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INFLUENCE OF INTERCROPPING SYSTEM BETWEEN CORIANDER AND GARLIC AS WELL AS POTASSIUM FERTILIZATION SOURCE ON GROWTH AND PRODUCTIVITY OF GARLIC PLANT

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ABSTRACT: This work was carried out in a Private Farm at Kofor Negm Village, Elibrahimia District (N, 31° 33′ 47.11″ E 6.23″ 43′ 30°), Sharkia Governorate, Egypt, during the two consecutive winter seasons of 2021/2022 and 2022/2023 to study the influence of different potassium fertilizer sources [potassium citrate (36.5%K_2O), potassium thiosulphate (35% K_2O) and potassium silicate (18% K_2O) as foliar spray], different intercropping systems (sole crop of each components as control, 1: 1, 1: 2, 2: 1 and 2: 2 as row ratio of coriander: garlic) and their combination treatments on growth parameters, yield components and chemical constituents of garlic crop. The findings showed that, when coriander was intercropped with garlic at a ratio of 1: 2 as opposed to sole crop and the other intercropping systems under study, the highest benefits were obtained in terms of growth (plant height, number of leaves per plant, and total plant dry weight), yield components (bulb diameter, number of cloves per bulb, and average bulb weight), as well as N, P, K, and total carbohydrates percentage in garlic cloves. Compared to the other sources of potassium under study, potassium silicate application as a foliar spray four times/seasons produced a higher bulbs yield per feddan. The results indicated that, the development and production of the garlic crop can be maximized by using an intercropping system of 1 ridge of coriander: 2 ridges of garlic and potassium silicate application.

Key words: Coriander, garlic, intercropping, potassium, growth, yield, chemical.

INTRODUCTION

Contrary to single-crop planting, intercropping can boost crop output (**Mandal *et al*., 1986**). As a result, selecting the right crop combinations is crucial to optimize the use of growth resources like solar energy and water unit area per unit time, which will also preserve the physical health of the soil with an increase in yield components (**Mucheru-Muna *et al*., 2010**). Maximizing productivity and total yield per unit of space and time is the intercropping system's main objective.

Originally from the Mediterranean region, the coriander plant (*Coriandrum sativum*, L.), a member of the *Apiaceae* family, is now widely cultivated for use in cooking throughout North Africa, Central Europe, Asia and Egypt (**Mhemdi *et al*., 2011**). Coriander was once among the top 20 plants used to make essential oils (**Lawrence, 1993**). While its delicate green leaves are used as culinary herbs, the dried fruits are typically ground and added as a flavoring to foods, sauces, or spices. One of the oldest vegetable crops grown today is garlic (*Allium sativum* L.), a member of the *Alliaceae* family. Garlic also has a secondary medical function as a treatment for diseases including coronary heart disease and excessive cholesterol (**Sulichantini, 2016**). **Nainwal *et al.* (2015)** reported that, after onion (*Allium cepa*), garlic is the most grown plant in the onion family. Garlic cloves are often used as a seasoning or a flavor source (they contain allicin in the form of allyl sulfide) and to treat a number of health problems (**El-Hifny, 2010**).

Potassium (K^+), a crucial mineral, is required for the majority of biochemical and physiological

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activities that influence plant development and metabolism. Additionally, it aids in the survival of plants that are exposed to a variety of biotic and abiotic challenges (**Marschner, 1995**). It is also necessary for healthy cell division, the transport of carbohydrates, and the expulsion of nitrates. In contrast, potassium has a role in metabolism but doesn't appear to be a constant structural element (**Mengel, 2007**).

The objective of this study was to evaluate the influences of the intercropping system, potassium fertilizer sources and their combinations on the growth and yield components as well as some chemical components of garlic plants under Sharkia Governorate conditions.

MATERIALS AND METHODS

This work was carried out in a Private Farm at Kofor Negm Village, Elibrahimia District (N, 31° 33′ 47.11″ E 6.23″ 43′ 30°), Sharkia Governorate, Egypt, during the two consecutive winter seasons of 2021/2022 and 2022/2023 to study the influence of different intercropping systems, different potassium fertilizer sources and their combination treatments on growth parameters, yield components and some chemical constituents of garlic crop. The mechanical as well as chemical properties of the mixture of the two soil types was utilized are gave in Table 1 according to **Chapman and Pratt (1978)**.

Cultivation

The experimental unit measured 33.60 m^2 (4 m 8.40 m), had 12 ridges spaced 70 cm apart, coriander plants (two plants/hill) planted in one side of the row at a distance of 30 cm, and garlic plants cv. Balady (one plant/hill) planted in both sides of the row at a distance of 10 cm between cloves. As a result, 38096 coriander plants and 114,286 garlic plants were grown in a feddan (4000 m^2) as a lone crop, respectively. Surface irrigation system was utilized. Table 2 shows the number of plants grown under different intercropping systems.

The 20 treatments in this experiment were combinations of five intercropping system treatments and four potassium fertilization sources: Control (without potassium spraying), potassium citrate (36.5% K_2O), potassium thio-sulphate (35% K_2O), and potassium silicate (18% K_2O), sprayed at 40, 60, 80, and 100 days after sowing date.

The treatments for the intercropping system were as follows:

1. Sole planting system for coriander and garlic, with two plants per hill and a spacing of 30 cm as coriander was grown on one side of the ridge. Such a course of treatment served as the coriander characteristics' control. On both sides of the ridge, spaced 10 cm apart, garlic was planted. Such a course of treatment served as the garlic characteristics' control.
2. The 1:1 intercropping system was used, which involved planting 1 ridge of coriander and 1 ridge of garlic in alternating years. Such a system allocates 50.0 percent of the total area to coriander and 50.0 percent to garlic, respectively.
3. The 1:2 intercropping system, which involved planting 1 ridge of coriander and 2 ridges of garlic in succession. Such a system gives coriander and garlic, respectively, a proportional area of 33.3:66.7.
4. The 2:1 intercropping system was used, which involved planting 2 ridges of coriander in addition to 1 ridge of garlic. This system gives coriander and garlic, respectively, a proportional area of 66.7:33.3.
5. The 2:2 intercropping system, wherein 2 ridges of coriander and 2 ridges of garlic were planted alternately (2 ridges of coriander: 2 ridges of garlic). Such a strategy allocates 50.0 percent of the total area to coriander and 50.0 percent to garlic, respectively.

When necessary, all of the plants of the two crops (coriander and garlic) received normal agricultural procedures. Phosphorus and potassium fertilizers were applied to the soil at a rate of 200 kg/feddan of calcium super phosphate (15.5% P_2O_5) and 50 kg/feddan of potassium sulphate (50% K_2O), respectively, during the soil preparation process. While three equal quantities of 150 kg/feddan of ammonium sulfate (20.5% N) nitrogen fertilizer were put to the soil 30, 60, and 90 days after sowing.

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

Mechanical analysis			Soil texture
Clay (%)	Silt (%)	Sand (%)	Clay
56.18	28.61	15.21	

Chemical analysis										
pH	E.C. dSm^{-1}	Organic matter (%)	$CaCO_3$ (%)	Soluble cations (meq./ L)				Soluble anions (meq. /L)		
				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}
8.05	2.34	0.57	0.49	11.89	10.34	3.20	5.14	8.93	5.58	16.06

Available nutrient (mg kg^{-1}soil)						
N	P	K	Fe	Zn	Cu	Mn
37.25	24.31	197	1.67	0.62	0.53	0.47

Table 2. Number of coriander and garlic plants per feddan under intercropping systems

Intercropping systems (coriander: garlic)	Number of plants/feddan	
	Coriander	garlic
Sole crop	38096	114286
1 row of coriander: 1 rows of garlic	19048	57143
1 row of coriander: 2 rows of garlic	12572	76572
2 row of coriander: 1 row of garlic	25525	37715
2 rows of coriander: 2 rows of garlic	19048	57143

Recorded Data

After 100 days from the date of planting, the plant height (cm), the number of leaves per plant and the total dry weight of garlic per plant (g) were measured. After 190 days from the garlic cloves were planted, the bulb diameter (cm), number of cloves per bulb, average bulb weight (g) and bulb output per feddan (ton) were measured. In addition, total nitrogen, total phosphorus, potassium and total carbohydrates percentages in outer cloves of garlic bulbs were determined according to **Chapman and Pratt (1978)**, **Hucker and Catroux (1980), Brown and Lilleland (1946)** and **Dubois *et al.,* (1956)** respectively.

Experimental Design and Statistical Analysis

The statistical layout of this experiment was split-plot design. Since the 1st factor was intercropping systems which contained five treatments, while the 2nd factor was potassium fertilization sources included four types. Each treatment included three replicates. Each replicate contained twelve rows. The recorded data were statistically analyzed, and the means were compared using statistix software version 9 (**Analytical software, 2008**).

RESULTS AND DISCUSSION

Influence of Intercropping System Treatments on Growth, Yield Components and Chemical Constituents of Garlic Plants

According to the findings presented in Table 3, intercropping systems in general considerably improved plant height, number of leaves on each garlic plant and plant dry weight as compared to only planting garlic. In contrast to the other intercropping systems under study, coriander + garlic (2: 1 system) produced the tallest plants, while garlic + coriander (1: 2 system) produced the most leaves and the heaviest dry weight per plant. The development and production of garlic are impacted by the compatibility of the imported crops as well as the availability and control of nutrients. **Mohammed *et al*. (2021)** noted that, roselle and cluster bean plants' plant height, number of leaves per plant, and total dry weight were all considerably impacted by intercropping systems as opposed to solitary planting. Additionally, **Khashaba *et al*. (2023)** noted that, when 1 row of caraway and 2 rows of garlic were planted alternately, the plant height, leaves count and fresh weight of the garlic plants were all higher than with a lone crop.

Additionally, Table 4 demonstrates that, as compared to sole crop and the other intercropping systems examined, the 1:2 intercropping system considerably enhanced bulb width, cloves number per bulb, and average bulb weight. The garlic lone crop produced the highest fruit yield per feddan in the first and second seasons (6.36 and 6.18 tons/feddan, respectively) when compared to the intercropping systems under study. The effective use of inputs such nutrients, water, light and energy, which can considerably boost coriander production, may be responsible for the rise in N, P, K, and total carbs contents by intercropping systems. Using a 1:2 method, which involves alternating 1 row of caraway with 2 rows of onion, greatly increased the number of umbels and fruit yield per caraway plant in contrast to producing caraway as a sole crop, according to the same study by **Abdelkader *et al*. (2018)** on caraway and onion intercropped.

The intercropping system with coriander plants had a substantial impact on the total nitrogen, total phosphorus, potassium and total carbohydrate percentages of garlic cloves in both seasons (Table 5). When compared to the other intercropping systems and the control, the coriander and garlic rows that alternated produced the highest values in this regard. According to **Zyada (2016)**, who intercropped okra and cowpea, **Baghdadi *et al*. (2018)**, who intercropped corn and soybean, and **Ahmed *et al*. (2020)**, who intercropped maize and soybean, these results are consistent with those published by those researchers.

Influence of Potassium Fertilization Source Treatments on Growth, Yield Components and Chemical Constituents of Garlic Plants

Concerning the effect of potassium fertilization sources on plant growth (plant height, number of leaves per plant and total plant dry weight), yield components (bulb diameter, number of cloves per bulb, average bulb weight and bulbs yield per feddan) as well as chemical components (N, P, K, and total carbohydrates percentages) of garlic crop, Tables 6, 7 and 8 show that, compared to the control, all potassium fertilization sources led to a significant rise in these parameters during both seasons. Where, using potassium silicate as a source of potassium fertilization led to a large increase in plant growth, yield components and chemical components of garlic plants during both seasons. Furthermore, potassium (K) may alter biosynthesis and the growth of aromatic plants, and it is utilized by plants to create numerous processes, which contributes to the superior effects of potassium fertilizer application. According to **Page and Di Cera (2006)** and **Hafsi *et al*. (2014)**, this mineral has an impact on the activity and concentration of enzymes engaged in a variety of biosynthetic processes. Furthermore, comparable findings were made by **Moustafa *et al*. (2018)** on *Moringa oleifera* and **Mohamed and Ghatas (2021)** on *Achillea millefolium* plants.

Influence of Combination between Intercropping System and Potassium Source Treatments on Growth, Yield Components and Chemical Constituents of Garlic Plants

Regarding the effects of combination treatments between various intercropping systems and potassium fertilization sources, the findings

Table 3. Influence of intercropping systems on garlic growth parameters during 2021/2022 and 2022/ 2023 seasons

Intercropping system As row ratio (Coriander: garlic)	Plant height (cm)		Number of leaves /plant		Plant dry weight (g)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Sole garlic	82.39	76.71	7.42	6.83	15.44	13.99
1 : 1	84.91	81.60	7.50	7.67	16.41	15.63
1 : 2	86.73	87.06	10.13	9.67	19.53	18.59
2 : 1	88.53	88.08	7.63	7.46	14.10	13.58
2 :2	85.43	85.01	8.42	8.38	15.65	15.45
L.S.D. at 5 %	**1.17**	**0.54**	**0.21**	**0.44**	**0.60**	**0.57**

Table 4. Influence of intercropping systems on garlic yield components during 2021/2022 and 2022/ 2023 seasons

Intercropping system As row ratio (Coriander: garlic)	Bulb diameter (cm)		Number of cloves/plant		Average bulb weight (g)		Bulb yield /feddan (ton)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Sole garlic	5.43	5.33	23.75	28.50	55.65	54.08	6.36	6.18
1 : 1	4.53	4.85	24.38	29.38	59.98	57.71	3.43	3.30
1 : 2	5.90	6.04	30.38	32.25	62.90	65.21	4.82	4.99
2 : 1	4.41	4.53	21.00	22.38	53.26	50.88	2.01	1.92
2 :2	4.78	4.75	28.25	28.50	57.90	56.06	3.31	3.20
L.S.D. at 5 %	**0.19**	**0.11**	**1.06**	**1.59**	**4.00**	**0.76**	**0.17**	**0.04**

Table 5. Influence of intercropping systems on N, P, K and total carbohydrates percentages of garlic during 2021/2022 and 2022/ 2023 seasons

Intercropping system As row ratio (Coriander: garlic)	Total nitrogen (%)		Total phosphorus (%)		Potassium (%)		Total carbohydrates (%)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Sole garlic	2.864	2.750	0.509	0.481	2.641	2.651	28.69	29.23
1 : 1	2.900	3.013	0.531	0.520	2.658	2.675	28.90	29.35
1 : 2	3.225	3.363	0.578	0.556	2.800	2.884	31.65	31.10
2 : 1	2.638	3.075	0.485	0.490	2.670	2.685	31.44	30.63
2 :2	2.925	2.913	0.513	0.510	2.773	2.790	29.50	30.30
L.S.D. at 5 %	**0.126**	**0.182**	**0.011**	**0.006**	**0.021**	**0.017**	**0.78**	**0.50**

Table 6. Influence of potassium source as foliar spray on garlic growth parameters during 2021/ 2022 and 2022/ 2023 seasons

Potassium source treatments	Plant height (cm)		Number of leaves /plant		Plant dry weight (g)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	82.24	79.47	7.43	7.27	14.60	14.14
Potassium citrate	84.44	82.61	8.00	7.80	15.59	14.73
Potassium thiosulfate	86.99	84.83	8.43	8.20	17.06	16.18
Potassium silicate	88.71	87.86	9.00	8.73	17.65	16.73
L.S.D. at 5 %	**1.52**	**0.77**	**0.34**	**0.27**	**0.60**	**0.54**

Table 7. Influence of potassium source as foliar spray on garlic yield components during 2021/ 2022 and 2022/ 2023 seasons

Potassium source treatments	Bulb diameter (cm)		Number of cloves/plant		Average bulb weight (g)		Bulb yield /feddan (ton)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	4.67	4.62	20.30	23.50	56.35	54.06	3.82	3.74
Potassium citrate	4.86	4.89	23.80	27.10	56.40	55.78	3.90	3.85
Potassium thiosulfate	5.13	5.18	27.70	29.70	58.72	58.00	4.07	4.01
Potassium silicate	5.37	5.70	30.40	32.50	60.28	59.31	4.15	4.09
L.S.D. at 5 %	**0.10**	**0.11**	**0.96**	**1.21**	**2.96**	**0.53**	**0.12**	**0.03**

Table 8. Influence of potassium source as foliar spray on N, P, K and total carbohydrates percentages of garlic during 2021/2022 and 2022/ 2023 seasons

Potassium source treatments	Total nitrogen (%)		Total phosphorus (%)		Potassium (%)		Total carbohydrates (%)	
	1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Control	2.600	2.760	0.490	0.485	2.666	2.702	29.17	29.01
Potassium citrate	2.820	2.910	0.512	0.508	2.683	2.719	29.71	30.04
Potassium thiosulfate	3.030	3.140	0.535	0.517	2.721	2.755	30.39	30.41
Potassium silicate	3.191	3.280	0.555	0.536	2.763	2.772	30.87	31.02
L.S.D. at 5 %	**0.110**	**0.058**	**0.009**	**0.006**	**0.010**	**0.005**	**0.29**	**0.29**

shown in Tables 9, 10 and 11 show that, in most cases, the 1: 2 system combined with potassium silicate was the best combination treatment for increasing plant growth, fruit yield components as well as chemical constituents of garlic. However, compared to control [garlic growing alone and without potassium application] in both seasons, bulbs yield/feddan of the garlic plant was significantly higher with all combinations of intercropping systems and potassium fertilization sources. The growth, yield, and chemical components of the garlic crop were also gradually increased using potassium citrate, potassium thiosulfate, and then potassium silicate fertilization sources under each treatment of intercropping systems. In this regard, **Abdelkader *et al*. (2018)** observed that, both potassium fertilization treatments and the intercropping system (each alone) boosted caraway growth parameters. As a result, they may have a greater impact when combined, increasing the fruit yields of caraway intercropped with onion. Relay strip intercropping, which combines potassium and phosphorus, can boost soybean yield, claim **Xiang *et al*. (2012)**. The findings of **Sherawat and Singh (2009)** on beans intercropped with potatoes and fertilized with potassium and **Gendy *et al*. (2018)** on black cumin intercropped with fenugreek and fertilized with NPK rates are consistent with these findings.

Table 9. Influence of combination between intercropping system and potassium source on garlic growth parameters during 2021/2022 and 2022/ 2023 seasons

Intercropping system As row ratio (Coriander: garlic)	Potassium source	Plant height (cm)		Number of leaves/plant		Plant dry weight (g)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season
Sole garlic	Control	80.30	73.85	7.17	6.17	14.25	12.95
	K citrate	81.25	74.10	7.50	6.50	15.20	13.30
	K thiosulfate	82.95	75.05	7.17	7.17	15.85	14.45
	K silicate	85.05	83.85	7.84	7.50	16.45	15.25
1 : 1	Control	81.85	77.50	7.17	6.84	15.20	15.05
	K citrate	83.20	80.65	7.17	7.33	15.25	14.30
	K thiosulfate	86.35	82.80	7.50	8.00	17.35	16.25
	K silicate	88.25	85.45	8.17	8.50	17.85	16.90
1 : 2	Control	83.10	80.45	8.50	8.50	16.35	16.55
	K citrate	86.20	87.20	9.84	9.50	18.65	18.00
	K thiosulfate	87.35	89.55	11.00	10.17	21.15	19.95
	K silicate	90.25	91.05	11.17	10.50	21.95	19.85
2 : 1	Control	84.20	82.65	7.17	7.50	12.95	13.05
	K citrate	86.60	87.25	7.50	7.17	13.90	13.35
	K thiosulfate	90.95	90.60	7.50	7.17	14.50	13.55
	K silicate	92.35	91.80	8.34	8.00	15.05	14.35
2 :2	Control	81.75	82.90	7.17	7.34	14.25	13.10
	K citrate	84.95	83.85	8.00	8.50	14.95	14.70
	K thiosulfate	87.35	86.15	9.00	8.50	16.45	16.70
	K silicate	87.65	87.15	9.50	9.17	16.95	17.30
L.S.D. at 5 %		**3.17**	**1.57**	**0.68**	**0.68**	**1.30**	**1.19**

Table 10. Influence of combination between intercropping system and potassium source on garlic yield components during 2021/2022 and 2022/ 2023 seasons

Intercropping system As row ratio (Coriander: garlic)	Potassium source	Bulb diameter (cm)		Number of cloves/plant		Average bulb weight (g)		Bulb yield/feddan (ton)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Sole garlic	Control	5.05	4.85	17.50	22.50	51.95	51.35	5.94	5.87
	K citrate	5.25	5.15	23.00	28.00	55.05	52.75	6.29	6.03
	K thiosulfate	5.55	5.45	25.50	30.50	57.75	55.85	6.60	6.38
	K silicate	5.85	5.85	29.00	33.00	57.85	56.35	6.61	6.44
1 : 1	Control	4.35	4.65	19.50	24.50	57.90	55.40	3.31	3.17
	K citrate	4.25	4.60	20.50	29.00	58.90	57.10	3.37	3.27
	K thiosulfate	4.65	4.85	27.00	31.50	61.25	58.45	3.50	3.34
	K silicate	4.85	5.30	30.50	32.50	61.85	59.90	3.54	3.42
1 : 2	Control	5.55	5.40	25.50	27.50	58.85	62.00	4.51	4.75
	K citrate	5.75	5.70	29.50	31.50	61.65	64.35	4.73	4.93
	K thiosulfate	6.00	5.90	32.50	34.50	64.45	66.40	4.94	5.09
	K silicate	6.30	7.15	34.00	35.50	66.65	68.10	5.11	5.22
2 : 1	Control	4.00	3.75	15.50	18.00	57.40	46.85	2.17	1.77
	K citrate	4.30	4.35	20.00	20.50	48.95	49.45	1.85	1.87
	K thiosulfate	4.65	4.85	23.00	24.00	51.80	52.75	1.96	1.99
	K silicate	4.70	5.15	25.50	27.00	54.90	54.45	2.07	2.05
2 :2	Control	4.40	4.45	23.50	25.00	55.65	54.70	3.18	3.13
	K citrate	4.75	4.65	26.00	26.50	57.45	55.25	3.29	3.16
	K thiosulfate	4.80	4.85	30.50	28.00	58.35	56.55	3.34	3.23
	K silicate	5.15	5.05	33.00	34.50	60.15	57.75	3.44	3.30
L.S.D. at 5 %		**0.27**	**0.24**	**2.13**	**2.82**	**6.95**	**1.27**	**0.28**	**0.08**

Table 11. Influence of combination between intercropping system and potassium source on N, P, K and total carbohydrates percentages of garlic during 2021/2022 and 2022/2023 seasons

Intercropping system As row ratio (Coriander: garlic)	Potassium source	Total nitrogen (%)		Total phosphorus (%)		Potassium (%)		Total carbohydrates (%)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
Sole garlic	Control	2.75	2.65	0.49	0.46	2.59	2.63	28.15	28.35
	K citrate	2.85	2.75	0.50	0.48	2.63	2.64	28.45	29.10
	K thiosulfate	2.85	2.75	0.51	0.49	2.66	2.66	29.00	29.65
	K silicate	3.01	2.85	0.54	0.51	2.70	2.69	29.15	29.80
1 : 1	Control	2.85	2.70	0.51	0.50	2.64	2.65	27.90	27.45
	K citrate	2.75	2.85	0.53	0.52	2.63	2.66	28.65	29.75
	K thiosulfate	2.85	3.20	0.55	0.53	2.67	2.69	29.40	30.00
	K silicate	3.15	3.30	0.55	0.55	2.71	2.71	29.65	30.20
1 : 2	Control	2.80	3.15	0.51	0.52	2.74	2.82	30.80	30.25
	K citrate	3.15	3.35	0.56	0.54	2.77	2.85	31.15	30.45
	K thiosulfate	3.45	3.40	0.61	0.58	2.81	2.93	32.10	31.50
	K silicate	3.50	3.55	0.64	0.60	2.90	2.95	32.55	32.20
2 : 1	Control	2.25	2.75	0.47	0.47	2.63	2.66	30.35	29.85
	K citrate	2.50	2.85	0.48	0.51	2.65	2.68	31.20	30.35
	K thiosulfate	2.75	3.25	0.49	0.49	2.70	2.71	31.95	30.55
	K silicate	3.05	3.45	0.51	0.51	2.72	2.71	32.25	31.75
2 :2	Control	2.35	2.55	0.49	0.50	2.75	2.77	28.65	29.15
	K citrate	2.85	2.75	0.50	0.51	2.76	2.78	29.10	30.55
	K thiosulfate	3.25	3.10	0.53	0.52	2.79	2.81	29.50	30.35
	K silicate	3.25	3.25	0.55	0.53	2.81	2.82	30.75	31.15
L.S.D. at 5 %		**0.25**	**0.21**	**0.02**	**0.01**	**0.03**	**0.02**	**0.95**	**0.74**

Additionally, **Ahmed *et al*. (2020)** reported that, in comparison to T0 (no potassium application), the increased nutrient accumulation under T2 (maize 80, soybeans 60 kg potassium /ha) increased the overall biomass and its distribution to root, green biomass, and grain in maize and soybeans by 11% and 18% and 16% and 19%, 20% and 12%, respectively. This was in comparison to T0, in which there was no potassium application.

Conclusion

Overall, the acquired results showed that, the study's potassium fertilization treatments and intercropping method had a substantial impact on the growth and yield components of the garlic crop. According to this study, farmers should grow coriander and garlic together rather than just those two crops alone, particularly when using a 1:2 cropping scheme with potassium silicate in the Sharkia Governorate.

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تأثير نظام التحميل بين الكزبرة والثوم وكذلك مصدر التسميد البوتاسي على نمو وإنتاجية نبات الثوم

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أجري هذا العمل في مزرعة خاصة بقرية كفور نجم بمركز الابراهيمية (شمال 31 ° 33 ′ 47.11 ″ شرق 6.23 ″ 43 ′30°) بمحافظة الشرقية، مصر، خلال موسمي الشتاء المتتاليين لأعوام 2022/2021 و 2023/2022 لدراسة تأثير مصادر سماد البوتاسيوم المختلفة [سترات البوتاسيوم (أكسيد بوتاسيوم 36.5%)، ثيوسلفات البوتاسيوم (أكسيد بوتاسيوم 35%) وسيليكات البوتاسيوم (أكسيد بوتاسيوم 18%) رشاً على الأوراق]، نظم التحميل مختلفة (المحصول المنفرد لكل محصول ككنترول ، 1: 1 ، 1: 2 ، 2: 1 و 2: 2 كنسب خطوط من الكزبرة: الثوم) ومعاملات التداخل بينهما على صفات النمو ومكونات المحصول والمحتوي الكيميائي لمحصول الثوم. أظهرت النتائج أنه عند زراعة الكزبرة مع الثوم بنظام 1: 2 تم الحصول على أعلى القيم من حيث النمو (ارتفاع النبات، عدد الأوراق لكل نبات، والوزن الكلي الجاف للنبات)، مكونات المحصول (قطر البصلة ، عدد الفصوص لكل بصلة، ومتوسط وزن البصلة)، والنسب المئوية للنيتروجين الكلي والفسفور الكلي والبوتاسيوم والكربوهيدرات الكلية في فصوص الثوم مقارنة بالمحصول المنفرد وأنظمة التحميل الأخرى قيد الدراسة. على جانب آخر، أدى استخدام سيليكات البوتاسيوم رشاً على الأوراق (أربع مرات/موسم) إلى إنتاج أعلى محصول من الأبصال للفدان مقارنة بمصادر البوتاسيوم الأخرى قيد الدراسة. أشارت النتائج إلى أنه يمكن تعظيم زراعة وإنتاج محصول الثوم باستخدام نظام التحميل المكون من 1 خط من الكزبرة: 2 خط من الثوم والمعاملة بسيليكات البوتاسيوم.

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