Effect of Anti-Transpirants foliar application on productivity and quality of Egyptian cotton under water stress conditions in clay soils

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Abstract

Two field experiments were conducted at Sakha, Agricultural Research Station, Egypt in two growing seasons during 2021 and 2022 seasons, to study the effect of three irrigation intervals (every 15, 30 and 45 days) and four foliar application with some anti-transpirants (without , linseed Oil (7%), Pure Gylatine (1.5 %) Magnesium Carbonate for dusting (250 g / plot), Potassium Silicate (3cm^3 K_2SiO_3 / liter) on the growth, productivity, quality of Egyptian cotton plants (Super Giza 94 cultivar) and some water relations .The experiment was designed by using split plot design with three replicates. The results showed that, irrigation cotton plants every 30 days significantly increased leaf water content%, chlorophyll (a) in the second season, chlorophyll (b), number of open bolls / plant, earliness % in the second season, seed cotton yield, boll weight, seed index all in the two growing seasons compared with other two irrigation intervals. On the other hand, irrigation every 15 days was more effective on plant height, number of fruiting branches per plant in both seasons, fineness in the first season, fiber length in the second season and fiber strength in the two seasons. Foliar application of anti- transpirants significantly increased in the most studied characters, leaf water content%, chlorophyll a and b , plant height, number of fruiting branches, number of open bolls, earliness %, seed cotton yield, boll weight , seed index , fiber fineness , fiber strength and fiber length except fiber uniformity which was not affected in the two seasons as compared with the control in the two seasons. The highest values were obtained from potassium silicate compared with other anti- traspirants.

Concerning the interaction effect between irrigation interval and anti-transpirants , the data indicated that the application of Potassium Silicate and irrigation cotton plants every 30 days produced the highest significant increase in leaf water content %, chlorophyll a , chlorophyll b , number of fruiting branches ,seed cotton yield and earliness % in the first and second season .

Key words: cotton, anti-transpiration, irrigation, intervals and yield.

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Introduction

"White gold" is the famous name of cotton; it takes this fame from its importance in the economy. It is the main cash crop of Egypt.

All over the world, especially in arid and semi-arid regions that were water limitation resources which effects badly on the yield and growth, which is considered the most harmful stresses in the plant environment and reduces plant growth and development (**Garcia *et al*., 2019**).

Water deficit conditions, permanent or temporary, limits the growth and the distribution of natural vegetation and the performance of cultivated plants more than any other environmental factor. In order to this study aimed of investigating the effect of foliar application of anti-transpirants for reducing the bad effect of water deficit. Water, not only ecologically but also physiologically, is of great importance, because it contributes to most of the internal processes in plants and almost all the metabolic activities in plant cells, depend on water **(Norozpoor and Rezvani, 2002، Safikhani *et al*., 2007**). Shortage of absorbed water by plants can cause a series of morphological, physiological and biochemical changes as following: reduced swelling and cell growth.

Linseed oil Anti-transpirant film reduces mechanically not only stomata and cuticle transpiration but also gas exchanges. As most of the water absorbed by plants is lost by transpiration, reducing plant transpiration could conserve absorbed water and minimize plant stress. The goal of this study is to investigate the conditions of anti-transpirant use without affecting gas exchanges on leaves.

Pure Gylatine has a unique amino acid composition with a high percentage of proline and hydroxyproline. We use it as a foliar applied of cotton leaves to make a film on the surface of the leaves. Different types of hydrolyzed collagen, including granulated gelatin and gelatin hydrolysate.

Magnesium Carbonate is used as an anti-transparent. Film particle technology impacts on plant during water stress; it can reduce the bad effects of water stress through improved physiological processes which leading to efficient yield (**Rosati *et al*., 2006**). The compound developed an anti-transparent layer on leaf surface that enhanced the grapevines' enhanced phenolic content and antioxidant capacity (**Dinis *et al*., 2016**).

Potassium silicate agent led to reduction by 20% of recommended amount of water added using anti-transpiration agent improving water use efficiency by reducing leaf transpiration rate, decrease leaf water loss. Present study aims to investigate the possibility of improving the yield and yield components of cotton yield through anti-transpiration compounds under water deficit stress **(Ferraz *et al*. , 2017).**

The main objective of this present investigation was to study the effect of foliar application of some anti-transpirents and irrigation intervals on the growth, productivity, quality and some water relations for Egyptian cotton under clay soils.

Materials and Methods

Two field experiments were carried out in 2021 and 2022 seasons at Sakha Agricultural Research Station farm / kafr Elshiekh Governorate, Egypt. The study was conducted using split plot design with three replicates, so that the main plots would include irrigation intervals (every 15, 30 and 45 days) and the subplots would include anti-transpirants (without , linseed Oil (7%), Pure Gylatine (1.5 %) Magnesium Carbonate by dusting (250 g / plot), Potassium Silicate (3cm^3 K_2SiO_3 / liter) Each subplot was considered to be 400 cm long and 70 cm wide in five rows and distance between rows was 70 cm, each plot was 14 m^2 .

Preceding crop was Egyptian clover in both seasons. Chemical analyses for the experimental field were done at Sakha agricultural Research Station. Soil samples air dried crushed, some physical and chemical properties were determined according to **Black *et al*. (1965)** and **Jackson, (1967)** some soil chemical and physical properties (Table 1).

Table 1: Some chemical properties of the top experimental soil at 2021 and 2022 seasons.

Characters				
	PH	**EC(ds m⁻)**	**O.M (%)**	**ESP (%)**
2021 **2022**	8.22 8.18	7.33 7.41	1.56 1.65	21.27 20.72
Particle Size Distribution (%)				
	Sand	**Silt**	**Clay**	**Texture grad**
2021 **2022**	28.22 28.76	24.11 24.60	47.67 46.64	Clayey Clayey
Soluble Cations (meq L^{-1})				
	Ca^{+2}	**Mg^{+2}**	**Na^{+}**	**K^{+}**
2021 **2022**	7.32 8.11	5.12 5.38	24.22 23.67	0.38 0.34
Soluble Anions (meq L^{-1})				
	Co_3^{-2}	**Hco_3^{-}**	**Cl^{-}**	**$So4^{-2}$**
2021 **2022**	-- --	4.01 3.98	20.00 21.13	13.03 12.39

Note: So_4^{--} was determined by the difference between soluble cations and anions.

Meteorological Data

Meterological conditions during the two experimental growing seasons (mean of the two seasons 2021 and 2022) for Sakha area are presented in Table (2).

Humidity, temperature and evaporation had a positive effect relationship between plant height, stem elongation rate, number of squares and bolls. Also, cotton plants need humidity during vegetative growth. **(Roussopoulos *et al*., 1998).**

This table (Table 2) can construes the balance between vegetative and reproductive development which influenced by many factors such as temperature, humidity and evaporation especially in water deficit conditions. Anti-transpirents able to reduce evaporation from cotton leaf especially in squaring and flowering stage (**Sawan *et al*., 2006)**

Table 2: mean of some meteorological data at Kafr Elshiekh area as means of the two growing seasons 2021 and 2022

Months		T (c°)		RH%		Wind Velocity (km / 24 hr)	Pan Evap. (mm)
		Max	Min	7:30	13:30		
April (DAYS)	1-10	29.2	19.6	78.3	44.4	99.1	497.8
	11-20	22.6	19.0	74.2	54.2	130.9	530.3
	20-30	28.3	20.5	76.0	42.1	104.8	607.3
May (DAYS)	1-10	27.5	20.7	75.8	44.1	107.6	528.9
	11-20	29.8	21.7	80.2	44.9	103.3	727.3
	20-31	32.3	23.1	81.3	44.1	92.0	807.2
June (DAYS)	1-10	33.6	25.2	83.1	49.1	59.4	745.9
	11-20	32.6	22.9	75.4	50.0	87.7	724.2
	20-30	32.9	26.2	81.2	52.2	111.3	763.6
July (DAYS)	1-10	30.1	26.3	86.5	55.0	104.8	825.1
	11-20	32.6	26.3	57.3	85.7	111.3	800.4
	20-31	34.1	25.1	52.1	90.0	107	754.5
August (DAYS)	1-10	33.4	25.5	89.2	57.8	96.4	741.2
	11-20	33.6	25.6	90.4	55.2	100.8	767.3
	20-31	36.1	27.3	53.7	89.8	117.3	727.8
September (DAYS)	1-10	33.0	29.7	85.1	54.2	120.2	728.5
	11-20	32.2	25.3	81.5	56.3	80.8	582.0
	20-30	33.8	25.5	84.1	55.1	89.0	537.4
October (DAYS)	1-10	30.6	21.9	82.5	58.1	84.0	435.4
	11-20	28.7	26.2	90.0	72.0	84.1	295.0
	20-30	29.9	25.9	101.6	70.3	95.3	267.5

Source: Meteorological station at Sakha 31-07' N Latitude, 30-57' E longitude, about 6 metres above mean sea level.

Field Experiment

A) Experimental layout and treatments distribution.

Cotton seeds of Super Giza 94 (cultivar) were planted on the middle of April. The experiment was designed in split plot with three replicates. Main-plot treatments for irrigation intervals by (irrigation every 15, 30 and 45 days), five subplot treatments were designed for foliar application with anti-transpirants in the rate of (linseed Oil (7%), Pure Gylatine (1.5 %) Magnesium Carbonate for dusting (250 g / plot), Potassium Silicate (3cm^3 K_2SiO_3 / liter), plus a non-sprayed control subtreatment). Phosphorus fertilizer in the form of superphosphate (15.5% P_20_5) at the rate of 31 kg P_20_5/fed. was applied during land preparation. Nitrogen fertilizer in the form of ammonium nitrate (33.5% N) at the rate of 60 kg N/fed. was applied in two equal doses, the first dose after thinning and before the second irrigation, the second dose before the third irrigation. Potassium fertilizer as potassium sulfate (48% K_2O) at the rate of 48 Kg K_2O/fed. Cotton leaf worm insecticide(s) was applied as a common treatment for all the field area when necessary. After 30 days from sowing, thinning was done, so 2 uniform plants were left in each hill. Foliar application of cotton plants with anti-transpirants was used to improve cotton drought tolerance under different levels of irrigation intervals. anti-transpirant were sprayed after 50 days from sowing (beginning of square) and 65 days from sowing (beginning of flowering stage).

B) Studied characters:

The following data were recorded:

A- Ten plants per plot were randomly selected for measurement of yield components. The length of the selected plants was measured in cm from two cotylendonary nodes to the terminal boll.

1- Plant height (cm).
2- No. of fruiting branches / plant.
3- No. of open bolls / plant. Average number of mature bolls / plant.
4- Boll weight (g). Average weight of open bolls / plant (g).
5- Seed cotton yield (kentar /fed), (kentar = 157.5 kg of seed cotton).
6- Seed index (g). The weight of 100 seeds.
7- Earliness (%).

B- Water Relations.

Relative water content % (RWC) of leaves was measured at flowering (at 70 days old) stage at 8:00 am. fully developed 3rd leaf from the top was used for RWC measurement. Immediately after cutting, leaves were sealed within plastic bags and kept in ice box and quickly transferred to the laboratory. The fresh weight of leaves from each treatment was recorded just after removal. Turgid weight (TW) was obtained after soaking leaves in distilled water in beakers for 24 hours at room temperature (about 20ºC) and under low light condition of the laboratory. After soaking, leaves were quickly and carefully blotted dried with tissue paper in preparation for determining turgid weight. Dry weight (DW) of the leaf was obtained after oven drying the leaf samples for 72 hour at 70ºC. RWC was calculated using the formula of **Schonfeld *et al.* (1988)**: RWC (%) = (FW – DW) / (TW – DW) x 100 Where, FW = Fresh weight , DW = Dry weight TW = Turgid weight

C- Photosynthetic pigments:-

Chlorophyll (a) and chlorophyll (b) (mg/g dwt) in fresh leaves were determined using the method described by **Lichtenthaler and Buschmann (2001)**. The samples were taken fron the forth leaf from the upper of plant in 75 days after sowing by using 85(%) acetone. The absorbance was determined by using Spectrophotometer model 390 at wave lengths of 662, 644 and 440 mm, as follows:

Chlorophyll A = (9.784 x E662) - (0.99 x E 644).

Chlorophyll B = (21.426 x E644) - (4.62 x E 662).

Where, E = Optical density at the given wave length

D- After the harvest, seed cotton samples were ginned on a mini-laboratory roller-gin for lint quality. All fiber testes performed at the laboratories of cotton Res. Inistitute, Agr.Res.Cen. Under control conditions .Fiber quality properties were determined according to ASTM (**D3818-1967**).

1- Fiber fineness:- It was expressed as (Micronair units) reading which measure of fiber fineness and is related to maturity.

2- Fiber strength:- It was determined as (Pressley index). Fiber strength is closely related to yarn and fabric strength and spinning efficiency.

3- Fiber length:- It was determined by the digital fibrograph according to the standard method of testing the fiber length at 2.5 % Upper half mean length. Fiber length is a good indicator of yarn strength and spinning efficiency.

4-Uniformity index:- length uniformity measures the degree of uniformity in a sample, which is related to spinning of efficiency, yarn uniformity and yarn strength.

II- Applied water (AW, M^3 / fed.)

AW = IW

Where,

AW = applied water (m3 / fed) and IW = Irrigation water delivered to the field plot.

Irrigation water delivered.

Submerged flow orifice with fixed dimension were used in convey and measure the irrigation water applied, as the following equation (**Michal, 1978**)

$$Q = CA\sqrt{2\ gh}$$

Where:

Q = Discharge through orifice, ($cm^3\ sec^{-1}$).

C= Coefficient of discharge (0.61).

A= Cross sectional area of orifice, cm^2.

G= Acceleration due to gravity, cm / sec^{-2}.

H= pressure head, over the orifice center cm.

III- The intervals of irrigation was every 15, 30 and 45 days for I_1, I_2 and I_3 respectively.

Note : Amount of water delivered was calculated by multiplied Q * T

T : where , T time of plot irrigation.

1- Productivity of irrigation water (PIW , Kg / m^3)

Productivity of irrigation water (PIW) as calculated according to **(Ali *et al*., 2007)**

PIW = Y/AW

Where:

PIW = productivity of irrigation water (kg / m^3).

Y= Yield (kg / fed.) and AW= applied water (m^3/ fed.)

E- Statistical Analysis:

Significance of the difference among treatments was tested using the analysis of variance (ANOVA) according to **Snedecor and Cochoran (1972)**, using

STATISTICA program. Comparison between means of treatments was carried out significance level using least significant difference test (LSD) at 5% probability according to **Walter and Duncan (1969)**.

Results and Discussion

A- Amount of seasonal irrigation water applied (m^3/ fed)

A. 1- Amount of seasonal applied water (m^3 / fed).

Presented data in Table (3) showed that the amount of applied water were affected by irrigation intervals where the highest values were recorded under the shortest irrigation intervals (15 days), but the lowest were recorded under irrigation interval (45 days) . Data also indicated that the values of seasonal applied water were not affected by foliar application of anti-transpirants. The values of seasonal applied water can be descended in order irrigation every 15 days > irrigation every 30 days > irrigation every 45 days.

A. 2- Productivity of irrigation water / m^3 / fed.

Data in the same table illustrated that the values of PIW were affected by irrigation intervals where the highest value was recorded under irrigation interval (30 days). On the contrary the lowest values were recorded under the shortest irrigation interval (15 days). **Bittelli *et al.* (2001)** elucidated that foliar application of antitranspirant caused reduction of plants transpiration through partial or full closure of stomata.

Table 3: Effect of irrigation intervals and foliar application of anti-transpirants on seasonal amount of water applied (m^3 / fed) and productivity of irrigation water PIW, Kg / m^3) for cotton plants in the two seasons.

			First season		Second season		The overall mean values through the two seasons	
Irrigation intervals	Foliar treatments	Ir. Nu.	Water applied (m3 / fed)	PIW g/m^3	Water applied (m3 / fed)	PIW g/m^3	Water applied (m3 / fed)	PIW g/m^3
Every 15 days	B1: Control; B2: Linseed oil; B3: pure Gylatin; B4: Magnesium Carbonates; B5: Pottasium Silicate	I_1	344.35	21.16	273.31	28.27	308.83	24.72
		I_2	335.49		265.50		300.59	
		I_3	339.68		269.23		304.45	
		I_4	342.95		271.79		307.37	
		I_5	346.45		274.36		310.41	
		I_6	348.55		276.23		312.39	
		I_7	353.45		282.55		318.00	
		I_8	356.95		282.99		319.97	
Mean			346.01		274.50		310.26	
Every 30 days	B1: Control; B2: Linseed oil; B3: pure Gylatin; B4: Magnesium carbonates; B5: Pottasium Silicate	I_1	342.95	37.46	271.63	55.76	307.29	46.61
		I_2	331.05		262.28		296.67	
		I_3	337.70		267.39		302.55	
		I_4	-----------		-----------		----------	
		I_5	347.15		272.42		309.79	
		I_6	-----------		-----------		-----------	
		I_7	349.25		274.92		312.09	
		I_8	-----------		-----------		---------	
Mean			213.51		168.58		191.05	
Every 45 days	B1: Control; B2: Linseed oil; B3: pure Gylatin; B4: Magnesium carbonates; B5: Pottasium Silicate	I_1	341.90	34.73	270.74	48.41	306.32	41.57
		I_2	331.75		262.84		297.30	
		I_3	335.25		265.40		300.25	
		I_4	-----------		-----------		----------	
		I_5	-----------		-----------		-----------	
		I_6	347.50		275.22		311.36	
		I_7	-----------		-----------		----------	
		I_8	-----------		-----------		-----------	
Mean			169.55		134.28		151.92	

Ps: I_1 (Sowing irrigation), I_2 (Planting and first irrigation), I_3 (Second irrigation), I_4 (Third irrigation), I_5 (Fourth irrigation), I_5 (Fifth irrigation), I_6 (Six irrigation), I_7 (Seventh irrigation) and I_8 (Eight irrigation)

A) Photosynthetic pigments:

Recorded data in Table 4 cleared those photosynthetic pigments (Chlorophyll a, b) and leaf water content were affected by irrigation intervals and foliar application with different transpirants as well as their interaction. Irrigation every 30 days was more effective by gaving the highest values of these characters (Chl. a, Chl. b and leaf water content) compared with other two irrigation intervals. Shortage of absorbed water by plants can cause a series of morphological, physiological and biochemical changes as following: reduced swelling and cell growth, thereby, reducing the leaf area and plant height, closure of stomata and photosynthesis limitation, increased soluble compounds for adjusting osmotic pressure, reduction in nutrients uptake and ultimately decrease in the plant productivity, and these reactions create different effects, depending on the plant’s growth phase, and severity and duration of the stress **(Lebaschi *et al*., 2003).**

Concerning the effect of foliar application of transpirants on (Chl. a, Chl. b and leaf water content), data tabulated that, foliar application of linseed oil, Pure Gylatine, Magnesium carbonate, Potassium silicate and untreated plants were more effective and gave significantly effects on Chl. a, Chl. b and leaf water content, Potassium Silicate was more effective and gave the highest values compared with other treatments. Anti-transpiration might help the cotton plant to maintain relative water contents, water potential, and water use efficiency by increasing the plant turgor pressure which ultimately led to the higher yield in current study. During water stress conditions, most of active solutes such as Chlorophyll, RLWC and biochemical activities are actual mechanism for prevention the damage of plants sells. Seed cotton and fiber yield were decreased due to the imposition of water stress. The anti-transpiration material can play a role in increasing plant resistance to water shortage conditions **(Ibrahim and selim 2010؛Iriti *et al*., 2009 and Kattlewell *et al*., 2010)**

In spite of the interaction between irrigation intervals and foliar application of anti-transpirents , we noticed that irrigation cotton plants every 30 days and foliar plants with Potassium silicate was superior than other combinations of two factors in the two seasons.

Table 4: Effect of irrigation intervals and foliar application of anti-transpirants as well as their interaction on leaf water content, chlorophyll (a) and chlorophyll (b) in the two growing seasons.

Traits / Treatments		Leaf water content %		Chlorophyll (a) (mg / g dwt)		Chlorophyll (b) (mg / g dwt)	
		2021	2022	2021	2022	2021	2022
A1- 15 day		32.6 c	33.5 b	2.9 ab	2.8 b	1.6 b	1.9b
A2- 30 day		40.8 a	41.0 a	3.5 a	3.7 a	2.1 a	2.3 a
A3- 45 day		22.6 b	21.6 c	2.3 b	2.5 b	1.3 b	1.7 b
LSD at 5%		2.65	0.84	0.17	0.13	0.15	0.30
B1-Control		30.4 d	30.0 c	2.6 bc	2.6 c	1.5 c	1.3 d
B2- Linseed oil		34.1 b	32.7 b	3.1 ab	3.2 ab	1.7 b	1.8 b
B3- Pure Gylatine		33.2 bc	32.5 b	2.9 b	3.0 b	1.8 b	1.5 c
B4-Maghnisium Carbonate		31.1 c	30.6 c	2.7 bc	2.7 c	1.5 c	2.7 d
B5- Silicate Potassium		36.8 a	34.3 a	3.3 a	3.6 a	2.0 a	2.2 a
LSD at 5%		1.64	0.77	0.15	0.14	0.11	0.23
A_1	B_1	31.6	31.0	2.7	2.3	1.4	2.4
	B_2	35.1	35.4	3.1	3.1	1.8	2.6
	B_3	34.2	34.1	2.9	2.9	1.5	2.6
	B_4	32.5	31.4	2.8	2.5	1.5	2.4
	B_5	36.2	35.8	3.3	3.4	1.8	2.9
A_2	B_1	37.9	38.6	3.1	3.4	1.8	2.6
	B_2	40.7	41.0	3.6	3.9	2.2	3.0
	B_3	37.3	41.4	3.7	3.7	2.1	2.8
	B_4	36.7	39.8	3.4	3.3	1.9	2.6
	B_5	44.0	44.3	3.9	4.3	2.6	3.4
A_3	B_1	21.5	20.3	2.1	2.3	1.2	2.2
	B_2	28.5	20.7	2.4	2.6	1.4	2.4
	B_3	27.9	21.8	2.4	2.6	1.4	2.4
	B_4	26.7	22.1	2.2	2.4	1.2	2.1
	B_5	30.6	20.6	2.6	3.0	1.5	2.6
LSD at 5%		0.22	1.11	0.23	1.32	0.20	1.32

C) Yield and its components

Data tabulated in Tables (5 and 6) showed that plant height and No. of fruiting branches were increased by irrigation every 15 days and reduced by increasing irrigation intervals in the two growing seasons. A decline in plant height due to drought stress may be attributed to the deregulation of elongating cells due to disruption of the flow of water from the xylem to elongating cells, reduction in the growth-promoting hormones, cell elongation, cell expansion and mitosis during cell division **(Farooq *et al*., 2009)**. On the other hands, No. of open bolls / plant, earliness %, seed cotton yield, boll weight and seed index were increased by irrigation cotton plants every 30 days compared with other two irrigation intervals. Water stress adversely affects cotton growth and productivity by reducing leaf area index, sympodial. branches, average Boll weight and yield, Increasing the values of productivity of irrigation water under irrigation treatment 30 days between watering may be due to increasing yield under the conditions of this treatment in comparison with other irrigation treatments 15 and 45 days. (**Loka *et al*., 2011**).

Consider to the effect of some anti-transpirants, we found that foliar application of Potassium Silicate had the better effect compared with other studied materials on yield and its components (plant height, No. of fruiting branches, No. of open bolls / plant, Earliness% , seed cotton yield / fed. , boll weight and seed index in the two seasons. In spite of the interaction between irrigation intervals and transpirants, plant height and No. of fruiting branches were significantly increased by irrigation every 15 days with application of Potassium Silicte in the both seasons.No. of open bolls , Ealiness % and seed cotton yield were increased by irrigating cotton every 30 days with foliar application of Potassium Silicate in the two growing seasons.cleared from the data , boll weight and seed index increased significantly by iirigation cotton plants every 30 days with foliar application of Potassium Silicatein the first season only, the second one was not significantly

Table 5: Effect of irrigation intervals and foliar application of anti- transpirants as well as their interaction on yield and its components in the first growing season.

Treatments \ Traits		Plant height (cm)	No. of fruiting branches plant	No. of open bolls plant	Seed cotton yield fed (kentar)	Earliness %	Boll weight (g)	Seed index (g)
A-Irrigation intervals:								
A_1- 15 day		147.7 a	17.5 a	15.3 b	8.0 b	53.5 b	2.9 b	10.6 b
A2- 30 day		131.5 b	15.9 b	19.0 a	9.4 a	56.9 a	3.1 a	10.9 a
A3- 45 day		119.1 c	13.2 c	10.2 c	6.5 c	52.3 c	2.3 c	10.2 c
LSD at 5%		1.54	0.51	0.98	0.17	0.68	0.13	0.32
B- Antitranspiration treatments:								
B1-Control		130.4 d	14.6 d	12.5 d	7.4 d	53.2 c	2.5 c	10.4 d
B2- Linseed oil		134.0 b	16.1 b	16.1 b	8.3 b	54.3 b	2.8 b	10.6 b
B3- Pure Gylatine		132.4 c	15.3 c	14.3 c	7.9 c	54.1 b	2.7 b	10.6 b
B4-Maghnisium Carbonate		131.2 c	15.0 c	13.9 c	7.8 c	53.7 b	2.6 b	10.5 c
B5- Silicate Potassium		135.8 a	16.7 a	18.1 a	8.6 a	56.0 a	3.0 a	10.9 a
LSD at 5%		1.26	0.52	0.86	0.22	1.02	0.12	0.17
A B Interaction:								
A_1	B_1	143.5	16.7	11.7	7.3	52.3	2.7	10.4
	B_2	150.1	18.0	13.5	8.3	53.4	3.0	10.7
	B_3	148.0	17.3	12.6	8.0	53.7	2.9	10.7
	B_4	144.5	17.0	12.7	7.8	52.8	2.8	10.4
	B_5	152.3	18.7	15.8	8.8	55.2	3.1	11.0
A_2	B_1	129.4	15.0	16.2	8.8	55.4	2.8	10.6
	B_2	132.4	16.7	20.4	9.8	57.2	3.1	10.9
	B_3	131.1	15.7	20.1	9.2	56.0	3.0	11.0
	B_4	130.9	15.3	19.0	9.2	56.6	2.9	10.8
	B_5	133.6	17.0	22.5	10.1	59.4	3.4	11.3
A_3	B_1	118.3	12.0	9.6	6.2	51.8	2.1	10.1
	B_2	119.5	13.7	11.3	6.7	52.2	2.3	10.3
	B_3	118.1	13.0	10.1	6.5	52.5	2.3	10.2
	B_4	118.2	12.7	10.1	6.4	51.7	2.2	10.3
	B_5	121.7	14.7	12.0	.68	53.5	2.5	10.3
LSD at 5%		2.56	2.26	2.36	1.82	3.12	N.S	N.S

Table 6: Effect of irrigation intervals and foliar application of anti- transpirants as well as their interaction on yield and its components in the second growing season.

Treatments \ Traits		Plant height (cm)	No. of fruiting branches plant	No. of open bolls plant	Earliness %	Seed cotton yield fed (kentar)	Boll weight (g)	Seed index (g)
A-Irrigation intervals:								
A1- 15 day		146.3 a	17.2 a	17.3 b	55.8 b	7.3 b	1.9 b	12.0
A2- 30 day		123.3 c	15.3 b	19.2 a	59.1 b	8.0 a	2.2 a	12.2
A3- 45 day		114.0 b	12.2 c	15.4 c	65.9 a	5.8 c	1.7 b	11.5
LSD at 5%		1.84	1.02	1.51	3.5	0.16	0.10	N.S
B- Antitranspiration treatments:								
B1-Control		126.6 b	14.1 b	10.5 d	53.5 b	6.6 c	1.8 b	10.3 d
B2- Linseed oil		127.9 ab	15.3 a	16.3 b	49.9 c	7.3 b	2.0 ab	12.1 b
B3- Pure Gylatine		128.5 a	14.7 b	14.3 c	55.2 ab	6.8 c	1.9 b	12.2 b
B4-Maghnisium Carbonate		127.4 ab	14.6 b	13.4 c	50.7 bc	6.7 c	1.8 b	11.5 c
B5- Silicate Potassium		128.9 a	15.8 a	19.6 a	58.4 a	7.8 a	2.1 a	12.8 a
LSD at 5%		2.94	0.80	1.30	4.15	0.23	0.12	0.58
A B Interaction:								
A_1	B_1	145.1	16.31	11.98	54.4	6.8	1.8	11.0
	B_2	146.7	17.33	17.78	56.3	7.3	2.0	12.0
	B_3	145.5	17.03	16.56	55.7	7.1	2.0	12.0
	B_4	145.3	17.00	14.74	55.2	6.9	1.8	11.3
	B_5	149.1	18.00	18.65	57.4	7.5	2.0	12.3
A_2	B_1	122.2	14.6	19.1	60.5	7.5	2.1	13.0
	B_2	123.3	16.0	21.1	66.7	8.3	2.3	13.6
	B_3	123.3	15.2	21.6	62.3	8.2	2.2	13.6
	B_4	122.9	15.0	21.5	62.1	7.8	2.1	13.3
	B_5	125.0	16.3	24.7	68.4	8.9	2.5	14.6
A_3	B_1	112.6	11.2	11.7	51.0	5.5	1.8	9.3
	B_2	115.1	12.6	12.5	49.6	6.1	1.7	11.0
	B_3	113.8	12.0	11.5	48.1	5.7	1.6	10.6
	B_4	113.2	11.6	13.1	45.6	5.6	1.6	10.3
	B_5	115.4	13.2	15.3	43.8	6.3	1.6	11.0
LSD at 5%		3.06	2.16	2.62	2.17	0.24	0.17	0.17

C) Quality of cotton fibers (Technology Characters)

From tables 7 and 8 it can observe that lint fineness in the first season only, strength and length were affected by the treatments and we noticed that, high values of these characters were obtained by irrigation every 15 days compared with other two intervals, fiber uniformity was not affected by irrigation intervals in the two growing seasons.cotton plants has a deep root system and is considered as moderateresistant crop under water shortage. Moreover, Water shortage in semiarid regions is a major yield reduction factor. Water shortage could result in the decline of cotton yield and quality **(Reddy *et al.*, 2004)**.

Foliar application of Potassium Silicate was superior for gave the highest values of fiber fineness, Potassium Silicate and pure Gylatine obtained the highest values of fiber strength and length. On the other hand, fiber Uniformity was not affected by treatments in the two seasons. Consider to the interaction between irrigation intervals and foliar application treatments it were not significant in the two growing seasons.

Table 7: Effect of irrigation intervals and foliar application of anti- transpirants as well as their interaction on lint cotton technology in the first growing season.

Treatments \ Traits		Fineness (Micronair units)	Strength (Pressely index)	Fiber Length (mm)	Fiber Uniformity Index
A-Irrigation intervals:					
A1- 15 day		4.2 a	10.7 a	33.4 a	86.5
A2- 30 day		4.0 b	10.4 b	33.6 a	85.3
A3- 45 day		3.8 c	10.2 b	33.7 a	86.0
LSD at 5%		0.20	0.30	N.S	N.S
B- Antitranspiration treatments:					
B1-Control		3.7 c	10.1 b	33.5 a	85.3
B2- linseed oil		4.0 bc	10.4 b	33.6 a	84.3
B3- Pure Gylatine		4.0 bc	10.5 ab	33.2 b	86.9
B4-Maghnisium Carbonate		4.2 b	10.6 ab	33.1 b	87.6
B5- Silicate Potassium		4.3 a	10.8 a	33.7 a	86.2
LSD at 5%		0.30	0.40	0.30	N.S
A B Interaction:					
A_1	B_1	4.1	10.6	33.4	86.3
	B_2	4.0	10.4	33.2	84.5
	B_3	4.2	10.5	33.6	87.6
	B_4	4.3	10.4	33.5	87.3
	B_5	4.2	10.5	33.4	86.3
A_2	B_1	4.0	10.2	33.2	84.3
	B_2	4.1	10.1	33.1	87.6
	B_3	4.0	10.3	33.2	83.4
	B_4	4.1	10.2	33.5	86.5
	B_5	4.1	10.1	33.1	84.3
A_3	B_1	4.2	10.1	33.4	86.6
	B_2	4.0	10.0	33.5	87.4
	B_3	4.0	10.0	33.6	86.3
	B_4	4.2	10.2	33.7	84.5
	B_5	4.0	10.1	33.4	85.3
LSD at 5%		N.S	N.S	N.S	N.S

Table 8: Effect of irrigation intervals and foliar application of anti- transpirants as well as their interaction on lint cotton quality in the second growing seasons.

Treatments \ Traits		Fineness (Micronair units)	Strength (Pressely index)	Fiber Length (mm)	Fiber Uniformity Index
A-Irrigation intervals:					
A1- 15 day		4.0	10.9 a	33.5 a	86.0
A2- 30 day		4.2	10.5 b	32.6 b	85.7
A3- 45 day		4.3	10.1 c	32.4 b	85.5
LSD at 5%		N.S	0.40	1.10	N.S
B- Antitranspiration treatments:					
B1-Control		4.1 b	10.7 a	32.5 b	87.8
B2- Linseed oil		4.2 b	10.6 a	33.4 a	87.3
B3- Pure Gylatine		4.1 b	10.6 a	33.0 a	85.6
B4-Maghnisium Carbonate		4.2 b	10.2 b	32.6 b	84.3
B5- Silicate Potassium		4.4 a	10.8 a	33.7 a	85.4
LSD at 5%		0.20	0.35	1.15	1.20
A B Interaction:					
A_1	B_1	4.2	10.7	32.5	86.3
	B_2	4.3	10.8	33.4	87.2
	B_3	4.5	10.6	33.0	88.0
	B_4	4.1	10.9	33.1	87.3
	B_5	4.0	10.9	32.6	86.5
A_2	B_1	4.2	10.7	33.2	86.9
	B_2	4.3	10.5	32.6	87.0
	B_3	4.1	10.6	33.1	88.2
	B_4	4.2	10.8	33.0	87.3
	B_5	4.0	10.6	32.6	86.7
A_3	B_1	4.1	10.7	32.7	86.2
	B_2	4.2	10.9	32.6	85.2
	B_3	4.3	10.8	33.1	86.3
	B_4	4.0	10.7	32.5	86.5
	B_5	4.1	10.6	33.0	87.0
LSD at 5%		N.S	N.S	N.S	N.S

Conclusion

According to the results obtained in the present study, the use of anti-transpirants compounds under different irrigation intervals showed a significant impact on the yield and yield components of cotton. Spraying of **Silicate Potassium** anti-transpirants compounds compared to the control reduced the effect of drought stress and improved the negative effects of drought stress compares to normal irrigation. Considering the mean comparisons and the relationships among the traits, it was turned out that choosing the appropriate amount of spray greatly influences on enhancing each of the traits. Providing the appropriate conditions, Silicate Potassium (3 cm^3 / litre) with irrigation every 30 days treatment can enhance the yield under drought stress. Increasing irrigation intervals decreased the amount of applied water and increased productivity of irrigation water.

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الملخص العربى

تاثير الرش بمضادات النتح على النمو , الانتاجية وصفات الجودة للقطن المصرى تحت ظروف الاجهاد المائى للاراضى الطينية

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**قسم بحوث المقننات المائية والرى الحقلى – معهد بحوث الاراضى والمياه والبيئة – مركز البحوث الزراعية – مصر

اجريت تجربتان حقليتان بمزرعة سخا التابعة لمركز البحوث الزراعية بجمهورية مصر العربيةخلال موسمى زراعة 2021 و 2022 وذلك لدراسة تأثير ثلاث من فترات الرى (كل 15 و 30 و 45 يوم)مع اربع معاملات للرش الورقى بأنوع من مضادات النتح (بدون رش – زيت بذور الكتان 7%-جيلاتين نقى 1.5% مع التعفير بمادة كربونات المغنسيوم (250 جم /

للقطعة) بالاضافة الى سليكات البوتاسيوم (3 سم^{3}) على النمو والانتاجية وصفات جودة القطن المصرى (سوبر جيزة 94 المنزرع) وتقدير بعض العلاقات المائية.

التصميم المستخدم فى التجربة قطع منشقة مرة واحدة فى ثلاث مكررات. وكانت النتائج كالتالى:-

-الرى كل 30 يوم أدى الى زيادة معنوية فى (نسبة المحتوى المائى فى الورقة – كلوروفيل أ و ب – عدد اللوز المتفتح على النبات – محصول القطن الزهر ووزن اللوزة فى كلا الموسمين و % للتبكير فى الموسم الثانى . على الجانب الاخر كان الرى كل 15 يوم الاكثر تأثيرا على طول النبات -عدد الافرع الثمرية ومتانة التيلة فى كلا الموسمين – النعومة فى الموسم الاول وطول التيلة فى الموسم الثانى . وذلك مقارنة بفترات الرى الاخرى موضع الدراسة.

- تفوق الرش بمادة سيليكات البوتاسيوم عن باقى المواد الاخرى كمضادات للنتح حيث انها أدت الى زيادة معنوية فى أغلب الصفات المدروسة (المحتوى المائى للاوراق – كلوروفيل أ وب – طول النبات – عدد الافرع الثمرية – عدد اللوز المتفتح – محصول القطن الزهر - % للتبكير – وزن اللوزة و دليل البذرة – نعومة التيلة – متانة التيلة و طول التيلة وذلك فى كلا الموسمين ونسبة الانتظام فى الموسم الثانى فقط اما الاول كان غير معنوى .

- بالنسبة للتاثير التفاعلى بين فترات الرى ومضادات النتح , النتائج توضح ان الرى كل 30 يوم مع رش النباتات بسليكات البوتاسيوم أدت الى زيادة معنوية فى محتوى الاوراق من الماء الكلى – كلوروفيل أ و ب – عدد الافرع الثمرية - محصول القطن الزهر قنطار / فدان و% للتبكير وذلك فى كلا الموسمين .