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Effect potassium silicate foliar application and water stress by using different amounts of irrigation water supply on potato plants (*Solanum tuberosum* L.).

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Abstract

This study was carried out through two successive seasons (2021 and 2022) for investigating potassium silicate influence on potato plants (*Solanum tuberosum L*.) under water stress. It was aimed to enhance potato plants growth process and yield parameters by using different concentrations of potassium silicate (500 & 1000 ppm) as well as the control under different levels of water supply (100, 75 and 50% of ETc i.e. evapotranspiration) in sandy loam soil conditions at Belbeis region – El Sharkia Governorate, Egypt.

Data obtained during both experimental seasons revealed obviously that all the treatments enhanced both plants growth process and yield parameters as compared to control. However, spraying with potassium silicate (1000 ppm) with irrigation requirement (ETc 100% or 75%) particularly were statistically the highest treatments in this study, while the most effective treatment for water productivity was potassium silicate 1000 ppm combined with water supply ETc 75%, which produced 12.63 kg for every 1 meter cubic from irrigation water.

Keywords: potato plants, irrigation, evapotranspiration, spunta and potassium silicate

Introduction

In Egypt, potato is one of the most important crops as they are sensitive to soil moisture deficit. The cultivated area of potato in Egypt was about 475,000 fed. in 2020 producing 5,842,500 tons with an average of 12.30 tons fed^{-1} (Hectare is equivalent to 2.4 Feddan) (**Ministry of Agriculture, The Agricultural Statistics, 2020**). Potato production in the newly reclaimed soil, which a sandy soil in texture, low water, high evaporation rates, high salinity in water and soil, low fertility and organic matter content, it is not optimal for crop production, the amount of land allocated for potato production about 20% of the total cultivated area and crop yields in reclaimed areas are greater than those obtained in the old production areas of the Nile Delta and Villages. Most yield in reclaimed soil is primarily due to a reduction in common diseases, such as brown rot disease and others, which its negative effects on potato production in the Nile Delta and Valley (**Kabeil *et al*., 2008; Kabeil *et al*., 2008 and Arafa and El-Howeity, 2017**).

Drought, as abiotic stress increased mainly in arid and semi-arid regions like Egypt, causes a direct decline in crop growth may be across either decrease in cell elongation, cell turgor or cell volume due to covering of xylem and phloem vessels thus obstructing any translocations (**Banon *et al*., 2006 and Taha *et al*., 2019**). The potato plants are sensitive to water deficiency. In semi-arid and arid regions potato plants are grown under high day and night temperatures combined with a dry atmosphere, the irrigation is essential for a good crop production (**Arafa and El-Howeity, 2017**).

Potassium silicate is the name for a family of inorganic compounds. The most common potassium silicate has the formula K_2SiO_3, samples of which contain varying amounts of water. These are white solids or colorless solutions. The structural composition of potassium silicate molecules is as shown in Figure (1) (https://en.wikipedia.org/wiki/Potassium_silicate)

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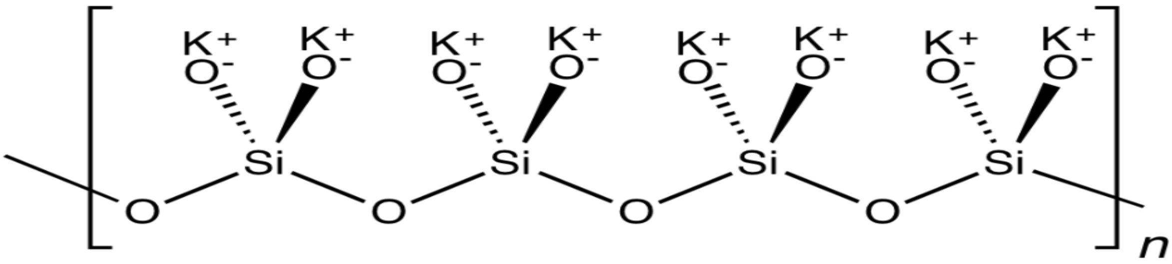

Figure 1: The structural composition of potassium silicate molecules

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Potassium silicate (K_2SiO_3) is used as a plant biostimulant and a source of both potassium (K) and highly soluble silicon (Si) (**Rodrigues *et al.*, 2009).** It enhances the plant potential under salt stress by reducing Na^+ absorption and increasing K^+ absorption in the leaves (**Yaghubi *et al.*, 2016).** Hence, Si can improve root architecture, plant growth, leaf erectness, photosynthesis, and water relations. Potassium is one of the essential elements of the plant and plays a pivotal role in the formation of sugars and starch, protein synthesis, cell division, growth, seed size and quality. Potassium has been shown to stimulate root length, vegetative growth, and osmoregulation and enhance physiological processes such as chlorophyll pigments, stomata movement, and water status (**Hasanuzzaman *et al.*, 2018).** Potassium has been proven to improve ionic balance and antioxidant enzymatic activity (**Ahmad *et al.*, 2016).** Potassium silicate could improve yield-related traits, seed yield and quality, and nutrient (N, P, and K) uptake (**Gomaa *et al.*, 2021).**

Silicon (Si) is abundantly present in soils, but it is not an essential element for plants (**Ashraf *et al.*, 2009**). However, importance of Si has been widely recognized for plants under stressful environments (**Li *et al.*, 2009; Parveen and Ashraf, 2010**). It has been reported that Si treatment could alleviate drought stress (**Hattori *et al.*, 2005**), salt stress (**Ibrahim *et al.*, 2015**), heat stress (**Ma, 2004**), and oxidative damage (**Zhu *et al.*, 2004**). According to **Epstein and Bloom (2005)**, Si does not appear to be beneficial to plants, in most cases, until some stress is imposed. The beneficial role of Si in alleviating stress in plants exposed to drought is mainly due to the enhancement in water relations and photosynthesis (**Maghsoudi *et al.*, 2015 and Ali *et al.*, 2019**).

Some reports have shown that potassium silicate effectively affects plant development, production, and quality (**Hafez *et al.*, 2021 and Liang *et al.*, 2007)**. As a consequence, enhancing the activities of enzymatic antioxidants during salinity stress retains the plasma-membrane functions, e.g., controlling the permeability, which contributes to higher root activity, strengthening the root's ability to acquire the necessary nutrients (**Ahmad *et al.*, 2019 and Salim *et al.*, 2019)**.

This study aimed to enhance potato plants growth process and yield parameters by using different concentrations of potassium silicate (control, 500 and 1000 ppm) under different levels of water supply (100, 75 and 50% of ETc i.e. evapotranspiration) in sandy loam soil conditions at Belbeis region – El Sharkia Governorate, Egypt.

1. Material and Methods

The present investigation has been carried out throughout two successive seasons (2021 and 2022) on potato plants cv. Spunta **(***Solanum tuberosum L.***)** to enhance growth process and yield parameters by using different concentrations of potassium silicate (500 & 1000 ppm) as well as the control under different levels of water supply (100, 75 and 50% of ETc i.e. evapotranspiration) in sandy loam soil conditions at Belbeis region – El Sharkia Governorate, Egypt, (30°20'42.3"N 31°37'24.5"E).

This experiment included 9 treatments, which were the interactions between three rates of evapotranspiration (100, 75 and 50% of ETc) and three concentrations of potassium silicate (control, 500 and 1000 ppm). The experimental layout was split plot system in a complete randomized block design with five replicates. Spraying with potassium silicate was randomly arranged in the main plots while evapotranspiration rates were randomly distributed in the sub plots.

The area of the experimental unit was 25 m^2 containing 5 rows with a length of 5.0 m and a width of 0.7 m and the distance between the rows was 30 cm, as well as the distance between the tubers within the row was 25 cm in the longitudinal direction and the distance between the tubers in the transverse direction was 55 cm, so the experimental unit contained 210 plants that is, a feddan contains 35,280 plants.

The tuber seeds were sown on 17^{th} of January in 2021 and 2022 seasons, respectively and the normal agriculture practices for growing potato plants were applied whenever required.

After twenty days from planting, potato plants were subject to three levels of water supply [50, 75 and 100 % of evapotranspiration (ETc)]. These treatments reflect conditions achieved as severe water stress, moderate and optimum level of water supply, respectively. The plants in every treatment were irrigated every 3 days, while the spraying of potassium silicate was applied at 30 and 60 days from planting.

The tested irrigation levels are based on different rates of irrigation water i. e. 2003.19, 1503.98 and 1001.99 m^3/fed./season, which resulted from the FAO – Penman -Moteith equation using meteorological data of the region and characteristics of the experimental trees as in the following tables:

Table 1: Reference crop evapotranspiration rate (ETo) calculated with CROPWAT V.8.00 computer program from meteorological data under Sharkia Governorate conditions using FAO – Penman – Moteith equation (Average of two years 2021&2022).

Month	Day	Stage	Number of days	ETo 100 %	Kc	ETc 100 %	ETc 75 %	ETc 50 %	W. R. for ETc 100% m^3/fed.	W. R. for ETc 75% m^3/fed.	W. R. for ETc 50% m^3/fed.
January	17-	Initial 25 days	15	1.93	0.8	1.54	1.16	0.77	97.02	73.08	48.51
February	1-		10	2.50	0.8	2.00	1.50	1.00	84.00	63.00	42.00
February	11-	Development	18	2.50	1.0	2.50	1.88	1.25	189.00	142.13	94.50
March	1-		12	3.42	1.0	3.42	2.57	1.71	172.37	129.53	86.18
March	13-	Mid-season 45 days	19	3.42	1.1	3.93	2.95	1.97	313.61	235.41	157.21
April	1-		26	4.82	1.1	5.54	4.16	2.77	604.97	454.27	302.48
April	26-	Late season 30 days	5	4.82	0.7	3.62	2.71	1.81	76.02	56.91	38.01
May	1-		25	5.92	0.7	4.44	3.33	2.22	466.20	349.65	233.10
Total	-	130	130	-	-	-	-	-	2003.1	1503.9	1001.9

W. R. = water requirements.

The tested treatments were evaluated throw the following parameters:

1.1. Vegetative growth:

Five plants were selected randomly from each replicate at 90 days after planting to measure plant height (cm), leaves area per plant (cm^2), Haulm fresh weight (g) and No. of main stems per plant.

1.2. leaf area

Leaf area (cm^2) was determined using discs of the leaf blades according to **Bremner and Taha (1966).**

1.3. Yield and its components:

At harvest, (after approximately 130 days from planting) plants that were produced from the inner rows of each plot were harvested and data were recorded for the tuber yield per plant (g) and total tubers yield (ton fed^{-1}) was recorded as the total weight of harvested tuber per plot and converted into ton per feddan.

1.4. Water productivity :

Water productivity values were calculated according to the following equation (**Jensen, 1983**). Water productivity = Yield (Kg per feddan) / Seasonal ETc (m^3 per feddan).

1.5. Canopy total water content

Potato plants arial biomass was cut above the ground for all studying plots. Thereafter, a representative subsample was placed in an oven at 70 C for 24 hours. Samples were weighted before and after drying to determine canopy water content. The percentage canopy water content was calculated using following equation:

$$Canopy\ water\ content = 100\ \frac{\text{fresh weight} - \text{dry weight}}{\text{dry weight}}$$

1.6. Leaf proline content:

The proline content of fresh leaves (μ moles/g fresh weight) was determined following the method adopted by **Bates *et al.*,1973.**

1.7. Starch percentage:

Starch percentage was determined according to the method described by **Dogras *et al.* (1991).**

1.8. Protein percentage:

Protein percentage was calculated according to **Ranganna (1977)**, using: Nitrite concentration was determined using a spectrophotometric method after color reaction with Griess reagent (**Polish standard method, 1992**).

1.9. Statistical analysis:

The experimental design was split plot system in a complete randomized block design with five replicates. spraying materials were randomly arranged in the main plots while evapotranspiration rates were randomly distributed in the sub plots. This experiment included 9 treatments, which were the interactions between three rates of evapotranspiration (ETc) and three potassium silicate concentration (control, 500 and 1000 ppm). The data obtained were statistically analyzed using the analysis of variance method as reported by **Snedecor and Cochran, 1980**. The differences between means were differentiated by using Duncan's range test **(Duncan, 1955)**.

2. RESULTS AND DISCUSSION

The data in Table (2) showed a great positive effect of potassium silicate concentrations under different rates of water evapotranspiration and their interaction on vegetative growth parameters of potato plants in both seasons.

There are statistically different values for the two tested spraying concentrations as compared to the control. This came true in the two seasons. The highest significant values for plant height in the first season were 54.64 cm with potassium silicate (1000 ppm) compared to the control which was 49.35 cm. For ETc, the highest significant values were 54.99 & 53.51 cm for ETc 100% & 75%, respectively

The present data in Table (3) illustrated that, all potassium silicate concentrations under different rates of water evapotranspiration and their interaction treatments had a great statically influence on yield and water productivity in both seasons. There are statistically different values for the two tested potassium silicate concentrations as compared to the control. This came true in the two seasons. The highest significant values for water productivity in the first season were 10.15 kg $m^{-3}$with potassium silicate (1000 ppm) as compared to the control which was 8.57 kg m^{-3}. For ETc, the highest significant values were 11.32 kg $m^{-3}$for ETc 75% as compared to

ETc 50% which was 7.72 kg m^{-3}. Additionally, the interaction between spraying potassium silicate and ETc rates effect, it was cleared that the highest significant values were 12.63 kg m^{-3}per potassium silicate (1000 ppm) combination with ETc 75%.

Moreover, the highest significant values for total yield in the first season were 15.55 ton $fed^{-1}$with potassium silicate (1000 ppm) as compared to the control which was 13.02 ton fed^{-1}. For ETc, the highest significant value was 18.28 ton $fed^{-1}$for ETc 100% as compared to ETc 50% which was 7.74 ton fed^{-1}. Additionally, the interaction between spraying potassium silicate and ETc rates effect, it was cleared that the highest significant values were 19.60 ton fed^{-1}per potassium silicate (1000 ppm) combination with

compared to 47.81 cm for ETc 50%. Regarding, the interaction between potassium silicate and ETc rates effect, it was clear that the highest significant values were found with potassium silicate (1000 ppm) combination to ETc 100%, which were 58.19 cm, while potassium silicate (1000 ppm) combination to ETc 75% came in the second rank with 56.46 cm.

The total leaves area, haulm fresh weight and numbers of stems per plant parameters showed a nearly similar trend as plant height parameter.

In this respect, our results are in agreement with those obtained by other researchers **Abdalla *et al.*, 2016; Abd El-Mageed *et al.*, 2017; Mustafa *et al.*, 2017; Youssef *et al.*, 2017; Abd-Elrahman and Taha, 2018; Ali *et al.*, 2019; Youssef and Hozayen, 2019 and Abd El-Wahed *et al.*, 2020.**

Generally, it can be observed that K-silicate gained the highest significant values compared with control. In this connection, this increase may be due to increased root growth by K-silicate application, and hence increases the ability of plants to absorb nutrients (N, P, and K) **(Singh *et al.*, 2005; Gomaa *et al.*, 2021 and Hafez *et al.*, 2021).**

ETc 100%, while potassium silicate (1000 ppm) combination to ETc 75% came in the second rank with 18.99 ton fed^{-1}. The tuber yield per plant (g) parameters cleared a nearly similar trend as the total yield parameter.

In this respect, our results are in agreement with those obtained by other researchers **Kassem and AL-Moshileh 2005; Onder *et al.*, 2005; Abdalla *et al.*, 2016; Abd El-Mageed *et al.*, 2017; Abd-Elrahman and Taha, 2018; Ali *et al.*, 2019 and Abd El-Wahed *et al.*, 2020.**

Regarding, it can be noticed that potassium silicate got the highest significant values compared with control. In this connection, this increase may be due to the presence of K in the K-silicate solution, which has a significant role in chlorophyll pigments, stomata movement, and water status, stimulating vegetative growth, formation of sugars and starch, protein synthesis, cell division, growth, scaling of roots, root length, as well as posing a potential for increasing yield by adjusting K fertilizer recommendation in the study area. Moreover, Si can improve root architecture, plant growth, leaf erectness, photosynthesis, and water relations (**Hasanuzzaman *et al.*, 2018 and Ali *et al.*, 2019 and Hafez *et al.*, 2021)**.

Table 2: Effect potassium silicate foliar application and water stress by using different amounts of irrigation water supply on vegetative growth parameters of potato plants (*Solanum tuberosum L.)* at 2021-2022 seasons.

Seasons	Factors	Treatments	Plant height (cm)		Total leaves area (cm^2)		Haulm fresh weight (g)		No. of stems per plant	
First season	**A**	PS 00 ppm	49.35	C	180.03	C	414.64	C	4.28	C
		PS 500 ppm	52.32	B	212.70	B	468.92	B	4.65	B
		PS 1000 ppm	54.64	A	241.72	A	531.05	A	4.95	A
	B	100% ETc	54.99	A	252.60	A	529.93	A	5.00	A
		75% ETc	53.51	A	229.71	B	504.75	B	4.84	A
		50% ETc	47.81	B	152.14	C	379.92	C	4.05	B
	Interaction	PS 00 ppm×100 ETc%	51.99	e	220.97	d	463.05	c	4.71	b
		PS 00 ppm×75 ETc%	49.81	f	184.32	e	430.19	d	4.43	c
		PS 00 ppm×50 ETc%	46.25	i	134.81	h	350.67	f	3.71	d
		PS 500 ppm×100 ETc%	54.79	c	247.30	c	517.59	b	4.95	b
		PS 500 ppm×75 ETc%	54.27	d	243.27	c	508.90	b	4.91	b
		PS 500 ppm×50 ETc%	47.91	h	147.53	g	380.27	e	4.08	c
		PS 1000 ppm×100 ETc%	58.19	a	289.53	a	609.15	a	5.33	a
		PS 1000 ppm×75 ETc%	56.46	b	261.55	b	575.16	a	5.17	a
		PS 1000 ppm×50 ETc%	49.26	g	174.08	f	408.83	e	4.35	c
Second season	**A**	PS 00 ppm	50.88	C	188.10	C	461.87	C	3.63	C
		PS 500 ppm	52.35	B	216.24	B	525.08	B	4.09	B
		PS 1000 ppm	54.91	A	241.08	A	568.88	A	4.54	A
	B	100% ETc	54.37	A	250.77	A	579.00	A	4.47	A
		75% ETc	53.59	A	230.60	B	552.64	B	4.31	B
		50% ETc	50.18	B	164.06	C	424.19	C	3.47	C
	Interaction	PS 00 ppm×100 ETc%	52.27	e	230.97	d	538.14	c	3.94	c
		PS 00 ppm×75 ETc%	51.25	f	192.43	e	488.16	d	3.71	c
		PS 00 ppm×50 ETc%	49.13	h	140.91	g	359.30	f	3.24	e
		PS 500 ppm×100 ETc%	53.57	c	245.3	c	579.97	b	4.43	b
		PS 500 ppm×75 ETc%	53.26	d	242.22	c	569.61	b	4.32	b
		PS 500 ppm×50 ETc%	50.21	g	161.19	f	425.66	e	3.52	c
		PS 1000 ppm×100 ETc%	57.26	a	276.03	a	618.89	a	5.05	a
		PS 1000 ppm×75 ETc%	56.27	b	257.15	b	600.15	a	4.90	a
		PS 1000 ppm×50 ETc%	51.20	f	190.07	e	487.61	d	3.66	c

PS = Potassium silicate, PPM= parts per million and ETc = evapotranspiration.
Mean followed by the same letter\s within each column are not significantly different from each other at 0.5% level.

The existing data in Table (4) supply that, all potassium silicate concentrations under different rates of water evapotranspiration and their interaction treatments had a major statically impact on total water content, proline, starch and protein parameters in both seasons.

Generally, there are statistically different values for the two tested potassium silicate concentrations as compared to the control. This came true in the two seasons.

The highest significant values for total water content in the first season were 87.38% with potassium silicate (1000 ppm) as compared to the control which was 82.80%. For ETc, the highest significant values were 87.19 & 86.46 % for ETc 100% & 75% as compared to 81.60 for ETc 50%. Regarding the interaction between spraying potassium silicate and ETc rates effect, it was clear that the highest significant values were found with potassium silicate (1000 ppm) combination to ETc 100% or 75%, which were 89.77% and 89.29%, respectively. The starch% and protein% parameters showed a nearly similar trend as the total water content parameter.

Table 3: Effect potassium silicate foliar application and water stress by using different amounts of irrigation water supply on yield parameters of potato plants (*Solanum tuberosum L.)* at 2021-2022 seasons.

Seasons	Factors	Treatments	Tuber yield per plant (g)		Yield per fed. (ton)		Water productivity (kg m^{-3})	
First season	**A**	PS 00 ppm	369.24	C	13.02	C	8.57	C
		PS 500 ppm	410.15	B	14.47	B	9.45	B
		PS 1000 ppm	440.76	A	15.55	A	10.15	A
	B	100% ETc	518.33	A	18.28	A	9.13	B
		75% ETc	482.43	B	17.02	B	11.32	A
		50% ETc	219.39	C	7.74	C	7.72	C
	Interaction	PS 00 ppm×100 ETc%	467.97	c	16.51	c	8.24	e
		PS 00 ppm×75 ETc%	430.27	d	15.18	d	10.09	c
		PS 00 ppm×50 ETc%	209.47	f	7.39	f	7.38	f
		PS 500 ppm×100 ETc%	531.46	b	18.75	b	9.36	d
		PS 500 ppm×75 ETc%	478.74	c	16.89	c	11.23	b
		PS 500 ppm×50 ETc%	220.24	f	7.77	f	7.75	f
		PS 1000 ppm×100 ETc%	555.56	a	19.60	a	9.78	c
		PS 1000 ppm×75 ETc%	538.27	b	18.99	b	12.63	a
		PS 1000 ppm×50 ETc%	228.46	e	8.06	e	8.04	f
Second season	**A**	PS 00 ppm	346.47	C	12.22	C	8.03	C
		PS 500 ppm	385.87	B	13.62	B	8.97	B
		PS 1000 ppm	410.34	A	14.47	A	9.48	A
	B	100% ETc	482.62	A	17.03	A	8.50	B
		75% ETc	447.56	B	15.79	B	10.50	A
		50% ETc	212.49	C	7.50	C	7.48	C
	Interaction	PS 00 ppm×100 ETc%	442.18	c	15.60	c	7.79	e
		PS 00 ppm×75 ETc%	401.08	d	14.15	d	9.41	c
		PS 00 ppm×50 ETc%	196.15	f	6.92	f	6.91	f
		PS 500 ppm×100 ETc%	477.04	b	16.83	b	8.40	d
		PS 500 ppm×75 ETc%	464.29	b	16.38	b	10.89	b
		PS 500 ppm×50 ETc%	216.27	e	7.63	e	7.61	e
		PS 1000 ppm×100 ETc%	528.63	a	18.65	a	9.31	c
		PS 1000 ppm×75 ETc%	477.32	b	16.84	b	11.20	a
		PS 1000 ppm×50 ETc%	225.06	e	7.94	e	7.92	e

PS = Potassium silicate, PPM= parts per million and ETc = evapotranspiration.
Mean followed by the same letter\s within each column are not significantly different from each other at 0.5% level.
Hectare is equivalent to 2.4 Feddan

For leaves proline content, the lowest significant value was 19.40 mg g^{-1}FW. with potassium silicate (1000 ppm) as compared to the control which was 25.68 mg g^{-1}FW. Where, the lowest significant values were 19.09 & 20.67 mg g^{-1}FW. for ETc 100%&75% as compared to ETc 50%, which was 27.50 mg g^{-1}FW. Regarding the interaction between spraying potassium silicate and ETc rates effect, it was clear that the lowest significant values were found with potassium silicate (1000 ppm) combination to ETc 100%, which was 15.45 mg g^{-1}FW. This came true in the two seasons.

In this respect, our results are in agreement with those obtained by other researchers **Kassem and AL-Moshileh 2005; Onder *et al.*, 2005; Abd El-Mageed *et al.*, 2017; Abd-Elrahman and Taha, 2018; Ali *et al.*, 2019 and Abd El-Wahed *et al.*, 2020.** According to **Savant *et al.*, 1999 and Ma, 2004** Si reduces the negative effects of drought stress on plants because it gets deposited beneath the cuticle layer of leaves forming a Si-cuticle double layer that increases the rigidity of cell wall and hence reduces water loss through transpiration. **Agarie *et al.*, 1998** found that deposition of Si in the cell wall of rice increased internal storage of water and reduced transpiration rate under drought stress.

Moreover, the presence of K in the K-silicate solution has a significant role in water status, formation of sugars, starch, as well as protein synthesis, (**Hasanuzzaman *et al.*, 2018; Ali *et al.*, 2019 and Hafez *et al.*, 2021)**.

Table 4: Effect potassium silicate foliar application and water stress by using different amounts of irrigation water supply on water content and some chemicals parameters of potato plants (*Solanum tuberosum L.)* at 2021-2022 seasons.

Seasons	Factors	Treatments	Total water content %		proline mg g^{-1}FW.		Starch %		protein %	
First season	A	PS 00 ppm	82.80	C	25.68	A	10.60	C	8.33	C
		PS 500 ppm	85.07	B	22.18	B	11.20	B	8.71	B
		PS 1000 ppm	87.38	A	19.40	C	11.78	A	9.19	A
	B	100% ETc	87.19	A	19.09	B	11.70	A	9.25	A
		75% ETc	86.46	A	20.67	B	11.54	A	9.09	A
		50% ETc	81.60	B	27.50	A	10.34	B	7.89	B
	Interaction	PS 00 ppm×100 ETc%	84.56	c	22.80	d	11.03	b	8.89	c
		PS 00 ppm×75 ETc%	83.53	c	24.81	c	10.70	c	8.64	c
		PS 00 ppm×50 ETc%	80.31	d	29.42	a	10.06	c	7.46	d
		PS 500 ppm×100 ETc%	87.25	b	19.01	e	11.67	b	9.18	b
		PS 500 ppm×75 ETc%	86.55	b	20.15	e	11.62	b	9.15	b
		PS 500 ppm×50 ETc%	81.40	d	27.38	b	10.31	c	7.79	d
		PS 1000 ppm×100 ETc%	89.77	a	15.45	g	12.39	a	9.67	a
		PS 1000 ppm×75 ETc%	89.29	a	17.06	f	12.29	a	9.48	a
		PS 1000 ppm×50 ETc%	83.08	c	25.70	c	10.65	c	8.41	c
Second season	A	PS 00 ppm	82.08	C	23.85	A	10.56	C	8.56	C
		PS 500 ppm	84.68	B	21.50	B	11.13	B	8.83	B
		PS 1000 ppm	87.15	A	17.87	C	11.86	A	9.23	A
	B	100% ETc	87.08	A	17.61	B	11.93	A	9.21	A
		75% ETc	86.16	A	19.23	B	11.54	A	9.08	A
		50% ETc	80.66	B	26.38	A	10.07	B	8.33	B
	Interaction	PS 00 ppm×100 ETc%	84.30	c	20.81	c	11.20	b	8.90	c
		PS 00 ppm×75 ETc%	83.04	c	23.22	b	10.66	c	8.72	c
		PS 00 ppm×50 ETc%	78.89	d	27.53	a	9.82	d	8.07	d
		PS 500 ppm×100 ETc%	87.16	b	18.49	c	11.80	b	9.12	b
		PS 500 ppm×75 ETc%	86.37	b	19.20	c	11.59	b	9.12	b
		PS 500 ppm×50 ETc%	80.50	d	26.82	a	9.99	d	8.25	d
		PS 1000 ppm×100 ETc%	89.78	a	13.53	e	12.80	a	9.61	a
		PS 1000 ppm×75 ETc%	89.08	a	15.28	d	12.38	a	9.41	a
		PS 1000 ppm×50 ETc%	82.58	c	24.80	b	10.40	c	8.66	c

PS = Potassium silicate, PPM= parts per million and ETc = evapotranspiration.
Mean followed by the same letter\s within each column are not significantly different from each other at 0.5% level.

3. CONCLUSION

On the data of the present investigation, it is concluded that potato plants (*Solanum tuberosum L.*) treated by using potassium silicate (1000 ppm) combined with water supply (100 or 75 of ETc) enhanced vegetative growth and gained economic yield as compared to the control, while the most effective treatment for water productivity was potassium silicate 1000 ppm combined with water supply ETc 75%, which produced 12.63 kg for every 1 meter cubic from irrigation water.

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