Journal of Plant Production

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

Influence of Irrigation Periods, Soil Additions and Antitranspirant Spraying Folaire on Productivity and Fruit Quality of Eggplant

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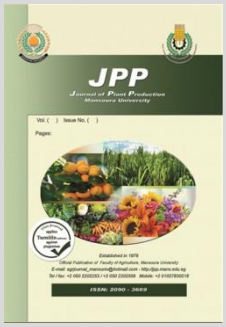

ABSTRACT

This study was carried out at Sinbillawain district, Dakahlia Governorate, Egypt, during 2022 and 2023 summer seasons to clarify the influence of irrigation periods, soil additions, antitranspirant applying sprays to the foliage treatments, and their interactions on development, yield, and their components, as well as fruit quality of eggplant Sawad Allayl cultivar. The experimental layout was a strip-split plots design in three replications. The vertical-strips were assigned to irrigation periods (irrigation every 10, 15 and 20 days intervals). The horizontal-strips were devoted to soil additions (without, zeolite 500 kg/fed and polymer 30 kg/fed). While, the sub-plots were allocated to applying sprays to the foliage with antitranspirants (without, potassium silicate 2.5 ml/l and chitosan 0.5 g/l. Approximating irrigation periods by irrigation every 10 days, polymer soil addition at 30 kg/fed and applying sprays to the foliage eggplant plants with potassium silicate at 2.5 ml/l produced highest values of growth characters, yield and its components, chemical constituents of fruits. In order to save irrigation water at the same time maintaining highest growth, productivity and fruit quality of eggplant. It could be recommended that irrigation eggplant plants every 15 days besides soil addition with polymer at 30 kg/fed and foliage sprayed with potassium silicate at 2.5 ml/l under the environmental conditions of Sinbillawain district, Dakahlia Governorate, Egypt.

Keywords: Eggplant, irrigation periods, soil addition, zeolite, polymer.

INTRODUCTION

Eggplant (*Solanum melongena* L.) is one of Egypt's oldest, most beloved and most widely grown vegetable crops. Fruits from eggplants have a significant amount of carbohydrates, proteins, vitamins, minerals, amino acids and bioactive compounds (Karimi *et al.* 2021). It is grown both for domestic consumption and for export.

High crop productivity is understood to be the end result of numerous variables and processes Furthermore, the significant contribution of agricultural operations like; irrigation periods, applying sprays to the foliage with some antitranspirants and soil addition treatments that have significant impact on yield, vegetative growth, and its basic parts and chemicals.

Drought stress is major factor that limit Egypt's agricultural productivity and decrease the effectiveness of using dry lands for agriculture. Therefore, it is possible to exploit semi-arid regions through the identification and application of drought-tolerant crops as well as unique crop enhancement techniques. For the eggplant crop to grow as productively as possible, it needs enough water during every stage of its physiological development. However, just like other crops, its yield significantly impacted by dry soil during some crucial periods of growth. By supplying the necessary amount of water when it is needed, a suitable irrigation interval can significantly increase productivity and the efficiency of water consumption. However, insufficient irrigation intervals might cause crops to grow. (Rakha, 2014). Fouda (2021) demonstrated that eggplants irrigated every 7 days outperform eggplants irrigated every 10 and 14 days in terms of yield and performance. Opoku *et al.* (2024) found that there were antagonistic effects on the development, yield, composition, and quality of the fruit of eggplant when drought stress was applied.

Zeolite is an aluminosilicate mineral that can be produced artificially from other minerals or found naturally (Belviso *et al.*, 2017). Zeolite's crystalline structure is unaffected by the absorption and retention of water. Zeolite can thereby enhance soil qualities by raising the soil's capacity to hold water, exchange cations, and rate of leakage (Mondal *et al.*, 2021). It can also be used in agricultural production, where it improves plant growth and productivity by acting as a chelating agent or slow-release fertilizer (Belviso *et al.*, 2022). Farooqi *et al.* (2022) showed that brinjal's development, as well as its biochemical and physiological characteristics, responded best to treatment with zeolite . Ghazi *et al.* (2023) indicated that mineral amendments like zeolite can enhancing soil to retain water, increasing soil nutrients and improve its structure, resulting in an optimal environment for root growth and development.

Polymers are classified as hydrophilic materials because they have the ability to absorb and retain water for up to 400 times their dry weight. As a result, they can draw moisture into the soil and provide plant roots with water. As a result, it can enhance soil qualities by retaining more water in the soil, postponing the point at which growing plants wilt, and reducing nutrient loss through leaching (Palanivelu *et al.*, 2022). Additionally, it is distinguished by its nontoxicity, granule swelling, imbibition ability, and capacity for rewetting (Oladosu *et al.*, 2022). In comparison to the control, Mnyika *et al.* (2020) demonstrated that the superabsorbent polymer increased soil moisture, eggplant growth, and yield.

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DOI: 10.21608/jpp.2024.324072.1387

Foliar application produces greater advantages than soil application. The crop responds quickly to nutrient delivery since application rates are lower than those for soil application, making it easier to achieve the same application. It is also highly helpful when different edaphic variables, such as low soil temperature, low soil moisture, and nutrient loss through leaching, interfere with roots' ability to absorb nutrients from the soil. Accordingly, foliar treatment is a good technique for any crop's production (Alshaal and El-Ramady, 2017). Antitranspirants, in general, lessen the amount of water lost through transpiration, which mostly occurs when stomatal pores on the surface (Mishra, 1996).

One source of silicon and potassium that are very soluble is potassium silicate. In addition to serving as a silica supplement in agricultural production systems, it also provides trace levels of potassium as well as antitransparent material. There are no volatile organic chemicals in potassium silicate, therefore using it won't produce any environmentally harmful or lasting byproducts (Blumberg, 2001). Devi *et al.* (2023) showed that spaying with potassium silicate at 2.5 ml/l increased the growth rate and yield of eggplant. Gad *et al.* (2023) found that applying sprays to the foliage with potassium silicate at 1 g L^{-1} significantly increased growth, yield, chemical constituents of the leaves and quality of eggplant plants.

A naturally occurring polymer, chitosan is produced when chitin is deacetylated. Shellfish waste from food preparation is an easy source of chitin. Chitosan is a high molecular polymer that is nontoxic and bioactive. Because it inhibits fungus and triggers defensive mechanisms in plant tissues, it is now recognized as a valuable substance. Chitosan creates a semi-permeable coating that slows down the ripening processes, lowers respiration and transpiration rates, and controls gas exchange (Terry and Joyce, 2004). Hossaini *et al.* (2021) revealed that the application of chitosan at 150 mg/l significantly influenced the physiological traits, height of the plant, quantity of branches, quantity of leaves, and total number of fruits produced by each eggplant plant.

Hence, this search aimed to study the way that soil addition treatments and spraying foliage with certain antitranspirants under the impact of varying irrigation times affect the growth, productivity, and fruit quality of eggplant in the Sinbillawain district of Dakahlia Governorate, Egypt.

MATERIALS AND METHODS

A strip-split plots design in a randomized complete blocks design with 3 replications made up the experimental setup. The vertical-strips were separated by deeper channels and allotted to 3 irrigation periods (irrigation every 10, 15 and 20 days). The irrigation treatments were applied after 40 days from transplanting during the growing two seasons, and continued until the end of the season.

The horizontal-strips were devoted to 3 soil adding treatments (without soil adding "control treatment", zeolite soil addition at 500 kg/fed and polymer soil addition at 30 kg/fed). Before transplantation inside the ridges, zeolite and polymer were applied to the experimental units, which were subsequently turned over using a hack.

While, the sub-plots were allocated to three applying sprays to the foliage treatments with antitranspirants (without applying sprays to the foliage "control treatment", applying sprays to the foliage with potassium silicate at 2.5 ml/l of water for every spraying. The commercial fertilizer potassium silicate (K_2SiO_3), is a white powder soluble in water, contain 22.7 % K_2O and 41.0 % SiO_2. Chitosan at 0.5 g/liter water in each spraying, dissolving the appropriate amount of chitosan powder [Poly-(1.4-B-D-glucopyranosamine), 2- Amino -2 -deoxy-(1-4)-B-D-glucopyranan] in 5% acetic acid solution. The experimental plots were sprayed with a hand sprayer, spraying treatment beginning at fifty days after transplanting, and repeated every ten days, for 11 times per season. Spraying with antitranspirants continued until the end of the growing season. The volume of the foliar solution was 200 liters per feddan. Wetting agent Tween-20 was utilized at a concentration of 0.02%.

Every experimental basic unit consisted of three ridges, each measuring 5.0 m in length and 0.70 m in width, yielding an area of 10.5 m^2. The planting distances were 50 cm between one plant and the other, and the number of plants in one line was 10 plant and 30 plant per plot.

The soil used for the trials was a clay loam with medium fertility. In order to assess the physical and chemical soil parameters according to Page (1982), Prior to soil preparation, soil samples were chosen at random from the experimental field area at a depth of 0 to 30 cm, as shown in Table 1.

Table 1. The experimental locations' physical and chemical soil properties during the course of the two growing seasons.

Soil analyses		2022	2023
A. Mechanical analysis			
Sand (%)		27.54	27.84
Silt (%)		37.55	37.34
Clay (%)		34.91	34.82
Texture class		Clay loam	Clay loam
B. Chemical analysis			
pH (1 : 2.5)		8.79	8.55
E.C. dS m^{-1} (1 : 2.5)		0.74	0.75
Organic matter (%)		1.34	1.35
Hygroscopic humidity (%)		6.41	6.45
Available N (mg/kg soil)		12.00	12.50
Available P (mg/kg soil)		4.00	4.50
Exchangeable K (mg/kg soil)		323.00	320.00
Cations (meq/100 g soil)	Ca^{++}	0.43	0.42
	Mg^{++}	0.62	0.61
	Na^{+}	0.83	0.85
	K^{+}	0.02	0.05
Anions (meq/100 g soil)	CO_3^{-}	0.21	0.22
	HCo_3^{-}	1.17	1.19
	Cl^{-}	0.54	0.55
	So_4^{--}	0.35	0.37

After three ploughings, compaction, leveling, and ridging, the investigational field was well prepared. Then, it separated into the investigational units, each with the dimensions listed above.

45-day-old eggplant seedlings were moved on April 7th of the 1st season and April 1st of the 2nd season, into the soil that was rather moist. On one side of the ridges, the hand-cultivated eggplant seedlings were spaced 50 cm apart and placed in hills. 50 kg of potassium sulfate (48.52 percent K_2O), 250 kg of calcium superphosphate (15.5% P_2O_5), and 150 kg of ammonium sulfate (20.5% N) were the standard suggested chemical fertilizer rates (mineral). The following amounts of chemical fertilizers were applied: 30% at 4th week, 35% at 8th week, and 35% at 12th weeks following transplanting. The typical agricultural methods for raising eggplant seedlings in accordance with ministry of agriculture instructions.

Studied characters:

Harvesting time in both seasons, was carried out 60 days after transplanting and continued to 7th and 1st October, respectively. In order to identify the following attribute, four guarded plants were randomly sampled from each sub-plot:

1. To measure the foliage dry matter (g), a random sample of four plants was selected from each sub-plot's inner ridges at 100 days after the plants were transplanted.
2. Number of fruits/plant: It was measured by counting all fruits formed on all branches of the chosen plants at 100 days from transplanting.
3. Early yield per feddan: First five pickings' worth of yield weight in ton/fed.
4. The total yield weight, expressed in ton/fed from the beginning of harvesting until the end.

Random fruit samples were gathered from each sub-plot during harvesting (the fourth picking) in order to identify the following characteristics:

1. Total carbohydrates percentage (%). It was calculated using the technique of Hedge and Hofreiter (1962).
2. Crude protein (%). The total nitrogen was multiplied by a factor of 6.25 to compute it (AOAC, 2000).
3. Crude fiber (%). It was calculated using the methodology detailed in AOAC (2000).
4. Ascorbic acid (Vitamin C). It was calculated using the procedure described in AOAC (2000) in mg/100 g FW.
5. Proline content (%). It was calculated in leaves using the technique of Bates *et al.* (1973).
6. Nitrate (NO_3-N) and nitrite (NO_2-N) contents (ppm). It were decided according to the method designated by Singh (1988**)**.

The study data were statistically assessed using the "MSTAT-C" computer software program in accordance with the Gomez and Gomez (1984) published technique of variance (ANOVA) for the strip-split plot design. The Least Significant Difference (LSD) approach was used to examine the differences between treatment means at the 5% level of probability, as Snedecor and Cochran (1980) explained.

RESULTS AND DISCUSSION

Influence of irrigation periods:

Data in Tables 2 and 4 show that approximating watering periods of eggplant by watering every 10 days resulted in the highest significant values of foliage dry matter, number of fruits/plant, early and total yields/fed, total carbohydrates, crude protein and fiber percentages, Vitamin-C and proline contents and lowest values of NO_3-N and NO_2-N contents in the fruits through both times of year. While, prolonging irrigation periods of eggplant by irrigation every 20 days produced the lowest values of characters mentioned previously.

The increases in traits of growth, yield and its components, and chemical composition of eggplant fruits due to approximating irrigation periods might be attributed to consistently providing hydration to eggplant plants, enabling greater growth and improving the vegetative growth characteristics of the plants. On the other hand, water stress during the vegetative stage hindered root development, which restricted deep water uptake, reducing leaf production and leaf membrane stability that led to low growth. These findings were obtained from a viewpoint that was comparable to that presented by Fouda (2021) and Opoku *et al.* (2024).

Influence of soil addition treatments:

In the same Tables, the geometric analysis of the collected data on the subject of traits of growth, yield and its components, and chemical composition of eggplant fruits understandable that studied soil addition treatments *i.e.* without soil addition (control treatment), zeolite soil addition at the rate of 500 kg/fed and polymer soil addition at the rate of 30 kg/fed revealed significant effects on all studied traits of growth, yield and its components, and chemical composition of eggplant fruits through both seasons. .

It could be noticed that polymer soil addition at the rate of 30 kg/fed produced the highest significant values of foliage dry matter, number of fruits/plant, early and total yields/fed, total carbohydrates, crude protein and fiber percentages, ascorbic acid (Vitamin-C) and proline contents and lowest values of nitrate (NO_3-N) and nitrite (NO_2-N) contents in the fruits through both times of year. Zeolite soil addition at the rate of 500 kg/fed came in the second rank after polymer treatment through both times of year. Adversely, the lowest values of traits of growth, yield and its components, and chemical composition of eggplant fruits were obtained from control treatment (without soil addition) through both seasons. .

These improvements in fruit chemical composition, yield and its components, and growth characteristics of eggplant allied with polymer or zeolite soil addition may be recognized to polymer has a significant impact on the hydro-physical characteristics of soil, preventing soil erosion, reducing water loss and nutrient leaching, and improving water quality due to gravity. In addition, zeolite can enhancing soil to retain water, increasing soil nutrients and improve its structure, resulting in an optimal environment for root growth and development. These results are in harmony with those recorded by Mnyika *et al.* (2020), Farooqi *et al.* (2022) and Ghazi *et al.* (2023).

Influence of applying sprays to the foliage treatments with antitranspirants:

Applying sprays to the foliage eggplant plants with potassium silicate at the rate of 250 ml/100 litres of water for every spraying exceeded other treatments of applying sprays to the foliage treatments with antitranspirants and produced the highest values of Foliage dry matter, number of fruits/plant, early and total yields/fed, total carbohydrates, crude protein and fiber percentages, ascorbic acid (Vitamin-C) and proline contents and lowest values of nitrate (NO_3-N) and nitrite (NO_2-N) contents in the fruits through both times of year. Followed by applying sprays to the foliage with chitosan at the rate of 500 mg/liter water in each spraying. Whereas, the lowest values of traits of growth, yield and its components, and chemical composition of eggplant fruits were resulted from control treatment (without foliar spraying) through both times of year (Tables 2 and 4).

These increases in vegetative growth characters of eggplant due to applying sprays to the foliage with antitranspirants (potassium silicate) may be ascribed to its profitable strategy that is able to alleviate the harmful impact of stress alongside increasing plant growth. Besides, applying sprays to the foliage with antitranspirants (chitosan) having a strong fungistatic effect, also it has other properties such stimulating the plant growth. These results were parallel with those reported by Hossaini *et al.* (2021), Devi *et al.* (2023) and Gad *et al.* (2023).

Influence of interactions:

The results showed that the three factors under study, irrigation times, soil addition treatments, and applying sprays to the foliage with certain antitranspirants

interacted in a variety of ways that had a substantial impact on the growth characteristics, yield and its components, and chemical components of fruits of eggplant through both seasons (Tables 2 and 4).

The triple interactions among irrigation periods, soil addition treatments and applying sprays to the foliage with some antitranspirants had significant effects on all studied traits of growth, yield and its components, and chemical composition of eggplant fruits through both seasons. The highest values of foliage dry matter, number of fruits/plant, early and total yields/fed, total carbohydrates, crude protein and fiber percentages, ascorbic acid (Vitamin-C) and proline contents and lowest values of nitrate (NO_3-N) and nitrite (NO_2-N) contents in the fruits were resulted from irrigation eggplant plants irrigation every 10 days, soil addition with polymer at 30 kg/fed and plants sprayed foliarly with potassium silicate at 2.50 ml/litre of water for every spraying through both seasons (Tables 3 and 5). While, irrigation eggplant plants irrigation every 20 days without soil addition and applying sprays to the foliage with any antitranspirants resulted in the lowest values of all characters mentioned previously through both seasons.

Table 2. Foliage dry matter, number of fruits/plant, early and total yields/fed of eggplant as affected by irrigation periods, soil addition treatments and applying sprays to the foliage with some antitranspirants as well as their interactions during 2022 and 2023 seasons.

Characters Treatments	Foliage dry matter (g)		Number of fruits/plant *		Early yield (ton/fed)		Total yield (ton/fed)	
Seasons	2022	2023	2022	2023	2022	2023	2022	2023
A. Irrigation periods:								
Irrigation every 10 days.	71.76	71.82	10.83	11.38	5.061	5.545	45.313	49.638
Irrigation every 15 days.	64.19	64.26	9.75	10.20	2.634	2.885	30.935	33.887
Irrigation every 20 days.	47.03	47.12	9.11	9.50	2.316	2.538	20.707	22.682
LSD at 5 %	0.16	0.15	0.53	0.60	0.605	0.618	1.273	1.305
B. Soil addition treatments:								
Without.	60.35	60.42	9.18	9.64	2.736	2.997	25.678	28.127
Zeolite at 500 kg/fed.	61.05	61.12	9.88	10.35	3.320	3.638	32.325	35.412
Polymer at 30 kg/fed.	61.58	61.65	10.63	11.09	3.955	4.332	38.953	42.668
LSD at 5 %	0.47	0.45	0.29	0.32	0.497	0.505	2.148	2.158
C. Applying sprays to the foliage treatments with antitranspirants:								
Without	59.50	59.56	9.20	9.67	2.313	2.533	23.382	25.615
Potassium silicate at 250 ml/100 liter	62.00	62.07	10.81	11.29	4.219	4.622	39.366	43.117
Chitosan at 500 mg/liter.	61.49	61.56	9.68	10.11	3.479	3.812	34.208	37.476
LSD at 5 %	0.28	0.27	0.33	0.31	0.371	0.385	0.923	1.003
D- Interactions (F. test):								
A × B	*	*	*	NS	*	*	*	*
A × C	*	*	*	*	*	*	*	*
B × C	*	*	NS	NS	*	*	*	*
A × B × C	*	*	*	*	*	*	*	*

***: count number of fruits per plant at 100 day after transplanting**

Table 3. Foliage dry matter, number of fruits/plant, early and total yields/fed of eggplant as affected by the interaction among irrigation periods, soil addition treatments and applying sprays to the foliage with some antitranspirants during 2022 and 2023 seasons.

Treatments			Foliage dry matter (g)		Number of fruits/plant *		Early yield (ton/fed)		Total yield (ton/fed)	
Irrigation periods	Soil additions	Spraying with anti-transpirants	2022	2023	2022	2023	2022	2023	2022	2023
Irrigation every 10 days	Without	Without	65.26	65.33	9.83	10.26	2.068	2.268	26.880	29.452
		Potassium silicate	73.24	73.30	11.00	11.50	5.170	5.662	45.248	49.557
		Chitosan	73.12	73.17	9.66	10.16	3.018	3.307	38.823	42.524
	Zeolite at 500 kg/fed	Without	68.74	68.78	10.16	10.83	3.904	4.278	33.927	37.167
		Potassium silicate	73.48	73.53	11.00	11.50	6.209	6.803	52.467	57.470
		Chitosan	73.31	73.36	10.50	11.00	5.817	6.383	48.802	53.478
	Polymer at 30 kg/fed	Without	69.95	70.03	10.83	11.50	3.907	4.277	37.541	41.123
		Potassium silicate	74.60	74.67	12.83	13.33	8.597	9.417	67.443	73.867
		Chitosan	74.15	74.19	11.66	12.33	6.856	7.510	56.690	62.105
Irrigation every 15 days	Without	Without	62.73	62.78	8.16	8.50	1.094	1.198	18.115	19.844
		Potassium silicate	64.48	64.55	10.66	11.00	2.531	2.772	29.065	31.835
		Chitosan	63.94	64.01	8.83	9.33	1.488	1.629	27.342	29.956
	Zeolite at 500 kg/fed	Without	64.16	64.23	8.16	8.66	1.400	1.531	22.257	24.386
		Potassium silicate	64.65	64.71	11.33	11.83	3.515	3.848	35.816	39.236
		Chitosan	64.03	64.11	9.50	10.00	2.731	2.992	32.760	35.884
	Polymer at 30 kg/fed	Without	64.26	64.30	9.00	9.50	3.207	3.511	26.784	29.335
		Potassium silicate	65.23	65.30	12.33	12.66	4.789	5.246	47.611	52.147
		Chitosan	64.26	64.34	10.33	10.66	3.362	3.684	38.665	42.362
Irrigation every 20 days	Without	Without	46.70	46.78	7.66	8.16	0.686	0.751	10.380	11.377
		Potassium silicate	47.10	47.21	8.50	9.00	3.077	3.375	19.577	21.435
		Chitosan	46.60	46.68	8.33	8.83	1.349	1.898	15.671	17.168
	Zeolite at 500 kg/fed	Without	46.80	46.88	9.16	9.33	1.664	1.481	16.897	18.512
		Potassium silicate	47.55	47.63	9.33	9.66	2.266	2.479	24.762	27.126
		Chitosan	46.75	46.85	9.16	9.50	1.731	1.825	23.236	25.449
	Polymer at 30 kg/fed	Without	46.88	46.95	9.66	10.00	2.562	2.805	17.658	19.336
		Potassium silicate	47.83	47.91	9.83	10.33	3.600	3.943	32.300	35.377
		Chitosan	47.09	47.18	9.83	10.33	3.502	3.835	25.883	28.360
LSD at 5 %			0.83	0.81	0.98	0.94	1.112	1.128	2.768	2.805

***: count number of fruits per plant at 100 day after transplanting**

Table 4. Total carbohydrates, crude protein and fiber percentages and ascorbic acid (Vitamin-C), proline, nitrate (NO3-N) and nitrite (NO2-N) contents in eggplant fruits as affected by irrigation periods, soil addition treatments and applying sprays to the foliage with some antitranspirants as well as their interactions during 2022 and 2023 seasons.

Characters Treatments Seasons	Total carbohydrates (%)		Crude protein (%)		Crude fiber (%)		Vitamin-C (mg/100 g FW)		Proline (%)		NO_3-N (ppm)		NO_2-N (ppm)	
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
A. Irrigation periods:														
Irrigation every 10 days.	28.93	29.00	18.34	18.41	6.84	6.90	1.96	1.99	5.61	5.65	23.56	23.65	1.226	1.252
Irrigation every 15 days.	28.69	28.76	18.18	18.24	6.74	6.80	1.88	1.91	5.59	5.62	23.71	23.83	1.237	1.266
Irrigation every 20 days.	28.46	28.48	17.86	17.94	6.62	6.68	1.72	1.75	5.56	5.60	24.01	24.09	1.246	1.275
LSD at 5 %	0.33	0.35	0.15	0.13	0.13	0.14	0.07	0.09	0.02	0.02	0.22	0.20	0.010	0.011
B. Soil addition treatments:														
Without.	27.12	27.17	17.51	17.60	6.36	6.47	1.65	1.68	5.26	5.34	24.66	24.78	1.488	1.517
Zeolite at 500 kg/fed.	29.11	29.19	17.96	18.02	6.75	6.82	1.89	1.91	5.58	5.60	23.63	23.72	1.150	1.174
Polymer at 30 kg/fed.	29.85	29.88	18.91	18.97	7.09	7.10	2.03	2.06	5.92	5.94	22.99	23.07	1.071	1.101
LSD at 5 %	0.35	0.32	0.30	0.29	0.20	0.17	0.16	0.15	0.04	0.05	0.12	0.14	0.017	0.018
C. Applying sprays to the foliage treatments with antitranspirants:														
Without	27.05	27.12	17.53	17.61	6.16	6.24	1.82	1.85	4.86	4.90	24.03	24.12	1.285	1.313
Potassium silicate at 250 ml/100 liter	29.81	29.87	18.66	18.73	7.18	7.22	1.89	1.92	6.01	6.05	23.54	23.64	1.171	1.196
Chitosan at 500 mg/liter.	29.23	29.25	18.19	18.25	6.86	6.92	1.85	1.88	5.89	5.93	23.70	23.81	1.253	1.283
LSD at 5 %	0.22	0.21	0.11	0.10	0.10	0.09	0.05	0.06	0.05	0.06	0.15	0.14	0.009	0.010
D- Interactions (F. test):														
A × B	NS	NS	*	*	NS	NS	NS	NS	*	NS	*	*	*	*
A × C	NS	*	NS	NS	NS	NS	NS	NS	*	*	NS	NS	*	*
B × C	*	*	*	*	*	*	*	*	*	*	*	*	*	*
A × B × C	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Table 5. Total carbohydrates, crude protein and fiber percentages and ascorbic acid (Vitamin-C), proline, nitrate (NO3-N) and nitrite (NO2-N) contents in eggplant fruits as affected by the interaction among irrigation periods, soil addition treatments and applying sprays to the foliage with some antitranspirants during 2022 and 2023 seasons.

Treatments			Total carbohydrates (%)		Crude protein (%)		Crude fiber (%)		Vitamin-C (mg/100 g FW)		Proline (%)		NO3-N (ppm)		NO2-N (ppm)	
Irrigation periods	Soil addition	Spraying with antitranspirants	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Irrigation every 10 days	Without	Without	25.27	25.28	17.33	17.53	5.98	6.02	1.88	1.88	4.61	4.65	24.80	24.91	1.397	1.413
		Potassium silicate	28.61	28.66	18.05	18.13	6.86	6.91	1.69	1.75	5.53	5.89	24.18	24.26	1.603	1.617
		Chitosan	28.49	28.57	17.98	18.08	6.74	6.82	1.80	1.83	5.74	5.78	24.08	24.16	1.387	1.423
	Zeolite at 500 kg/fed	Without	28.12	28.29	17.91	17.98	6.40	6.45	1.91	1.93	4.91	4.94	23.84	23.96	1.230	1.253
		Potassium silicate	30.19	30.26	18.33	18.35	7.22	7.27	2.09	2.12	6.06	5.92	22.95	23.02	0.987	1.017
		Chitosan	29.46	29.53	18.20	18.18	6.98	7.05	1.94	1.96	5.88	5.92	23.63	23.71	1.237	1.260
	Polymer at 30 kg/fed	Without	28.26	28.35	18.00	18.05	6.43	6.51	1.93	2.02	5.21	5.25	22.90	22.98	1.140	1.170
		Potassium silicate	31.12	31.18	20.18	20.24	7.79	7.84	2.23	2.26	6.45	6.34	22.85	22.91	0.977	1.003
		Chitosan	30.83	30.89	19.08	19.15	7.19	7.26	2.17	2.19	6.15	6.19	22.87	22.93	1.080	1.110
Irrigation every 15 days	Without	Without	25.12	25.19	17.11	17.18	5.90	5.98	1.73	1.77	4.57	4.61	25.05	25.15	1.447	1.513
		Potassium silicate	28.23	28.31	17.78	17.83	6.70	6.79	1.61	1.66	5.50	5.54	24.26	24.35	1.600	1.627
		Chitosan	28.17	28.23	17.73	17.80	6.46	6.53	1.60	1.64	5.72	5.75	24.18	24.53	1.423	1.483
	Zeolite at 500 kg/fed	Without	27.89	27.96	17.83	17.89	6.29	6.34	1.86	1.88	4.83	4.87	24.07	24.15	1.247	1.300
		Potassium silicate	30.05	30.12	18.21	18.28	7.16	7.20	2.04	2.06	6.03	6.07	22.99	23.13	0.983	0.990
		Chitosan	29.23	29.33	18.09	18.14	6.91	6.94	1.94	1.96	5.87	5.91	23.80	23.88	1.223	1.227
	Polymer at 30 kg/fed	Without	28.09	28.16	17.87	17.93	6.30	6.37	1.87	1.89	5.16	5.20	23.07	23.13	1.163	1.213
		Potassium silicate	30.94	31.01	20.05	20.09	7.70	7.78	2.14	2.17	6.48	6.52	22.93	23.08	0.927	0.940
		Chitosan	30.49	30.56	18.98	19.04	7.25	7.32	2.16	2.18	6.11	6.13	23.02	23.08	1.120	1.180
Irrigation every 20 days	Without	Without	24.85	24.90	16.75	16.80	5.61	6.01	1.61	1.63	4.55	4.58	25.16	25.22	1.487	1.483
		Potassium silicate	28.26	28.30	17.47	17.56	6.64	6.70	1.46	1.49	5.48	5.52	24.49	24.63	1.600	1.627
		Chitosan	27.05	27.10	17.39	17.46	6.35	6.46	1.46	1.50	5.71	5.75	25.76	25.84	1.450	1.467
	Zeolite at 500 kg/fed	Without	27.76	27.80	17.46	17.56	6.16	6.22	1.74	1.76	4.76	4.81	24.25	24.33	1.273	1.273
		Potassium silicate	30.06	30.12	18.00	18.15	6.99	7.06	1.79	1.81	6.02	6.05	24.12	24.18	0.963	0.983
		Chitosan	29.27	29.31	17.60	17.67	6.70	6.86	1.66	1.70	5.84	5.88	23.03	23.12	1.203	1.260
	Polymer at 30 kg/fed	Without	28.06	28.13	17.51	17.57	6.41	6.28	1.86	1.88	5.13	5.18	23.23	23.31	1.183	1.200
		Potassium silicate	30.80	30.88	19.85	19.93	7.56	7.47	1.99	2.01	6.52	6.57	23.09	23.14	0.903	0.957
		Chitosan	30.05	29.78	18.68	18.75	7.17	7.05	1.94	1.96	6.05	6.09	22.98	23.07	1.150	1.140
LSD at 5 %			0.66	0.65	0.33	0.32	0.31	0.29	0.31	0.30	0.08	0.10	0.45	0.43	0.028	0.030

CONCLUSION

From obtained results of this study it can be induced that irrigation eggplant plants irrigation every 10 days, soil addition with polymer at 30 kg/fed and plants sprayed foliarly with potassium silicate at 2.5 ml/l of water for every spraying to obtain maximum vegetative growth characters, yield and its components, chemical constituents of the leaves and fruits. While, in order to save irrigation water at the same time maintaining highest growth, productivity and fruit quality of eggplant, it could be recommended that irrigation plants irrigation every 15 days besides soil addition with polymer at 30 kg/fed and plants sprayed foliarly with potassium silicate at 2.5 ml/l water in each spraying. In spite of the soil was poor in N, P and K and the pH was highest (Table 1) before the beginning of the experiment, but the yield of the interaction among irrigation plants irrigation every 15 days besides soil addition with polymer at 30 kg/fed and plants sprayed foliarly with potassium silicate at 2.5 ml/l of water for every spraying gave high productivity and good quality. Therefore we recommended the second treatment (irrigation every 15 days) to save irrigation water within the natural circumstances of Egypt's Dakahlia Governorate's Sinbillawain District.

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تأثير فترات الري ومعاملات إضافة التربة والرش الورقي ببعض مضادات النتح على إنتاجية وجودة ثمار الباذنجان

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الملخص

أجريت هذه الدراسة في مزرعة خاصة بقرية برهمتوش، مركز السنبلاوين، محافظة الدقهلية، مصر، خلال موسمي النمو الصيفي ٢٠٢٢ و٢٠٢٣. وكان الهدف الرئيسي من هذه الدراسة توضيح تأثير فترات الري ومعاملات إضافة التربة والرش الورقي ببعض مضادات النتح وتفاعلاتها على النمو الخضري والمحصول ومكوناته والمكونات الكيميائية لثمار الباذنجان صنف سواد الليل. تمت الدراسة في التصميم التجريبي الشرائح المتعامدة المنشقة في قطاعات كاملة العشوائية في ثلاث مكررات. تم فصل القطع الرأسية بقنوات عميقة وكانت فترات ري (الري كل ١٠ ، ١٥ و٢٠ يومًا). وقد خصصت القطع الأفقية لثلاث معاملات إضافة تربة (بدون إضافة تربة، إضافة زيوليت بمعدل ٥٠٠ كجم/فدان وإضافة بوليمر بمعدل ٣٠ كجم/فدان). في حين خصصت القطع الشقية لثلاث معاملات رش ورقي بمضادات النتح (بدون رش ورقي، رش ورقي بسليكات البوتاسيوم بمعدل ٢,٥ مل/لتر ماء في كل رشة ورش ورقي بـالشيتوزان بمعدل ٠,٥ جم/لتر ماء في كل رشة). توضح النتائج المتحصل عليها أن فترات ري للباذنجان بالري كل ١٠ أيام أدى إلى الحصول على أعلى القيم للنمو الخضري والمحصول ومكوناته والمكونات الكيميائية لثمار الباذنجان. قد لوحظ أن إضافة البوليمر للتربة بمعدل ٣٠ كجم/فدان أعطت أعلى القيم للنمو الخضري والمحصول ومكوناته والمكونات الكيميائية لثمار الباذنجان. تفوقت معاملة رش نباتات الباذنجان ورقيًا بسليكات البوتاسيوم بمعدل ٢,٥ مل/لتر ماء في كل رشة على المعاملات الأخرى من معاملات الرش الورقي بمضادات النتح وأنتجت أعلى القيم للنمو الخضري والمحصول ومكوناته والمكونات الكيميائية لثمار الباذنجان.من النتائج المتحصل عليها من هذه الدراسة يمكن استنتاج أن ري نباتات الباذنجان كل ١٠ أيام وإضافة البوليمر للتربة بمعدل ٣٠ كجم/فدان ورش النباتات ورقياً بسليكات البوتاسيوم بمعدل ٢,٥ مل/لتر ماء في كل رشة أدى للحصول على أعلى صفات للنمو الخضري والمحصول ومكوناته والمكونات الكيميائية للأوراق والثمار. في حين أنه من أجل توفير مياه الري مع الحفاظ على أعلى نمو وإنتاجية وجودة ثمار الباذنجان. ومن الدراسة يمكن التوصية بري النباتات كل ١٥ يوماً إلى جانب إضافة البوليمر للتربة بمعدل ٣٠ كجم/فدان ورش النباتات ورقياً بسليكات البوتاسيوم بمعدل ٢,٥ مل/لتر ماء في كل رشة تحت الظروف البيئية لمركز السنبلاوين، محافظة الدقهلية، مصر.