Journal of Plant Production

Journal homepage & Available online at: www.jpp.journals.ekb.eg

Impact of Organic Fertilization and External Potassium Silicate Application on Yield and Quality of Two Garlic Cultivars

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ABSTRACT

Enhancing the performance of garlic plants is crucial to meet the growing demand in the Egyptian market. Consequently, a field trial was conducted to assess the impact of varying levels of compost (0.0,7.0,10.0 ton fed^{-1}) and potassium silicate (0.0, 200, 300 gL^{-1}) on two prominent garlic cultivars (Balady and Chinese) in the Egyptian market. Despite differing performances between the two cultivars, all growth parameters, such as No. of leaves plant^{-1}, fresh and dry weights (g plant^{-1}), as well as quantitative and qualitative yield traits including bulb diameter (cm), neck diameter (cm), No. of cloves bulb^{-1}, bulb yield (ton ha^{-1}), dry matter (%) vitamin C (mg 100g^{-1}) and carbohydrates (%) significantly increased with higher compost levels. Similarly, improvements in these parameters were observed with increasing rates of potassium silicate. The most effective combined treatment involved the soil application of 10 tons of compost per feddan and spraying of potassium silicate at rate of 300 gL^{-1} simultaneously. Based on these findings it can be concluded that incorporating compost and potassium silicate into fertilizer management practices is beneficial to enhance soil fertility and improve garlic plant performance. The recommended application rates of 10 tons of compost per feddan and 300 gL^{-1} of potassium silicate can serve as a guideline for achieving optimal results. Overall, by implementing these recommendations and building upon the findings of this study, garlic producers in Egypt can improve their agricultural practices, meet the increasing market demand, and contribute to the sustainable growth of the garlic industry.

***Keywords**:* Compost, Potassium silicate, Balady, Chinese, Garlic

INTRODUCTION

Garlic (*Allium sativum*) holds profound importance across multiple domains due to its rich nutritional, medicinal, and economic value. Nutritionally, garlic is a powerhouse, boasting significant levels of essential nutrients such as vitamins C and B_6, manganese, and selenium, alongside antioxidants like allicin, which contribute to overall health and immune function (Ahmed *et al.*, 2010). Medically, garlic has been revered for its therapeutic properties for centuries, with research supporting its role in lowering blood pressure, reducing cholesterol levels, and combating microbial infections due to its antimicrobial and anti-inflammatory properties (Ali, 2017). Economically, garlic serves as a lucrative crop, contributing substantially to agricultural economies worldwide through its high demand in culinary and pharmaceutical industries, further bolstered by its versatility and long shelf life. Thus, garlic stands as a multifaceted crop with immense nutritional, medical, and economic significance, playing a pivotal role in human health and well-being while driving economic growth globally (Awad-Allah *et al.*, 2020).

Enhancing the performance of garlic plants is imperative to meet the escalating demand in the Egyptian market while ensuring optimal productivity and quality. Garlic holds significant importance in Egyptian cuisine and culture, thus, its consistent availability at high standards is crucial for both consumers and producers (Hamam *et al.*, 2021). Firstly, elevating garlic plant performance directly contributes to meeting the rising demand, ensuring a stable and sufficient supply to meet consumer needs. As the population grows and dietary preferences evolve, there is a heightened reliance on garlic as a culinary staple, making it essential to enhance its production capabilities. Moreover, maximizing the productivity of garlic plants not only addresses current market demands but also prepares for potential future growth. By implementing strategies to improve yield per feddan, farmers can effectively scale their operations to match the market's expanding requirements, thereby maintaining a balance between supply and demand (Ibraheim, 2022). Furthermore, emphasizing the quality of garlic produced is vital for maintaining consumer satisfaction and loyalty. With increased awareness of health and nutrition, consumers are not only seeking quantity but also quality in their food choices. High-quality garlic, rich in flavor and nutritional value, not only meets consumer expectations but also enhances the reputation of Egyptian garlic in both domestic and international markets. Additionally, enhancing garlic plant performance aligns with sustainable agricultural practices, promoting environmental conservation and long-term agricultural viability (Mohamed *et al.*, 2023).

By adopting organic fertilization methods and innovative techniques such as potassium silicate application, farmers can improve soil health, reduce reliance on chemical inputs, and mitigate environmental impact, ensuring the sustainability of garlic production for future generations

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DOI: 10.21608/jpp.2024.289212.1341

(Patle *et al*., 2021; El-Shal and Ahmed 2021; Abd El-Hady *et al.*, 2021; Abd ELhamied *et al.*, 2024).

Organic fertilization offers a promising avenue for sustainable agriculture (Doklega *et al.*, 2017; Abd ELhamied *et al.*, 2024), presenting numerous benefits for soil health, crop productivity, and environmental conservation (Sharma *et al.*, 2021). Unlike synthetic fertilizers, organic fertilizers, derived from natural sources such as compost, manure, and plant residues, nourish the soil with essential nutrients while fostering microbial activity and improving soil structure (Al-Obeidi and Al-Obeidi, 2023). This leads to enhanced nutrient availability, water retention, and overall soil fertility, promoting healthier plant growth and resilience to stressors such as drought and disease (Kumawat *et al.*, 2023).

Potassium silicate, often referred to as potassium metasilicate or soluble potash silicate, is a compound derived from potassium and silica (Yousif *et al.*, 2023). It plays a crucial role in agriculture as a source of both potassium and silicon, two essential nutrients for plant growth and development (Gad *et al.,* 2023). Potassium is vital for various physiological processes in plants, including enzyme activation, osmotic regulation, and stress tolerance, while silicon contributes to enhanced plant resilience against biotic and abiotic stresses (Youssef, 2023).

Therefore, the major aim of this study was to assess the impact of varying levels of compost and potassium silicate on the growth, yield, and quality of two prominent garlic cultivars in the Egyptian market.

MATERIALS AND METHODS

A field trial was conducted to assess the impact of varying levels of compost (0.0,7.0,10.0 ton fed^{-1}) as main factor and spraying potassium silicate (0.0, 200, 300 gL^{-1}) as sub main factor on two prominent garlic cultivars (Balady and Chinese) in the Egyptian market. The experimental design was split plot with three replicates.

Experimental site

During the agricultural seasons of 2022/23 and 2023/24, the trial was implemented at a private farm located in Met Antar village, Talkha district, El-Dakahlia Governorate, Egypt**.**

Soil sampling

Soil samples collected from a depth of 0-30 cm before sowing in both seasons under investigation were routinely analyzed following the methods outlined by Dane and Topp, (2020) and Sparks *et al.,* (2020). During the first season (2022/23) and the second season (2023/24), the initial soil characteristics were analyzed. The particle size distribution was measured, showing variations in sand, silt and clay content. In the first season, the percentage of sand was recorded at 22.0 %, while in the second season; it increased slightly to 22.2%. In the first season, the percentage of silt was recorded at 28.0 %, while in the second season; it decreased slightly to 27.8%, while clay content was 50% during both seasons. The textural class of the soil was predominantly clay in both seasons. Other soil characteristics were also evaluated. Electrical conductivity (EC, dSm-1) was measured, showing values of 2.4 and 2.7 for the first and second seasons, respectively. Soil pH levels were recorded at 8.0 and 8.05 for the first and second seasons, respectively. The percentage of calcium carbonate (CaCO3) in the soil was also determined, with values of 2.15% and 2.13% for the first and second seasons, respectively. Furthermore, organic matter content, field capacity, and saturation percentage were examined. Organic matter content increased from 1.2% in the first season to 1.33% in the second season. Field capacity, representing the soil's ability to retain water, showed a slight increase from 34.60% to 35.00% between the two seasons. Similarly, saturation percentage increased from 69.20% to 70.00% over the same period. Additionally, the availability of macronutrients and boron in the soil was assessed. Nitrogen content (mgKg-1) increased from 32.09 to 35.05 between the first and second seasons. Phosphorus content also showed a slight increase from 9.00 mgKg-1 to 10.00 mgKg-1 over the same period. Potassium content (mgKg-1) rose from 216.3 to 225.0 between the two seasons.

Compost

Compost was prepared in the field from plant residues, as it exhibited the following characteristics: phosphorus (P) content at 0.82 mg/kg, zinc (Zn) at 28.0 mg/kg, manganese (Mn) at 23.0 mg/kg, potassium (K) at 0.95 mg/kg, with a carbon-to-nitrogen (C:N) ratio of 12.0. Additionally, it contained 18% total carbon (C) and 1.50% total nitrogen (N). The pH of the compost measured at 6.3, with an electrical conductivity (EC) of 3.2 dSm-1 and an organic matter (OM) content of 31%.

Potassium silicate

The potassium silicate utilized in this study, comprising 12.0% K_2O and 25% SiO_2, was sourced from Atanor for Fertilizer Manufacture, Egypt. Subsequently, solutions at various studied rates were prepared.

Cultivation

The experimental plot covered an area of 86.4 m^2. Garlic cloves of cultivars Balady and Chinese were sourced from the Ministry of Agriculture and Soil Reclamation (MASR). The cloves were separated and soaked in running water for 18 hours before planting. Prior to sowing, the experiment area were pre-irrigated one day in advance. Planting took place on October 15th in both seasons, with cloves manually placed on one side of the ridges at 10 cm intervals. Compost application according to the designated treatments was carried out a month before sowing. Traditional agricultural practices, including fertilization, irrigation, and weed control, followed MASR guidelines. Forty-five days after sowing, potassium silicate was externally applied at the studied rates, repeated five times at two-week intervals. Harvesting occurred when bulbs reached maturity on April 15th in both seasons, approximately 180 days after sowing.

Measurements

At a period of 100 days from sowing

Plant height (cm), No. of leaves plant^{-1}, fresh and dry weight (g plant^{-1}) were measured. Nitrogen, phosphorus and potassium (%) in leaves were analyzed as outlined by Walinga *et al.*, (2013). Chlorophyll content was assessed by chlorophyll meter (SPAD-502), while carotene pigment (mg g^{-1}) was determined by the spectrophotometer according to the method described by Dere *et al.*, (1998).

At a period of 180 days from sowing (maturity stage)

Physical traits and yield of garlic including average bulb weight (g), bulb diameter (cm), neck diameter (cm), bulbing ratio (BR), No. of cloves bulb^{-1}, bulb and marketable yields (ton ha^{-1}) were measured at harvest time. BR was measured as the following formula as mentioned by Mann, (1952);

$$BR = \frac{\text{Neck diameter (cm)}}{\text{Bulb diameter (cm)}}$$

Dry matter (DM, %), vitamin C (mg $100g^{-1}$), carbohydrates (%), total dissolved solid (TDS, %) were determined according to AOAC, (2000). Pungency (purvate content,µmol.ml^{-1}) was determined according to Anthon and Barrett, (2003).

Statistical analysis

The collected data were subjected to analysis of variance following the methodology described by Gomez and Gomez, (1984) using the CoStat computer software package (Version 6.303, CoHort, USA, 1998–2004).

RESULTS AND DISCUSSION

Plant growth parameters, leaves photosynthetic pigments and leaves chemical constituents at a period of 100 days from sowing

Table 1 shows the effect of compost and potassium silicate on growth parameters of garlic (Cv. Balady). It's evident that the application of compost, especially at higher rates (10 ton fed^{-1}), significantly increased plant height (cm) compared to the control. Similarly, potassium silicate treatments also led to an increase in plant height, with the highest concentration (300 gL^{-1}) showing the most substantial effect. Also, compost and potassium silicate treatments resulted in a significant increase in the No. of leaves $plant^{-1}$ compared to the control. Again, higher rates of compost and higher concentrations of potassium silicate led to more pronounced effects. Similar trends were observed for fresh and dry weight (g $plant^{-1}$), with compost and potassium silicate treatments significantly enhancing these parameters compared to the control. Generally, The most effective combined treatment involved the soil application of 10 tons of compost per feddan and spraying of potassium silicate at rate of 300 gL^{-1} simultaneously. The observed increases in plant height (cm), No. of leaves $plant^{-1}$ and fresh, dry weight (g $plant^{-1}$) with compost and potassium silicate treatments can be attributed to their positive effects on soil fertility and nutrient availability. Compost application enriches the soil with organic matter and essential nutrients, promoting better plant growth (Sharma *et al.*, 2021). Additionally, potassium silicate is known to enhance plant tolerance to various stresses, including nutrient deficiencies, thus leading to improved growth parameters. Potassium silicate plays a pivotal role in influencing the growth of garlic plants by enhancing structural integrity and stress tolerance (Yousif *et al.*, 2023). It serves as a soluble silicon source, which contributes to the formation of robust cell walls, thereby fortifying plant tissues and providing structural support. This reinforcement promotes upright growth and overall plant vigor (Gad *et al.*, 2023). Furthermore, the strengthened cell walls act as a physical barrier against pathogens and pests, reducing susceptibility to biotic stresses and minimizing yield losses due to disease or pest infestations. Additionally, potassium silicate supplementation stimulates the expression of stress-responsive genes and activates defense mechanisms, enhancing the plant's ability to withstand environmental stressors such as drought, salinity, and temperature extremes. By bolstering growth and resilience, potassium silicate plays a crucial role in maximizing the productive potential of garlic crops, ensuring optimal performance and yield under challenging growing conditions (Youssef, 2023).

Table 1. Effect of compost and potassium silicate on growth parameters of garlic (Cv. Balady) at 100 days after sowing during the season of 2022/23 and 2023/24

Treatments		Plant height, cm		No. of leaves $plant^{-1}$		Fresh weight, g $plant^{-1}$		Dry weight, g $plant^{-1}$	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)									
Without compost (control)		74.92c	78.47b	4.33b	4.89b	72.08c	73.54c	15.75c	16.06c
With compost (7 ton fed^{-1})		80.83b	83.62a	5.00b	5.67b	75.81b	76.26b	16.18b	16.49b
With compost (10 ton fed^{-1})		82.20a	86.29a	6.22a	7.00a	76.57a	77.79a	16.42a	16.79a
LSD at 5%		0.95	2.74	1.05	1.25	0.24	0.25	0.19	0.18
Sub main factor: Potassium silicate treatments (foliar application)									
Without potassium silicate (control)		78.55b	81.84a	4.78b	5.56a	74.51b	75.35c	15.92b	16.23b
With potassium silicate (200gL^{-1})		79.44ab	82.55a	5.22ab	5.89a	74.80b	75.79b	16.15ab	16.49a
With potassium silicate (300gL^{-1})		79.96a	83.98a	5.56a	6.11a	75.15a	76.45a	16.28a	16.62a
LSD at 5%		0.12	*NS	0.67	*NS	0.34	0.37	0.26	0.21
Interaction									
Without compost (control)	Control	73.42	76.98	4.00	4.67	71.79	72.96	15.35	15.64
	Potassium silicate (200gL^{-1})	75.09	78.39	4.33	5.00	72.06	73.19	15.86	16.21
	Potassium silicate (300gL^{-1})	76.26	80.03	4.67	5.00	72.39	74.47	16.05	16.31
With compost (7 ton fed^{-1})	Control	80.32	83.26	4.67	5.33	75.50	75.87	16.12	16.41
	Potassium silicate (200gL^{-1})	80.94	83.17	5.00	5.67	75.76	76.20	16.14	16.47
	Potassium silicate (300gL^{-1})	81.23	84.41	5.33	6.00	76.17	76.70	16.28	16.60
With compost (10 ton fed^{-1})	Control	81.89	85.29	5.67	6.67	76.23	77.23	16.30	16.64
	Potassium silicate (200gL^{-1})	82.31	86.09	6.33	7.00	76.57	77.97	16.44	16.79
	Potassium silicate (300gL^{-1})	82.39	87.50	6.67	7.33	76.90	78.16	16.52	16.94
LSD at 5%		2.18	5.87	1.16	1.30	0.58	0.64	0.44	0.36

Means within a row followed by a different letter (s) are statistically different at a 0.05 level
***NS=Non-significant**

Table 2 illustrate the effect of compost and potassium silicate on growth parameters of garlic (Cv. Chinese). Similar trends were observed for garlic Cv. Chinese regarding plant height (cm), No. of leaves $plant^{-1}$ and fresh, dry weight per plant with compost and potassium silicate treatments. The findings for Cv. Chinese are consistent with those for Cv. Balady, indicating that the effects of compost and potassium silicate on garlic growth parameters are consistent across different cultivars.

Table 2. Effect of compost and potassium silicate on growth parameters of garlic (Cv. Chinese) at 100 days after sowing during the season of 2022/23 and 2023/24

Treatments		Plant height, cm		No. of leaves plant^{-1}		Fresh weight, g plant^{-1}		Dry weight, g plant^{-1}	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)									
Without compost (control)		63.02c	65.71c	8.67b	9.00b	78.78c	81.56c	17.30c	17.51c
With compost (7 ton fed^{-1})		64.68b	67.13b	9.78ab	10.22ab	84.81b	85.65b	18.54b	18.75b
With compost (10 ton fed^{-1})		66.36a	68.37a	11.00a	11.33a	85.80a	88.34a	19.22a	19.47a
LSD at 5%		0.21	0.22	1.94	1.50	0.28	0.33	0.19	0.19
Sub main factor: Potassium silicate treatments (foliar application)									
Without potassium silicate (control)		64.31b	66.67b	9.44b	9.78a	82.85b	84.38c	18.12b	18.34b
With potassium silicate (200gL^{-1})		64.53b	66.88b	9.78ab	10.22a	83.06b	84.86b	18.40ab	18.66a
With potassium silicate (300gL^{-1})		65.22a	67.66a	10.22a	10.56a	83.49a	86.31a	18.55a	18.72a
LSD at 5%		0.31	0.33	0.72	*NS	0.40	0.39	0.31	0.20
Interaction									
Without compost (control)	Control	62.67	65.24	8.33	8.67	78.50	81.02	17.18	17.39
	Potassium silicate (200gL^{-1})	62.82	65.59	8.67	9.00	78.67	81.14	17.28	17.56
	Potassium silicate (300gL^{-1})	63.58	66.31	9.00	9.33	79.18	82.51	17.45	17.59
With compost (7 ton fed^{-1})	Control	64.06	66.79	9.33	9.67	84.60	84.06	18.33	18.52
	Potassium silicate (200gL^{-1})	64.39	67.01	9.67	10.33	84.73	85.11	18.60	18.85
	Potassium silicate (300gL^{-1})	65.58	67.60	10.33	10.67	85.10	87.80	18.70	18.86
With compost (10 ton fed^{-1})	Control	66.22	68.00	10.67	11.00	85.45	88.06	18.85	19.10
	Potassium silicate (200gL^{-1})	66.39	68.05	11.00	11.33	85.78	88.35	19.32	19.58
	Potassium silicate (300gL^{-1})	66.49	69.08	11.33	11.67	86.18	88.63	19.49	19.72
LSD at 5%		0.55	0.57	1.23	1.76	0.70	0.67	0.54	0.34

Means within a row followed by a different letter (s) are statistically different at a 0.05 level
***NS=Non-significant**

Table 3 indicates the effect of compost and potassium silicate on photosynthetic pigments and chemical constituents in leaves of garlic (Cv. Balady). Compost application, especially at higher rates, and potassium silicate (especially at a rate of 300g L^{-1}) treatments resulted in increased chlorophyll content in garlic leaves compared to the control. Similar to chlorophyll, compost and potassium silicate treatments led to higher carotene content in garlic leaves. Compost application and potassium silicate treatments positively influenced the nitrogen, phosphorus and potassium content in garlic leaves.

Table 3. Effect of compost and potassium silicate on photosynthetic pigments and chemical constitutes in leaves of garlic (Cv. Balady) at 100 days after sowing during the season of 2022/23 and 2023/24

Treatments		Chlorophyll, SPAD		Carotene, mg g^{-1}		N, %		P, %		K, %	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)											
Without compost (control)		40.58c	42.60c	0.417c	0.435c	3.70b	3.14c	0.317c	0.330c	2.44c	2.52c
With compost (7 ton fed^{-1})		41.55b	43.51b	0.447b	0.467b	3.78b	3.42b	0.330b	0.344b	2.69b	2.77b
With compost (10 ton fed^{-1})		42.68a	43.90a	0.464a	0.483a	3.70a	3.73a	0.347a	0.361a	2.81a	2.91a
LSD at 5%		0.04	0.04	0.013	0.006	0.05	0.01	0.009	0.003	0.09	0.01
Sub main factor: Potassium silicate treatments (foliar application)											
Without potassium silicate (control)		41.34c	43.09b	0.435b	0.453b	3.68b	3.36b	0.326c	0.339c	2.58b	2.66b
With potassium silicate (200gL^{-1})		41.60b	43.40a	0.445a	0.464a	3.74a	3.44a	0.331b	0.345b	2.66ab	2.75a
With potassium silicate (300gL^{-1})		41.86a	43.52a	0.449a	0.468a	3.75a	3.49a	0.337a	0.351a	2.69a	2.78a
LSD at 5%		0.20	0.21	0.004	0.006	0.05	0.05	0.003	0.005	0.09	0.04
Interaction											
Without compost (control)	Control	40.19	42.27	0.407	0.424	3.65	3.09	0.314	0.326	2.34	2.41
	Potassium silicate (200gL^{-1})	40.65	42.68	0.422	0.441	3.72	3.15	0.316	0.329	2.48	2.56
	Potassium silicate (300gL^{-1})	40.88	42.84	0.424	0.442	3.73	3.18	0.320	0.335	2.50	2.59
With compost (7 ton fed^{-1})	Control	41.26	43.21	0.441	0.460	3.76	3.32	0.324	0.338	2.65	2.73
	Potassium silicate (200gL^{-1})	41.46	43.63	0.448	0.466	3.78	3.44	0.331	0.344	2.69	2.77
	Potassium silicate (300gL^{-1})	41.92	43.70	0.453	0.474	3.80	3.52	0.337	0.350	2.72	2.80
With compost (10 ton fed^{-1})	Control	42.56	43.79	0.458	0.477	3.64	3.67	0.340	0.353	2.76	2.85
	Potassium silicate (200gL^{-1})	42.68	43.88	0.465	0.484	3.72	3.75	0.347	0.361	2.83	2.93
	Potassium silicate (300gL^{-1})	42.79	44.03	0.471	0.489	3.73	3.78	0.355	0.370	2.86	2.94
LSD at 5%		0.35	0.36	0.007	0.010	0.09	0.10	0.005	0.008	0.15	0.07

Means within a row followed by a different letter (s) are statistically different at a 0.05 level

From the same Table, it can be noticed that the superior combined treatment was the addition of compost at a rate of 10 ton fed^{-1} in conjunction with spraying potassium silicate at a rate of 300g L^{-1}. The observed increases in photosynthetic pigments and chemical constituents in garlic leaves can be attributed to the improved nutrient availability and uptake facilitated by compost and potassium silicate treatments. These nutrients are essential for various physiological processes in plants, including photosynthesis, thus leading to enhanced pigment synthesis and overall plant health (Al-Obeidi and Al-Obeidi, 2023; Kumawat *et al*., 2023).

Table 4 shows the effect of compost and potassium silicate on photosynthetic pigments and chemical constituents in leaves of garlic (Cv. Chinese). Similar trends were observed for Cv. Chinese regarding photosynthetic pigments and chemical constituents in garlic leaves with compost and potassium silicate treatments. Also, it can be noticed that the superior combined treatment was the addition of compost at a rate of 10 ton fed^{-1} in conjunction with spraying potassium silicate at a rate of 300g L^{-1}.Consistent with the findings for Cv. Balady, compost and potassium silicate treatments positively influenced the photosynthetic pigments and chemical constituents in leaves of Cv. Chinese, indicating the robustness of these treatments across different garlic cultivars.

Table 4. Effect of compost and potassium silicate on photosynthetic pigments and chemical constitutes in leaves of garlic (Cv. Chinese) at 100 days after sowing during the season of 2022/23 and 2023/24

Treatments		Chlorophyll, SPAD		Carotene, mg g^{-1}		N, %		P, %		K, %	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)											
Without compost (control)		40.00b	40.74c	0.349c	0.362c	2.78c	2.92c	0.265c	0.277c	2.08c	2.15c
With compost (7 ton fed^{-1})		40.97a	41.81b	0.369b	0.385b	2.99b	3.13b	0.281b	0.293b	2.20b	2.27b
With compost (10 ton fed^{-1})		41.32a	42.31a	0.386a	0.402a	3.07a	3.23a	0.291a	0.302a	2.34a	2.41a
LSD at 5%		0.48	0.41	0.011	0.005	0.01	0.08	0.003	0.002	0.01	0.02
Sub main factor: Potassium silicate treatments (foliar application)											
Without potassium silicate (control)		40.46a	41.31b	0.361c	0.375c	2.91b	3.05b	0.274c	0.286b	2.17b	2.24c
With potassium silicate ($200gL^{-1}$)		40.78a	41.64ab	0.368b	0.382b	2.95ab	3.10a	0.280b	0.292a	2.21a	2.28b
With potassium silicate ($300gL^{-1}$)		41.05a	41.91a	0.376a	0.392a	2.99a	3.14a	0.283a	0.295a	2.24a	2.32a
LSD at 5%		*NS	0.45	0.004	0.004	0.05	0.04	0.003	0.005	0.04	0.03
Interaction											
Without compost (control)	Control	39.44	40.22	0.342	0.355	2.72	2.86	0.262	0.274	2.04	2.10
	Potassium silicate ($200gL^{-1}$)	40.05	40.85	0.346	0.359	2.80	2.94	0.264	0.275	2.09	2.15
	Potassium silicate ($300gL^{-1}$)	40.52	41.14	0.358	0.373	2.83	2.97	0.271	0.282	2.12	2.19
With compost (7 ton fed^{-1})	Control	40.75	41.59	0.361	0.375	2.95	3.09	0.275	0.286	2.18	2.26
	Potassium silicate ($200gL^{-1}$)	40.91	41.77	0.371	0.386	2.98	3.13	0.284	0.297	2.20	2.26
	Potassium silicate ($300gL^{-1}$)	41.24	42.07	0.376	0.393	3.03	3.18	0.285	0.297	2.23	2.30
With compost (10 ton fed^{-1})	Control	41.19	42.13	0.380	0.396	3.05	3.19	0.287	0.298	2.29	2.37
	Potassium silicate ($200gL^{-1}$)	41.37	42.29	0.387	0.403	3.07	3.23	0.291	0.304	2.35	2.42
	Potassium silicate ($300gL^{-1}$)	41.41	42.52	0.393	0.409	3.11	3.27	0.294	0.306	2.38	2.46
LSD at 5%		1.19	0.78	0.006	0.006	0.08	0.07	0.006	0.008	0.06	0.05

Means within a row followed by a different letter (s) are statistically different at a 0.05 level

Garlic yield and its quality at maturity stage

Data of Tables 5 and 7 show the effect of compost and potassium silicate on bulb physical traits and yield of garlic (Cv. Balady), including average bulb, weight (g), bulb diameter (cm), neck diameter(cm), bulbing ratio, No. of cloves $bulb^{-1}$, bulb and marketable yields (ton ha^{-1}) at maturity stage during the season of 2022/23 and 2023/24, while Tables 6 and 8 show the studied treatments on the same traits of garlic (Cv. Chinese). On the other hand, Tables 9 and 10 indicate the effect of the studied treatments on bulb quality parameters of Balady and Chinese varaiets, respectively, including dry matter (DM, %),vitamin C (mg $100g^{-1}$), carbohydrates (%), total dissolved solid (TDS, %) and pungency (purvate content,πmol.ml^{-1}). Despite differing performances between the two cultivars, the most of aformantioned traits significantly increased with higher compost levels. Similarly, improvements in these parameters were observed with increasing rates of potassium silicate. The most effective combined treatment involved the soil application of 10 tons of compost per feddan and spraying of potassium silicate at rate of 300 gL^{-1} simultaneously.

The increase in bulb weight, diameter, bulbing ratio, and number of cloves per bulb with compost application suggests that organic fertilization positively impacts the physical traits of garlic bulbs. This can be attributed to the nutrient-rich composition of compost, providing essential elements for bulb development, such as nitrogen, phosphorus, and potassium. Additionally, compost improves soil structure, water retention, and microbial activity, promoting better nutrient uptake and utilization by the garlic plants. Similar trends in both cultivars indicate the robustness of compost application across different garlic cultivars. The increase in bulb size and other physical traits with compost application reaffirms its role in enhancing garlic growth and development. Varietal differences may account for slight variations in response to compost, highlighting the importance of considering cultivar-specific requirements in agricultural practices.

The significant increase in bulb yield with compost application, particularly at higher rates, underscores the importance of organic fertilization in maximizing garlic productivity. Compost not only provides essential nutrients but also improves soil health and fertility, resulting in increased bulb formation and size. The positive impact of potassium silicate treatments further enhances yield, possibly through improved nutrient uptake, stress resistance, and overall plant vigor. Consistent with the Balady cultivar, the Chinese cultivar also exhibits substantial yield improvements with compost and potassium silicate treatments. The synergistic effects of these treatments on yield highlight their potential for enhancing garlic production and addressing yield-limiting factors such as nutrient deficiencies and environmental stresses.

Table 5. Effect of compost and potassium silicate on bulb physical traits of garlic (Cv. Balady) at maturity stage during the season of 2022/23 and 2023/24

Treatments		Average bulb weight, g		Bulb diameter, cm		Neck diameter, cm		Bulbing ratio		No. of cloves bulb^{-1}	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)											
Without compost (control)		38.25c	39.24c	3.08c	2.75c	0.67c	0.71c	0.219b	0.257a	23.33c	24.11c
With compost (7 ton fed^{-1})		39.58b	41.87b	3.29b	3.04b	0.76b	0.80b	0.231a	0.261a	24.56b	25.67b
With compost (10 ton fed^{-1})		42.74a	44.79a	3.41a	3.42a	0.80a	0.85a	0.236a	0.248b	26.22a	26.78a
LSD at 5%		0.85	0.50	0.06	0.04	0.02	0.03	0.008	0.007	0.67	0.25
Sub main factor: Potassium silicate treatments (foliar application)											
Without potassium silicate (control)		39.57c	41.31b	3.21b	2.93c	0.72b	0.76b	0.224a	0.261b	24.22b	25.11a
With potassium silicate (200gL^{-1})		40.20b	42.04a	3.24b	3.07b	0.75ab	0.79ab	0.230a	0.258a	24.67ab	25.44a
With potassium silicate (300gL^{-1})		40.80a	42.55a	3.33a	3.22a	0.76a	0.80a	0.231a	0.248a	25.22a	26.00a
LSD at 5%		0.50	0.67	0.04	0.04	0.03	0.03	*NS	0.010	0.78	*NS
Interaction											
Without compost (control)	Control	37.79	39.14	3.03	2.57	0.63	0.66	0.210	0.257	23.00	23.67
	Potassium silicate (200gL^{-1})	38.12	39.20	3.08	2.80	0.69	0.73	0.220	0.260	23.33	24.00
	Potassium silicate (300gL^{-1})	38.84	39.38	3.15	2.88	0.71	0.74	0.227	0.257	23.67	24.67
With compost (7 ton fed^{-1})	Control	38.99	40.33	3.25	2.99	0.75	0.79	0.230	0.263	24.00	25.33
	Potassium silicate (200gL^{-1})	39.82	42.06	3.26	3.03	0.76	0.80	0.233	0.263	24.33	25.67
	Potassium silicate (300gL^{-1})	39.93	43.21	3.35	3.12	0.76	0.80	0.230	0.257	25.33	26.00
With compost (10 ton fed^{-1})	Control	41.94	44.46	3.37	3.22	0.79	0.84	0.233	0.263	25.67	26.33
	Potassium silicate (200gL^{-1})	42.65	44.85	3.40	3.39	0.80	0.84	0.237	0.250	26.33	26.67
	Potassium silicate (300gL^{-1})	43.62	45.06	3.48	3.66	0.82	0.86	0.237	0.230	26.67	27.33
LSD at 5%		0.86	1.15	0.06	0.07	0.05	0.06	0.010	*NS	1.34	1.64

Means within a row followed by a different letter (s) are statistically different at a 0.05 level

Table 6. Effect of compost and potassium silicate on bulb physical traits of garlic (Cv. Chinese) at maturity stage during the season of 2022/23 and 2023/24

Treatments		Average bulb weight, g		Bulb diameter, cm		Neck diameter, cm		Bulbing ratio		No. of cloves bulb^{-1}	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)											
Without compost (control)		43.33c	44.82c	3.47c	3.76c	1.04c	1.05c	0.303a	0.280a	11.67b	12.33b
With compost (7 ton fed^{-1})		45.64b	46.79b	4.04b	4.29b	1.15b	1.17b	0.284b	0.273a	12.78ab	13.33ab
With compost (10 ton fed^{-1})		47.16a	49.15a	4.37a	4.55a	1.24a	1.28a	0.281b	0.280a	13.89a	14.33a
LSD at 5%		0.20	0.62	0.01	0.06	0.02	0.04	0.004	*NS	1.15	1.02
Sub main factor: Potassium silicate treatments (foliar application)											
Without potassium silicate (control)		44.81b	45.99b	3.80c	4.06c	1.11c	1.13b	0.293a	0.278a	12.44b	13.00a
With potassium silicate (200gL^{-1})		45.37ab	47.22a	3.97b	4.21b	1.15b	1.16b	0.290ab	0.277a	12.78ab	13.33a
With potassium silicate (300gL^{-1})		45.95a	47.55a	4.12a	4.33a	1.18a	1.21a	0.286b	0.279a	13.11a	13.67a
LSD at 5%		0.65	0.64	0.06	0.06	0.02	0.03	0.005	*NS	0.66	*NS
Interaction											
Without compost (control)	Control	42.56	43.30	3.18	3.51	1.01	1.02	0.320	0.290	11.33	12.00
	Potassium silicate (200gL^{-1})	43.51	45.41	3.49	3.77	1.05	1.05	0.300	0.277	11.67	12.33
	Potassium silicate (300gL^{-1})	43.92	45.74	3.74	4.01	1.08	1.09	0.290	0.273	12.00	12.67
With compost (7 ton fed^{-1})	Control	45.26	46.16	3.90	4.18	1.10	1.13	0.280	0.270	12.33	13.00
	Potassium silicate (200gL^{-1})	45.61	47.06	4.04	4.30	1.17	1.17	0.290	0.273	12.67	13.33
	Potassium silicate (300gL^{-1})	46.04	47.15	4.19	4.39	1.19	1.21	0.283	0.277	13.33	13.67
With compost (10 ton fed^{-1})	Control	46.60	48.51	4.31	4.48	1.21	1.23	0.280	0.273	13.67	14.00
	Potassium silicate (200gL^{-1})	47.00	49.20	4.38	4.56	1.24	1.27	0.280	0.280	14.00	14.33
	Potassium silicate (300gL^{-1})	47.88	49.75	4.42	4.60	1.26	1.33	0.283	0.287	14.00	14.67
LSD at 5%		1.13	1.11	0.11	0.10	0.03	0.07	0.009	0.012	1.14	1.39

Means within a row followed by a different letter (s) are statistically different at a 0.05 level
***NS=Non-significant**

Table 7. Effect of compost and potassium silicate on bulb yield of garlic (Cv. Balady) at maturity stage during the season of 2022/23 and 2023/24

Treatments		Bulb yield, ton ha^{-1}		Marketable yield, ton ha^{-1}	
		1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)					
Without compost (control)		6.12c	6.28c	5.03c	5.27c
With compost (7 ton fed^{-1})		6.33b	6.70b	5.33b	5.66b
With compost (10 ton fed^{-1})		6.84a	7.17a	5.69a	5.97a
LSD at 5%		0.14	0.08	0.13	0.06
Sub main factor: Potassium silicate treatments (foliar application)					
Without potassium silicate (control)		6.33c	6.61b	5.25c	5.52c
With potassium silicate (200gL^{-1})		6.43b	6.73a	5.35b	5.64b
With potassium silicate (300gL^{-1})		6.53a	6.81a	5.45a	5.75a
LSD at 5%		0.08	0.11	0.07	0.09
Interaction					
Without compost (control)	Control	6.05	6.26	4.92	5.17
	Potassium silicate (200gL^{-1})	6.10	6.27	5.04	5.29
	Potassium silicate (300gL^{-1})	6.21	6.30	5.12	5.36
With compost (7 ton fed^{-1})	Control	6.24	6.45	5.23	5.54
	Potassium silicate (200gL^{-1})	6.37	6.73	5.31	5.66
	Potassium silicate (300gL^{-1})	6.39	6.91	5.46	5.79
With compost (10 ton fed^{-1})	Control	6.71	7.11	5.60	5.86
	Potassium silicate (200gL^{-1})	6.82	7.18	5.70	5.98
	Potassium silicate (300gL^{-1})	6.98	7.21	5.78	6.08
LSD at 5%		0.14	0.19	0.12	0.17

Means within a row followed by a different letter (s) are statistically different at a 0.05 level

Table 8. Effect of compost and potassium silicate on bulb yield of garlic (Cv. Chinese) at maturity stage during the season of 2022/23 and 2023/24

Treatments		Bulb yield, ton ha^{-1}		Marketable yield, ton ha^{-1}	
		1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)					
Without compost (control)		6.93c	7.17c	5.69c	5.99c
With compost (7 ton fed^{-1})		7.30b	7.49b	6.11b	6.41b
With compost (10 ton fed^{-1})		7.55a	7.87a	6.47a	6.77a
LSD at 5%		0.03	0.10	0.08	0.08
Sub main factor: Potassium silicate treatments (foliar application)					
Without potassium silicate (control)		7.17b	7.36b	5.96c	6.26c
With potassium silicate (200gL^{-1})		7.26ab	7.56a	6.11b	6.36b
With potassium silicate (300gL^{-1})		7.35a	7.61a	6.20a	6.55a
LSD at 5%		0.10	0.10	0.08	0.09
Interaction					
Without compost (control)	Control	6.81	6.93	5.53	5.86
	Potassium silicate (200gL^{-1})	6.96	7.26	5.73	5.93
	Potassium silicate (300gL^{-1})	7.03	7.32	5.81	6.18
With compost (7 ton fed^{-1})	Control	7.24	7.38	5.98	6.28
	Potassium silicate (200gL^{-1})	7.30	7.53	6.12	6.38
	Potassium silicate (300gL^{-1})	7.37	7.54	6.23	6.56
With compost (10 ton fed^{-1})	Control	7.46	7.76	6.37	6.65
	Potassium silicate (200gL^{-1})	7.52	7.87	6.48	6.77
	Potassium silicate (300gL^{-1})	7.66	7.96	6.56	6.91
LSD at 5%		0.18	0.18	0.15	0.15

Means within a row followed by a different letter (s) are statistically different at a 0.05 level

Table 9. Effect of compost and potassium silicate on bulb quality of garlic (Cv. Balady) at maturity stage during the season of 2022/23 and 2023/24

Treatments		DM, %		Vitamin C, mg 100g^{-1}		Carbohydrates, %		TDS, %		Pungency (purvate content, µmol.ml^{-1})	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)											
Without compost (control)		23.30c	23.72c	15.10c	16.78c	24.86c	27.29c	23.90c	24.29c	10.61c	12.86c
With compost (7 ton fed^{-1})		24.78b	25.30b	16.37b	17.14b	26.31b	27.87b	24.84b	25.29b	12.10b	13.36b
With compost (10 ton fed^{-1})		25.69a	26.30a	16.88a	17.51a	27.66a	28.38a	25.70a	26.03a	13.33a	13.60a
LSD at 5%		0.29	0.71	0.12	0.13	0.03	0.11	0.29	0.29	0.17	0.14
Sub main factor: Potassium silicate treatments (foliar application)											
Without potassium silicate (control)		24.41b	24.91b	15.92c	17.00b	26.10c	27.65c	24.56b	24.91b	11.86b	13.12b
With potassium silicate (200gL^{-1})		24.47b	24.97ab	16.16b	17.17ab	26.27b	27.87b	24.85ab	25.24ab	12.01b	13.24ab
With potassium silicate (300gL^{-1})		24.89a	25.43a	16.27a	17.27a	26.45a	28.01a	25.03a	25.46a	12.18a	13.45a
LSD at 5%		0.41	0.49	0.06	0.26	0.13	0.13	0.39	0.43	0.16	0.22
Interaction											
Without compost (control)	Control	23.10	23.55	14.91	16.57	24.68	27.10	23.78	24.14	10.37	12.62
	Potassium silicate (200gL^{-1})	23.20	23.63	15.17	16.87	24.85	27.27	23.88	24.30	10.57	12.78
	Potassium silicate (300gL^{-1})	23.59	23.98	15.21	16.91	25.06	27.49	24.03	24.42	10.88	13.17
With compost (7 ton fed^{-1})	Control	24.61	25.13	16.17	17.07	26.14	27.59	24.59	24.97	11.92	13.18
	Potassium silicate (200gL^{-1})	24.62	25.11	16.40	17.06	26.29	27.97	24.92	25.37	12.15	13.37
	Potassium silicate (300gL^{-1})	25.12	25.65	16.53	17.28	26.49	28.05	25.01	25.54	12.23	13.53
With compost (10 ton fed^{-1})	Control	25.51	26.06	16.66	17.37	27.50	28.25	25.31	25.62	13.28	13.56
	Potassium silicate (200gL^{-1})	25.60	26.18	16.90	17.57	27.69	28.39	25.74	26.06	13.30	13.56
	Potassium silicate (300gL^{-1})	25.96	26.65	17.07	17.60	27.81	28.51	26.05	26.42	13.42	13.67
LSD at 5%		0.72	0.85	0.11	0.46	0.22	0.23	0.68	0.74	0.27	0.39

Means within a row followed by a different letter (s) are statistically different at a 0.05 level

Table 10. Effect of compost and potassium silicate on bulb quality of garlic (Cv. Chinese) at maturity stage during the season of 2022/23 and 2023/24

Treatments		DM, %		Vitamin C, mg $100g^{-1}$		Carbohydrates, %		TDS, %		Pungency (purvate content, $\mu mol.ml^{-1}$)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Main factor: Organic fertilization treatments (soil addition)											
Without compost (control)		20.97c	21.23c	12.88c	13.15c	21.90b	22.27c	20.48c	20.88c	10.02c	10.53c
With compost (7 ton fed^{-1})		21.49b	21.73b	13.56b	13.83b	22.76a	23.18b	21.00b	21.40b	10.52b	11.06b
With compost (10 ton fed^{-1})		22.12a	22.39a	14.10a	14.36a	23.07a	23.51a	21.76a	22.18a	11.01a	11.58a
LSD at 5%		0.08	0.23	0.02	0.16	0.55	0.04	0.02	0.22	0.02	0.09
Sub main factor: Potassium silicate treatments (foliar application)											
Without potassium silicate (control)		21.32a	21.54b	13.30b	13.54b	22.41b	22.78b	20.90c	21.31a	10.33c	10.84c
With potassium silicate ($200gL^{-1}$)		21.58a	21.87ab	13.58a	13.85a	22.56ab	23.00ab	21.10b	21.47a	10.52b	11.07b
With potassium silicate ($300gL^{-1}$)		21.68a	21.93a	13.67a	13.96a	22.76a	23.18a	21.24a	21.67a	10.71a	11.26a
LSD at 5%		*NS	0.37	0.23	0.23	0.31	0.37	0.10	*NS	0.17	0.17
Interaction											
Without compost (control)	Control	20.66	20.90	12.68	12.90	21.62	21.90	20.32	20.73	9.82	10.35
	Potassium silicate ($200gL^{-1}$)	21.09	21.40	12.96	13.25	21.84	22.29	20.47	20.82	9.96	10.46
	Potassium silicate ($300gL^{-1}$)	21.15	21.39	13.01	13.30	22.25	22.61	20.65	21.09	10.29	10.78
With compost (7 ton fed^{-1})	Control	21.23	21.42	13.40	13.62	22.58	22.96	20.80	21.20	10.32	10.83
	Potassium silicate ($200gL^{-1}$)	21.58	21.84	13.57	13.84	22.77	23.17	21.03	21.40	10.55	11.09
	Potassium silicate ($300gL^{-1}$)	21.66	21.93	13.72	14.03	22.94	23.40	21.16	21.59	10.69	11.25
With compost (10 ton fed^{-1})	Control	22.06	22.31	13.82	14.09	23.04	23.49	21.59	22.01	10.84	11.34
	Potassium silicate ($200gL^{-1}$)	22.09	22.38	14.20	14.45	23.08	23.53	21.79	22.21	11.04	11.65
	Potassium silicate ($300gL^{-1}$)	22.21	22.48	14.29	14.55	23.09	23.52	21.91	22.32	11.16	11.74
LSD at 5%		1.28	0.64	0.40	0.40	0.53	0.64	0.17	0.63	0.29	0.30

Means within a row followed by a different letter (s) are statistically different at a 0.05 level

The improvement in bulb quality parameters, including dry matter, vitamin C, carbohydrates, and pungency, with compost application indicates its positive influence on garlic nutritional value and flavor profile. Compost enhances soil fertility and microbial activity, leading to increased nutrient availability and uptake by garlic plants. The observed increase in pungency may be attributed to the accumulation of sulfur-containing compounds in response to improved nutrient availability and stress mitigation. Similar to the Balady cultivar, the Chinese cultivar shows improvements in bulb quality parameters with compost application. The enhanced nutritional value and flavor profile of garlic bulbs highlight the potential of compost as a sustainable soil amendment for improving crop quality and market value (Sharma *et al.*, 2021; Al-Obeidi and Al-Obeidi, 2023; Kumawat *et al.*, 2023). Varietal differences in response to compost underscore the need for tailored fertilizer management strategies based on specific cultivar requirements and environmental conditions.

Potassium silicate plays a pivotal role in enhancing garlic growth and development through its multifaceted effects on plant physiology and stress tolerance. By providing a source of soluble silicon, potassium silicate strengthens cell walls, enhancing structural integrity and resistance to biotic and abiotic stresses such as pests, diseases, and environmental fluctuations. Additionally, silicon-mediated activation of defense mechanisms promotes plant health and resilience, reducing the incidence of yield-limiting factors and improving overall productivity. Furthermore, potassium silicate supplementation enhances nutrient uptake and utilization efficiency, optimizing plant growth and metabolic processes. The observed improvements in bulb yield, physical traits, and quality parameters with potassium silicate treatments underscore its potential as a valuable component of integrated nutrient management strategies for sustainable garlic production, offering growers a versatile tool for enhancing crop performance and resilience in diverse agricultural environments (Yousif *et al.*, 2023; Gad *et al.*, 2023; Youssef, 2023).

CONCLUSION

The obtained results demonstrate the significant impact of compost and potassium silicate applications on enhancing the performance of garlic plants, particularly in terms of productivity and quality. Both Balady and Chinese garlic cultivars exhibited notable improvements in growth parameters and yield traits with increasing levels of compost and potassium silicate. The combined treatment of 10 tons of compost per feddan and 300 grams per liter of potassium silicate emerged as the most effective strategy for maximizing garlic yield and quality.

Based on these findings, several recommendations can be made for garlic cultivation in the Egyptian market:

Farmers should consider incorporating compost and potassium silicate into their fertilizer management practices to enhance soil fertility and improve garlic plant performance. The recommended application rates of 10 tons of compost per feddan and 300 grams per liter of potassium silicate can serve as a guideline for achieving optimal results. Given the observed differences in performance between Balady and Chinese garlic cultivars, growers should tailor their fertilizer regimes to the specific needs of each variety. This might involve adjusting application rates or considering other cultivars that respond differently to fertilizer treatments. The use of organic fertilizers such as compost aligns with principles of sustainable agriculture by promoting soil health and reducing reliance on synthetic inputs. Farmers are encouraged to adopt environmentally friendly practices that support long-term agricultural sustainability. Continued research warranted to explore additional factors that may influence garlic yield and quality, such as irrigation management, pest and disease control strategies, and post-harvest handling techniques. Investigating the interactions between different agronomic practices can provide valuable insights for optimizing garlic production in the Egyptian context.

Overall, by implementing these recommendations and building upon the findings of this study, garlic producers in Egypt can improve their agricultural practices, meet the increasing market demand, and contribute to the sustainable growth of the garlic industry.

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تأثير التسميد العضوي والرش الورقي لسليكات البوتاسيوم على إنتاج وجودة صنفين من الثوم

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الملخص

يعد تحسين أداء نباتات الثوم أمرًا بالغ الأهمية لتلبية الطلب المتزايد في السوق المصري. ونتيجة لذلك، تم إجراء تجربة حقلية لتقييم تأثير مستويات مختلفة من سماد الكومبوست (٠,٠ و٧,٠و١٠,٠ طن فدان-١) وسيليكات البوتاسيوم (٠,٠، ٢٠٠، ٣٠٠ جم لتر-١) على صنفين بارزين من الثوم في السوق المصري (البلدي والصيني). فبالرغم من اختلاف الأداء بين الصنفين، إلا أن جميع مدلولات النمو مثل عدد أوراق النبات-١، والأوزان الطازجة والجافة (جرام نبات-١)، وكذلك صفات المحصول الكمية والنوعية بما في ذلك قطر الرأس (سم)، وقطر العنق (سم)، عدد الفصوص الرأس-١، إنتاجية الرؤس (طن هكتار-١)، المادة الجافة (%) فيتامين C (ملجم ١٠٠جم-١) والكربوهيدرات (%) زادت معنوياً مع ارتفاع مستويات الكومبوست. وبالمثل، لوحظت تحسنات في هذه المدلولات مع زيادة معدلات الرش بسيليكات البوتاسيوم. وكانت المعالجة المشتركة الأكثر فعالية هي إضافة ١٠ طن من الكومبوست للفدان إلى التربة ورش النبات النامي بسيليكات البوتاسيوم بمعدل ٣٠٠ جرام لتر-١ في نفس الوقت. وبناء على هذه النتائج يمكن الاستنتاج أن دمج الكومبوست وسيليكات البوتاسيوم في ممارسات إدارة التسميد مفيد لتعزيز خصوبة التربة وتحسين أداء نبات الثوم. يمكن أن تكون معدلات الاستخدام الموصي بها البالغة١٠ طن من الكومبوست للفدان و سيليكات البوتاسيوم (٣٠٠ جرام لتر-١) بمثابة دليل إرشادي لتحقيق النتائج المثلى. بشكل عام، من خلال تنفيذ هذه التوصيات والبناء على نتائج هذه الدراسة، يمكن لمنتجي الثوم في مصر تحسين ممارساتهم الزراعية، وتلبية الطلب المتزايد في السوق، والمساهمة في النمو المستدام لصناعة الثوم.