 c	16.67 c	16.67 c
PS at 4 ml/l + AA at 150 ppm	376.00 b	396.67 b	18.00 b	19.67 b
PS at 4 ml/l + AA at 300 ppm	403.33 a	424.67 a	19.33 a	22.00 a

Ascorbic acid is an extremely abundant antioxidant that preserves cells, according to **Blokhina et al. (2003)**. Because of its effects on cell division and differentiation, ascorbic acid actually seems to be a regulator of plant development and growth. The most effective treatments for reducing onion white rot and raising plant fresh weight were potassium silicate applied at 0.4 percent as a combination treatment of dipping and soil drenching, soil drenching alone, and the combined treatment at 0.2 percent of potassium silicate (**Khalifa et al., 2017**). Foliar spraying with potassium silicate at 6.0 cm³/l produced the highest growth and total bulb production values in both seasons (**Zyada and Bardisi, 2018**). Also, after 120 days of planting, **Abdel-Latif et al. (2019)** found that foliar application of potassium silicate at 4000 ppm produced the highest garlic plant length, number of leaves and fresh and dry weight when compared to the control.

3.2. Yield components

Data listed in Table 4 indicate that utilizing any concentration of potassium silicate or/and ascorbic acid significantly improved bulb diameter after 90 and 120 from planting date in both seasons, in most cases, compared to control. The best treatment in this regard was that of 4 ml/l of potassium silicate + 300 ppm of ascorbic acid. Potassium silicate (4ml/l) + ascorbic acid (300 ppm) gave the highest means for number of cloves/bulb (60.00 and 62.00 cloves) as well as dry matter of bulb (10.00 and 10.67 g) in the 1st and 2nd seasons, respectively, compared to all other treatments under study (Table 5). Generally, cloves number per bulb significantly improved by using any potassium silicate and ascorbic acid rate in individual or combination type compared to control. Likewise, sprayed garlic plants with potassium silicate or/ and ascorbic acid significantly increased to bulb yield per feddan compared to control (Table 6) during the two consecutive seasons. The highest bulb yield per feddan (9.680 and 10.192 ton/ feddan) was obtained with potassium silicate + 300 ppm of ascorbic acid treatment, in both seasons, respectively.

Table (4). Impact of potassium silicate, ascorbic acid and their combinations on bulb diameter (cm) of garlic plant during both seasons

Treatments	Bulb diameter A (cm)		Bulb diameter B (cm)	
	1 st season	2 nd season	1 st season	2 nd season
Control	1.27 g	1.13 g	1.30 g	1.21 g
Potassium silicate (PS) at 2ml/l	1.30 fg	1.30 f	1.83 f	1.70 f
Potassium silicate (PS) at 4ml/l	1.47 ef	1.33 f	2.10 e	2.13 e
Ascorbic acid (AA) at 150 ppm	1.53 e	1.51 e	2.10 e	2.33 d
Ascorbic acid (AA) at 300 ppm	1.60 de	1.56 e	2.30 de	2.37 cd
PS at 2 ml/l + AA at 150 ppm	1.77 d	1.76 d	2.47 cd	2.53 cd
PS at 2 ml/l + AA at 300 ppm	2.00 c	2.07 c	2.60 bc	2.50 c
PS at 4 ml/l + AA at 150 ppm	2.40 b	2.50 b	2.73 ab	2.80 b
PS at 4 ml/l + AA at 300 ppm	2.77 a	2.87 a	2.92 a	3.00 a

Table (5). Impact of potassium silicate, ascorbic acid and their combinations on number of cloves /bulb and bulb dry matter of garlic plant during both seasons

Treatments	Number of cloves/bulb		Bulb dry matter (g)	
	1 st season	2 nd season	1 st season	2 nd season
Control	28.00 f	26.67 f	6.67 d	7.67 e
Potassium silicate (PS) at 2ml/l	31.67 e	36.67 e	7.00 cd	8.33 e
Potassium silicate (PS) at 4ml/l	41.00 d	44.00 d	7.00 cd	8.00 de
Ascorbic acid (AA) at 150 ppm	44.33 d	46.33 cd	7.67 cd	8.67 c-e
Ascorbic acid (AA) at 300 ppm	49.33 c	50.67 bc	8.00 bc	9.33 b-d
PS at 2 ml/l + AA at 150 ppm	49.67 c	50.33 bc	8.00 bc	9.67 a-c
PS at 2 ml/l + AA at 300 ppm	50.67 bc	50.67 bc	9.00 ab	10.33 ab
PS at 4 ml/l + AA at 150 ppm	53.33 b	53.33 b	9.33 a	10.00 ab
PS at 4 ml/l + AA at 300 ppm	61.00 a	62.00 a	10.00 a	10.67 a

Table (6). Impact of potassium silicate, ascorbic acid and their combinations on total bulb yield per feddan (kg) of garlic plant during both seasons

Treatments	Total bulb yield per feddan (kg)	
	1 st season	2 nd season
Control	5040 i	5120 h
Potassium silicate (PS) at 2ml/l	5712 h	5680 g
Potassium silicate (PS) at 4ml/l	6120 g	6216 f
Ascorbic acid (AA) at 150 ppm	6512 f	6480 f
Ascorbic acid (AA) at 300 ppm	7280 e	7528 e
PS at 2 ml/l + AA at 150 ppm	7920 d	8000 d
PS at 2 ml/l + AA at 300 ppm	8536 c	8512 c
PS at 4 ml/l + AA at 150 ppm	9024 b	9520 b
PS at 4 ml/l + AA at 300 ppm	9680 a	10192 a

It is possible to infer from the aforementioned results that the superior garlic bulb yield achieved by potassium silicate and ascorbic application is directly related to the improvement in garlic plant growth parameters, which led to increases in metabolites synthesized to fruits and, ultimately, an increase in total bulb yield. According to **Mohamed *et al.* (2019)**, the Balady cultivar was planted, and the average bulb weight, exportable, marketable, and total yield/fad., as well as the yield of grades 1, 2, 3, and 4 were all enhanced by spraying with potassium silicate (K silicate) at a rate of 2 milliliters per liter. Likewise, when potassium silicate was applied as a foliar spray four times every season, **Yousif *et al.* (2023)** pointed out that the garlic bulb yield per feddan increased.

3.3. NPK percentages

As shown in Table 7 it is clear that utilizing potassium silicate at 2 or 4 ml/l combined with ascorbic acid with 150 or 300 ppm, respectively, significantly recorded the highest percentages of nitrogen, phosphorus and potassium in both seasons compared to the treatments under study and control, in most cases. The control treatment gave the lowest values in NPK % compared to the other treatments under study in both seasons, in most cases. According to *Zyada et al. (2018)*, the maximum NPK values in leaves and bulbs throughout both seasons were obtained using a potassium silicate foliar spray at 6.0 cm³/l. Likewise, spraying potassium silicate at 6000 ppm considerably raised the percentage of K in garlic leaves (*Abdel-Latif et al., 2019*).

Table (7). Impact of potassium silicate, ascorbic acid and their combinations on N, P and K percentages of garlic plant during both seasons

Treatments	Nitrogen (%)		Phosphorus (%)		Potassium (%)	
	1 st season	2 nd season	1 st season	2 nd season	1 st season	2 nd season
Control	186.67 c	182.33 d	173.33 b	150.00 d	146.67 c	140.00 b
Potassium silicate (PS) at 2ml/l	176.67 c	179.33 d	173.33 b	160.00 d	166.67 b	153.33 b
Potassium silicate (PS) at 4ml/l	178.33 c	180.00 d	166.67 b	150.00 d	143.33 c	146.67 b
Ascorbic acid (AA) at 150 ppm	193.33 bc	200.00 b	180.00 b	180.00 c	141.33 c	153.33 b
Ascorbic acid (AA) at 300 ppm	190.00 bc	260.00 a	173.33 b	160.00 b	153.33 c	226.67 a
PS at 2 ml/l + AA at 150 ppm	256.67 a	250.00 a	240.00 a	250.00 a	220.00 a	226.67 a
PS at 2 ml/l + AA at 300 ppm	185.00 bc	262.33 a	180.00 b	262.33 a	160.00 b	240.00 a
PS at 4 ml/l + AA at 150 ppm	182.33 bc	253.67 a	170.00 b	253.67 a	154.67 b	230.00 a
PS at 4 ml/l + AA at 300 ppm	221.67 a	233.33 a	215.00 a	233.33 a	200.00 a	223.33 a

4. Conclusion

Using potassium silicate at a high rate (4 ml/l) resulted in higher garlic plant productivity. Garlic plant growth traits as well as yield and its constituents were all significantly enhanced by foliar treatment of 300 ppm ascorbic acid. Generally, as compared to the other treatments under the Sharkia Governorate conditions, a foliar spray containing 4 ml/l of potassium silicate and 300 ppm of ascorbic acid had a substantial impact on the aforementioned parameters of garlic plants.

References

- Abdel-Latif, A. A., Ibrahim, N. M. and Ismail, S. A. (2019).** Effect of foliar application of potassium silicate and some postharvest treatments on growth, productivity and storability of Garlic. Arab Universities Journal of Agricultural Sciences, 27(1): 761-773.
- Ali, M. A. M. (2017).** Effect of some bio-stimulants on growth, yield and bulb quality of garlic grown in newly reclaimed soil, new Valley-Egypt. Journal of Plant Production, 8 (12): 1285-1294.
- Amer, E. A., Abd-El Rahman, N. and Zohdy, N. O. (2018).** Effect of ascorbic and humic compounds pre-treatment on growth characteristics of some sugarcane varieties under salinity stress. Egyptian Journal of Agronomy, 40 (The 15th International Conference on Crop Science), 49-60.

- Analytical Software (2008).** Statistix Version 9, Analytical Software, Tallahassee, Florida, USA.
- Blokhina, O., Virolainen, E. and Fagerstedt, K. V. (2003).** Antioxidants, oxidative damage and oxygen deprivation stress: A review. *Annals of Botany*, 91(2): 179-194.
- Bremner, J. M. and Mulvaney, C.S. (1982).** Total nitrogen. In: Page, A.L., R.H. Miller and D.R. Keeney (Eds). *Methods of Soil Analysis. Part 2*, Ame. Soc. Agro. Madison, W.I. USA, 595-624.
- Chapman, D. H. and Pratt, R. F. (1978).** *Methods Analysis for Soil, Plant and Water*. Univ. of California Div. Agric. Sci. 16: 38.
- Duncan, B.D. (1955).** Multiple range and multiple F test. *Biometrics.*, 11:1- 42.
- El-Hifny, M.I. (2010).** Response of garlic (*Allium sativum* L.) to some sources of organic fertilizers under North Sinai conditions. *Res. J. Agric. Biol. Sci.*, 6 (6): 928-936.
- Hafsi, C., Debez, A. and Abdelly, C. (2014).** Potassium deficiency in plants: effects and signaling cascades. *Acta Physiol. Pl.*, 36: 1055-1070.
- Jackson, M.L. (1970).** *Soil Chemical Analysis* Prentice Hall. Englewood Gliffs, N.J.
- Khalifa, M. M. A., Fetian, N. A. H., Magid, M. S. A. and El-Sheery, N.I. (2017).** Effectiveness of potassium silicate in suppression white rot disease and enhancement physiological resistance of onion plants, and its role on the soil microbial community. *Middle East Journal of Agriculture Research*, 6 (2): 1-10.
- Magray, M. M., Chattoo, M. A., Narayan, S. and Mi, S. A. (2017).** Influence of sulphur and potassium applications on yield, uptake and economics of production of garlic. *International Journal of Pure & Applied Bioscience*, 5 (5): 924-934.
- Mohamed, Y. A., El-Ghamriny, M. A. and Nawar, D. A. (2019).** Effect of planting date and foliar spray with potassium silicate on growth and yield of some garlic cultivars. *Zagazig Journal of Agricultural Research*, 46(2): 295-308.
- Olsen, S.R. and Sommers, L.E. (1982).** Phosphorus. In: Page, A.L., R.H. Miller and D.R. Keeney (Eds). *Methods of Soil Analysis. Part 2*, Ame. Soc. Agro. Madison, WI, USA, 403-430.
- Shalaby, T. A. and El-Ramady, H. (2014).** Effect of foliar application of bio-stimulants on growth, yield, components, and storability of garlic (*Allium sativum* L.). *Australian Journal of Crop Science*, 8(2): 271-275.
- Snedecor, G. M. and Cochran, W. G. (1991).** *Statistical methods*, Sixth Edition Iowa State Univ. Press, Amer. Iowa, USA.
- Statistics of the Ministry of Agriculture (2022).** *Statistics of onion and garlic crops production in Egypt*.
- Wiedenhoeft, A. C. (2006).** *Plant Nutrition*. Hopkins WG (eds) The Green World, Chelsea House Publisher, New York NY. Pp,16-43.
- Yousif, R. A., Ismail, H. E. M. A., Arisha, M. H. and Abdelkader, M. A. I. (2023).** Influence of intercropping system between coriander and garlic as well as potassium fertilization source on growth and productivity of garlic plant. *Zagazig Journal of Agricultural Research*, 50(4): 451-562.
- Zyada, H. G. and Bardisi, E. A. (2018).** Effect of potassium application methods on garlic plants grown under sandy soil conditions. *Zagazig Journal of Agricultural Research*, 45(6): 1941-1951.

تحسين نمو وإنتاجية نباتات الثوم باستخدام سيليكات البوتاسيوم وحمض الأسكوربيك رشاً على الأوراق

محمد الناجي

قسم الانتاج النباتي- كلية التكنولوجيا والتنمية -جامعة الزقازيق -مصر

الملخص

زُرعت فصوص ثوم من صنف "بلدي" في مزرعة كلية التكنولوجيا والتنمية، جامعة الزقازيق، مصر، خلال موسمي الشتاء لأعوام 2022/2021 و 2023/2022. أُجريت هذه التجربة لتحسين نمو الثوم وإنتاجيته والنسب المئوية من النتروجين والفسفور والبوتاسيوم باستخدام معدلات مختلفة من سيليكات البوتاسيوم (2 و 4 مللي/لتر) وكذلك حمض الأسكوربيك بتركيزات مختلفة (150 و 300 جزء في المليون)، بجانب الكنترول (رش بماء الصنبور) للحصول على تسع معاملات. أوضحت النتائج المتحصل عليها أن رش نباتات الثوم ثلاث مرات في الموسم بسيليكات البوتاسيوم بتركيز 4 مللي/لتر + 300 جزء في المليون من حمض الأسكوربيك أعطى أعلى قيم لارتفاع النبات (65.00 و 65.67 سم) وعدد الأوراق لكل نبات (8.33 و 8.67 ورقة) والوزن الطازج للنبات (403.33 و 424.67 جم) والوزن الجاف للأوراق لكل نبات (19.33 و 22.00 جم) في الموسمين الأول والثاني، على التوالي. وكذلك، لوحظ أكبر قطر للبصل وعدد أكبر من الفصوص والنسب المئوية من النيرتوجين والفسفور والبوتاسيوم مع المعاملة بحمض الأسكوربيك بتركيز 300 جزء في المليون مع سيليكات البوتاسيوم بتركيز 4 مللي/لتر مقارنة بالمعاملات الأخرى قيد الدراسة. وبشكل عام، تم الحصول على أعلى إنتاجية من أبصال الثوم للفدان (9.680 و 10.192 طن) مع أعلى نسبة من سيليكات البوتاسيوم وأعلى تركيز من حمض الأسكوربيك مقارنة بالتأثير الفردي أو الخليط قيد الدراسة.