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EFFECT OF IRRIGATION INTERVALS AND SOME ANTITRANSPIRANTS ON GROWTH, YIELD AND FRUIT QUALITY OF EGGPLANT

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ABSTRACT

Two field experiments were conducted at Kafer EI-Wekala, Sherbin, El-Dakahlia Governorate, Egypt during the two summer seasons of 2013 and 2014 to study the effect of two water irrigation intervals, *i.e*., 10 and 15 days as well as foliar applications of some antitranspirants, *i.e.,* control, calcium carbonate, magnesium carbonate and kaolin on growth, chemical composition, yield and fruit quality of eggplant cv. black beauty cultivated under furrow irrigation system in Nile Delta lands.

The results showed that the lowest irrigation interval at 10 days combined with foliar application with kaolin induced significant effect on number of branches per plant, fresh and dry weight plant, as well as leaf area, followed by irrigation with the highest interval (15 days) combined with foliar application with kaolin. Moreover, the same treatment had a significant effect on total chlorophyll, N, P, K and Fe contents of eggplant foliage followed by irrigation every 15 days combined with foliar application with kaolin. It was found also that, significant effect on number of fruits per plant, average fruit weight, early and total yield per feddan of eggplant were recorded with spraying eggplant with kaolin under 10 days irrigation interval followed by spraying with kaolin under 15 days irrigation interval. Concerning to fruit quality it can said that irrigation eggplant every 10 days combined with foliar application of kaolin had the highest significant effect on TSS, vitamin C and titratable acidity in eggplant fruits followed by applying the high irrigation interval (15 days) combined with foliar application of kaolin. Generally, it can from this study recommend that it is possible to improve eggplant fruit yield and its quality by irrigation every 15 days combined with foliar spray with kaolin (4%, 4 times during the season) improve yield and quality as well as saving about 33% of the total used irrigation water quantity in eggplant production under furrow irrigation system in Nile Delta lands.

INTRODUCTION

Eggplant (*Solanum melongena* L.) is one of the most important, popular and favorite vegetable crops cultivated in Egypt for local consumption and exportation. The proper irrigation interval can play a major role in increasing the productivity and fruit quality by applying the required amount of water when it is needed. Water shortage during eggplant growing season led to reduction in fruit yield and its quality and this due to water and nutrients deficiency. The proper time of irrigation is essential to produce economic yield and good fruit quality of the eggplant. Shalata (2013) showed that vegetative growth parameters, yield components and fruit quality of eggplant were significantly decreased with increasing irrigation intervals from 10 up to 20 days.

One of the important methods that used to reduce water use by plant is antitranspirants as calcium carbonate, magnesium carbonate and kaolin, which are natural white materials form a coating film on the leaves, it increase the leaf reflectance by reflecting the radiation and increase the vapour pressure gradient and thus reduce transpiration (Glenn *et al*., 2002 and Creamer *et al*., 2005). Kaolin also is an important material used in this concern, it is considered as an effective natural antitranspirant and was reported to mitigate the negative effects of water deficiency and environmental stresses, such as heat stress and sunburn damage (Kahn and Damicone, 2008). Spraying tomato plants with 5% of kaolin suspension improved water status and yield under water stress conditions (Srinivasa Rao, 1985). Moreover, Anwar (2005) stated that, application of antitranspirants such as kaolin and whitewash ($CaCO_3$) to potato plant could reduce transpiration by increasing leaf resistance to diffusion of water vapor. In addition, Creamer *et al*. (2005) illustrated that applications of kaolin at hot temperatures might help hot Chile pepper plants from being subjected to severe water stress. Furthermore, Abd El-Aal *et al*. (2008) mentioned that foliar application with $MgCO_3$ at a rate of 2% gained more growth vigor and more fruits yield as well as better physical and chemical properties of eggplant fruit compared with non-treated plants.

The objective of the present investigation was to study the effect of irrigation intervals, some foliar applications of antitranspirants materials and their interaction on growth, chemical composition and yield as well as fruit quality of eggplant cultivated under furrow irrigation system at Nile Delta lands.

MATERIALS AND METHODS

Two field experiments were conducted at Kafer El-Wekala, Sherbin, El-Dakahlia Governorate, Egypt, during the two successive seasons of 2013 and 2014 to study the effect of irrigation intervals, some antitranspirant materials and their interaction on growth, chemical composition, yield and fruit quality of eggplant cultivated under furrow irrigation system at Nile Delta lands. Table 1 shows some physical and chemical properties of the experimental soil before planting, according to the methods described by Page (1982).

Table 1: Physical and chemical properties of the experimental soil at 30 cm depth

Parameters / Seasons	Texture (%)			O.M. %	EC (dSm^{-1})	pH	N ppm	P ppm	K ppm
	Sand	Silt	Clay						
1st season	21.81	26.04	52.15	1.24	0.77	7.9	74.19	4.12	404
2nd seasons	22.44	24.85	52.71	1.48	0.51	7.8	61.37	6.20	315

On March 1st week of both seasons, 45 day old eggplant seedlings, cv black beauty, were transplanted in the open field at 50 cm apart on one side of the ridge. The experiment was adopted in a split plot design with three

replicates, containing 8 treatments, which were the combination between two water irrigation intervals every 10 or 15 days as well as foliar applications of some antitranspirants, *i.e*., calcium carbonate, magnesium carbonate and kaolin, in addition to control treatment (Tap water).

Water irrigation intervals were distributed in the main plots, whereas the foliar applications of antitranspirants were arranged in the sub plots. The experimental unit consisted of four ridges each of 1 m wide and 5 m long with an area of 20 m^2. A distance of 2 m was left between each irrigation treatments to avoid the infiltration of water irrigation. Furrow irrigation method was used from the beginning to the end during the two seasons using Nile water. The irrigation treatments started after 55 days from eggplant transplanting.

Calcium carbonate ($CaCO_3$), Magnesium carbonate ($MgCO_3$) and kaolin (Aluminum silicate) powder, agriculture grade, were used as a fine mist foliar application at 4% till run-off with care being taken to cover all plant foliage.

Foliar application of the used antitranspirants were applied 4 times starting at 60 days after transplanting and repeated every 14 days intervals during the two growth seasons. The other agricultural practices for growing eggplant plants were followed according to the instruction laid down by the Egyptian Ministry of Agriculture, Egypt.

At 105 days after transplanting five plants from each plot were randomly taken for determination of number of branches per plant, fresh and dry weight of plant as well as leaf area per plant (Koller, 1972). Representative samples from the 4^{th} upper leaves were taken to determinate total chlorophyll content as SPAD units, using a portable leaf chlorophyll meter (Minolta Model SPAD 501) according to Murquard and Timpton (1987).

Representative samples of 5 plants from each plot were used to determine N, P and K contents (%) as well as Fe (ppm) in foliage dry weight. Total nitrogen was determined according to the methods described by Bremner and Mulvaney (1982); phosphorus was estimated colormetrically according to Olsen and Sommers (1982) while, potassium was determined using flame photometrically as described by Jackson (1973). Iron concentration in foliage dry weight were determined according to the methods described by Lindsay and Norvell (1978).

All harvested fruits from each plot at marketable ripe stage along the season were used to determine number of fruits per plant, average fruit weight, early yield per feddan and total yield per feddan. Early yield (ton per feddan) was calculated from the first three pickings. A representative sample of 10 eggplant fruits from each experimental plot at the marketable ripe stage was taken from the 3^{rd} harvest to determinate the fruits quality characteristics, *i.e.*, total soluble solids (TSS), Vitamin C and titratable acidity, according to the methods described by AOAC (1990).

The obtained data were subjected to statistical analysis by the technique of analysis of variance (ANOVA) according to Snedecor and Cochran (1982). The treatment means were compared using Duncan's Multiple Range Test as published by Duncan (1955).

RESULTS AND DISCUSSION

Vegetative growth characteristics:

The present data in Table 2 declare the effect of irrigation intervals on vegetative growth characteristics of eggplant. Data indicate that irrigation every 10 days recorded the highest significant values of vegetative growth characteristics, *i.e.*, fresh and dry weight of plant, as well as leaf area per plant. The exception was that on number of branches per plant, which showed no significant differences in both seasons. The data are coincided in both seasons of the study. The results are in harmony with those reported by Ezzo *et al*. (2010) they indicated that the highest plant length, stem diameter, fresh weight, dry weight and root/ shoot ratio of sweet pepper plants were obtained by using the high irrigation level. In addition, Shalata (2013) on eggplant reported that plant height, leaf area, number of leaves and number of branches per plant were significantly decreased with increasing irrigation intervals from 10 up to 20 days.

The negative effects of the highest irrigation interval (15 days) on eggplant growth may be related to the drought stress, which affects plant growth by reducing number of leaves and leaf area, resulting in less photosynthesis (Silber, 2005).

The same data demonstrate the effect of foliar application of calcium carbonate, magnesium carbonate and kaolin on vegetative growth characteristics of eggplant. It is clear that foliar applications with kaolin significantly increased vegetative growth characteristics, *i.e*., number of branches per plant, fresh and dry weight of plant as well as leaf area per plant. Moreover, the lowest significant values in this respect were recorded by the control treatment in both seasons of this work. The significant responses of kaolin foliar application on vegetative growth characteristics were confirmed by Creamer *et al*. (2005) on Chile pepper, Ezzat *et al*. (2009) on potato and Shalata (2013) on eggplant.

Regarding the effect of the interaction between irrigation intervals and foliar applications of some antitranspirants on the vegetative growth characteristics of eggplant, data in Table 2 clearly show that applying the low irrigation interval (10 days) combined with the foliar application of kaolin had the highest significant number of branches per plant, fresh and dry weight of plant as well as leaf area per plant, followed by applying the high irrigation interval (15 days) combined with the foliar application with kaolin.

The pronounced promotional effect of the foliar application of kaolin under water stress conditions (15 days irrigation interval) on vegetative growth characteristics of eggplant may be related to the direct effects of kaolin on plant resistance to both biotic and abiotic stress including drought (Glenn *et al*., 2002 and Creamer *et al*., 2005). In addition, kaolin foliar application was reported to improve CO_2 assimilation under high temperature (Glenn *et al*., 2002). Such gains can explain the enhancement of plant growth in associated with higher plant water content in eggplant grown under deficit irrigation condition.

Table 2: Effect of irrigation intervals and foliar applications with some antitranspirants as well as their interactions on vegetative growth characteristics of eggplant during 2013 and 2014 seasons.

Char. / Treat.		No .of branches/plant		Fresh weight (g/ plant)		Dry weight (g/plant)		Leaf area/ pant (cm^2)	
		2013	2014	2013	2014	2013	2014	2013	2014
Interval (days)									
10 days		6.17a	6.05a	769.67a	783.54a	79.43a	79.31a	4670.70a	4843.37a
15 days		5.22a	5.83a	732.90b	738.78b	75.63b	74.78b	4509.56b	4632.18b
Antitranspirants									
Control		5.27b	5.22c	647.38d	659.33d	66.81d	27.34d	3956.93d	3958.03d
$CaCO_3$		5.50ab	5.55c	712.20c	729.79c	73.50c	31.49c	4285.12c	4396.45c
$MgCO_3$		5.89ab	6.16b	778.19b	775.86b	80.31b	34.11b	4585.98b	4940.87b
Kaolin		6.11a	6.83a	867.37a	879.67a	89.51a	40.03a	5532.48a	5655.75a
Interaction									
10 days	Control	5.66bcd	5.33de	668.76g	696.33e	69.02g	70.48e	4066.33g	4084.33f
	$CaCO_3$	5.78bc	5.66cde	729.31e	753.50d	75.26e	76.27d	4364.37e	4447.77d
	$MgCO_3$	6.44ab	6.33abc	787.59c	779.08c	81.28c	78.85c	4627.63c	5164.87b
	Kaolin	6.78a	6.89a	893.01a	905.25a	92.16a	91.62a	5624.47a	5676.50a
15 days	Control	4.88d	5.11e	626.01h	622.33f	64.60h	62.99f	3847.53h	3831.73g
	$CaCO_3$	5.22cd	5.44de	695.08f	706.08e	71.73f	71.47e	4205.87f	4345.13e
	$MgCO_3$	5.33cd	6.00bcd	768.78d	772.63c	79.34d	78.20c	4544.33d	4716.87c
	Kaolin	5.44cd	6.77ab	841.73b	854.08b	86.87b	86.45b	5440.50b	5635.00a

Means followed by the same letters within each column do not differ significantly according to Duncan's Multiple Range Test at the 5% level.

Chemical composition:

Data presented in Table 3 are concerning with the effect of irrigation intervals on total chlorophyll, N, P, K, and Fe contents of eggplant foliage. It is obvious that, irrigation interval at 10 days increased significantly all studied characters in comparison to 15 days interval. These results were in accordance with those obtained by Sabli (2012) on bell pepper.

The positive effects of the low irrigation interval (10 days) on total chlorophyll, N, P, K, and Fe contents of eggplant foliage can be attributed to the proper balance of moisture in plant which creates favorable conditions for photosynthesis and metabolites translocation (Ezzo *et al*., 2010) that in turn accelerate the rate of nutrients uptake.

With respect to the effect of the foliar applications of antitranspirants, *i.e*., calcium carbonate, magnesium carbonate and kaolin on chemical composition of eggplant foliage, the same data illustrate that foliar application of different used sources of antitranspirants significantly enhanced total chlorophyll, N, P, K and Fe contents as compared with the untreated plants (control). It is clear that foliar applications with kaolin resulted in the highest significant increases in total chlorophyll, N, P, K, and Fe contents of eggplant foliage in both seasons.

Table 3: Effect of irrigation intervals and foliar applications with some antitranspirants as well as their interactions on total chlorophyll content, N, P, K and Fe contents of eggplant during 2013 and 2014 seasons

Char. / Treat.		Total chlorophyll content (SPAD units)		N (%)		P (%)		K (%)		Fe (ppm)	
		2013	2014	2013	2014	2013	2014	2013	2014	2013	2014
Interval (days)											
10 days		75.03a	75.67a	3.12a	3.16a	0.825a	0.841a	1.71a	1.74a	71.92a	73.05a
15 days		74.03b	74.69b	3.01b	3.04b	0.798b	0.808b	1.63b	1.66b	70.71b	71.79b
Antitranspirants											
Control		71.87d	72.92d	2.50d	2.53d	0.667d	0.688d	1.40d	1.43d	59.46d	60.60d
$CaCO_3$		73.70c	74.80c	2.99c	3.06c	0.800c	0.813c	1.60c	1.65c	72.03c	72.95c
$MgCO_3$		75.53b	75.78b	3.29b	3.29b	0.849b	0.856b	1.77b	1.80b	74.87b	76.01b
Kaolin		77.03a	77.23a	3.47a	3.50a	0.930a	0.941a	1.91a	1.92a	78.90a	80.13a
Interaction											
10 days	Control	72.53g	73.60g	2.54g	2.57g	0.680g	0.713g	1.44g	1.46g	60.62g	61.57g
	$CaCO_3$	74.10e	75.13e	3.07e	3.12e	0.815e	0.826e	1.64e	1.69e	72.40e	73.30e
	$MgCO_3$	75.90c	76.00c	3.35c	3.38c	0.864c	0.874c	1.81c	1.82c	75.27c	76.64c
	Kaolin	77.60a	77.93a	3.52a	3.55a	0.940a	0.949a	1.95a	1.97a	79.40a	80.70a
15 days	Control	71.20h	72.23h	2.46h	2.49h	0.653h	0.663h	1.35h	1.39h	58.30h	59.63h
	$CaCO_3$	73.30f	74.47f	2.91f	3.01f	0.785f	0.799f	1.56f	1.61f	71.67f	72.60f
	$MgCO_3$	75.17d	75.56d	3.24d	3.20d	0.833d	0.838d	1.72d	1.78d	74.47d	75.37d
	Kaolin	76.47b	76.52b	3.42b	3.45b	0.921b	0.932b	1.87b	1.88b	78.40b	79.57b

Means followed by the same letters within each column do not differ significantly according to Duncan's Multiple Range Test at the 5% level.

The positive significant effect of kaolin foliar application on total chlorophyll, N, P, K, and Fe contents may be related to its cooling effect as it reduces leaf temperature (Glenn *et al*., 2002). In other meaning, it play important role for reduce heat stress injury and this reflect on mineral and nutrient absorption. Moreover, the significant effect of kaolin on total chlorophyll in comparison with the other treatments may be attributed also to the significant absorption of Fe nutrient (Table 3).

Regarding to the effect of the interaction between irrigation periods and foliar application of antitranspirants, *i.e*., calcium carbonate, magnesium carbonate and kaolin on total chlorophyll, N, P, K and Fe contents of eggplant (Table 3), it is obvious that irrigation eggplant every 10 days combined with foliar application with kaolin recorded the highest values of total chlorophyll, N, P, K and Fe contents of eggplant followed by irrigation every 15 days combined with foliar spray with kaolin, in both seasons.

Similar results were confirmed by Ezzat *et al*. (2009) they stated that under insufficient water quantity the foliar application of 4% kaolin significantly increased photosynthetic pigments, *i.e.*, total chlorophyll a, b and carotenoids in potato leaves.

Yield characteristics:

It was found on number of fruits per plant, average fruit weight, early yield per feddan and total yield per feddan significantly increased with decreasing irrigation intervals as shown in Table 4. Eggplant under short irrigation interval (10 days) recorded the highest values of number of fruits per plant, average fruit weight, early yield per feddan and total yield per feddan during both seasons of the experiment.

The obtained results are in line with Amiri *et al.,* (2012) they studied the effects of 6 and 12 days irrigation intervals on eggplant, the results showed that the highest number of fruits per plant and fruits yield were observed with 6 days interval irrigation. In addition, Shalata (2013) on eggplant indicated that the short irrigation interval (10 days) significantly enhanced fruits yield, early yield, total yield, dry matter %, fruit length, fruit diameters, number of fruits per plant, number of flowers per plant and average fruit weight.

Concerning the effect of the used foliar antitranspirants, *i.e*., calcium carbonate, magnesium carbonate and kaolin on yield characteristics of eggplant. The same data clearly reveal that foliar applications of kaolin had the highest significant number of fruits per plant, average fruit weight, early and total yield per feddan compared to foliar application of calcium carbonate, magnesium carbonate and the control, in the both seasons.

These results are in accordance with the results obtained by Moftah (1997), Govindakrishnan *et al.,* (2003) and Abd El-Aal *et al.,* (2008) they found that foliar spraying with antitranspirants gained more growth vigor, more fruits yield in comparison with the untreated plants.

Regarding the effect of the interaction between irrigation periods and foliar application of antitranspirants, *i.e*., calcium carbonate, magnesium carbonate and kaolin on number of fruits per plant, average fruit weight, early and total yield per feddan, it is obviously clear that the interaction caused an increment in all the fore mentioned parameters in both seasons. The highest values were recorded with spraying eggplant with kaolin under 10 days irrigation interval followed by spraying eggplant with kaolin under 15 days irrigation interval. These results had the same trend during the two seasons. Such results are in line with those of Creamer *et al*. (2005) on Chile pepper and Shalata (2013) on eggplant.

Table 4: Effect of irrigation intervals and foliar applications with some antitranspirants as well as their interactions on yield characteristics of eggplant during 2013 and 2014 seasons

Treat.	Char.	No. of fruits/plant		Average fruit weight (g)		Earl yield (Ton/ fed.)		Total yield (Ton/ fed.)	
		2013	2014	2013	2014	2013	2014	2013	2014
Interval (days)									
10 days		7.07a	7.26a	187.77a	190.59a	4.48a	4.58a	18.01a	18.36a
15 days		6.63b	6.71b	183.99b	185.12b	4.33b	4.37b	16.99b	17.27b
Antitranspirants									
Control		4.97d	5.05d	173.37d	173.98d	3.76d	3.89d	14.91d	15.26d
$CaCO_3$		6.85c	6.97c	184.15c	185.33c	4.18c	4.29c	16.75c	17.07c
$MgCO_3$		7.54b	7.69b	187.97b	191.47b	4.49b	4.49b	18.55b	18.87b
Kaolin		8.04a	8.24a	198.03a	200.63a	5.17a	5.23a	19.79a	20.06a
Interaction									
10 days	Control	5.27g	5.34g	175.30e	175.70f	3.97g	4.07g	15.74g	16.14g
	$CaCO_3$	7.15e	7.32e	185.00d	187.23d	4.25e	4.34e	16.97e	17.34e
	$MgCO_3$	7.63c	7.72c	188.57c	193.37b	4.43c	4.54c	19.25c	19.78c
	Kaolin	8.21a	8.66a	202.20a	206.07a	5.27a	5.35a	20.07a	20.16a
15 days	Control	4.67h	4.75h	171.43f	172.27g	3.56h	3.71h	14.07h	14.37h
	$CaCO_3$	6.55f	6.61f	183.30d	183.43e	4.11f	4.24f	16.54f	16.79f
	$MgCO_3$	7.44d	7.65d	187.37c	189.57c	4.56d	4.43d	17.84d	17.96d
	Kaolin	7.87b	7.83b	193.87b	195.20b	5.07b	5.10b	19.50b	19.95b

Means followed by the same letters within each column do not differ significantly according to Duncan's Multiple Range Test at the 5% level.

It is clear that foliar application with kaolin tended to increase the studied yield characters under the two used irrigation intervals (10 or 15 days) comparing with the other treatments. This result could be explained the basis such treatment showed the pronounced positive effects on the vegetative growth aspects (Table 2), total chlorophyll, N, P, K and Fe contents (Table 3) leading to healthy plant and hence increasing yield aspects. In other meaning it can said that, the final result of all physiological processes including vegetative growth, total chlorophyll and nutrient uptake will be reflecting on yield and its obvious clearing from the figures (1, 2 & 3), which showed highest positive correlation between some vegetative characters *i.e*. leaf area, plant fresh weight and chlorophyll content in eggplant leaves and the total fruit yield.

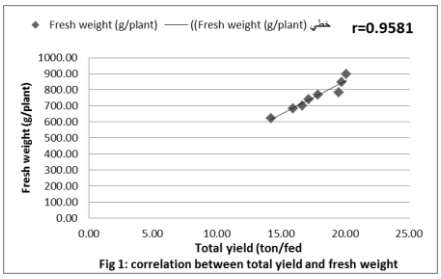
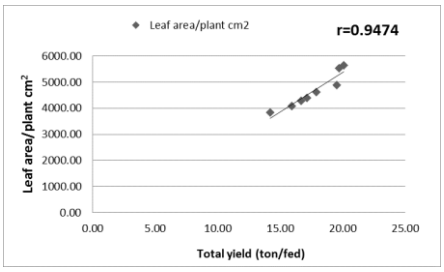


Fig 1: correlation between total yield and fresh weight



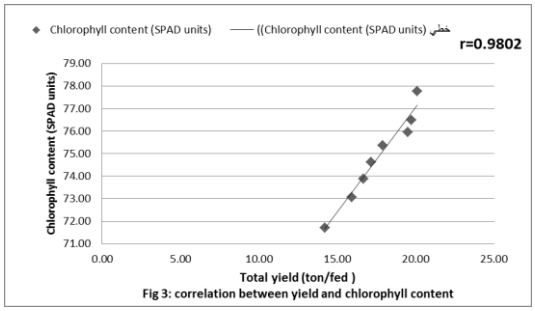


Fig 3: correlation between yield and chlorophyll content

Fruit quality characteristics:

Data listed in Table 5 show the effect of irrigation intervals on fruit quality characteristics of eggplant. It is clear that using the short irrigation interval (10 days) recorded the highest significant values of TSS, vitamin C and titratable acidity in eggplant fruits. On the other hand, irrigation at 15 days showed the lowest values in this respect. These results had the same trend in both growing seasons. The results are coincided with those of Shalata (2013) who indicated that TSS and vitamin C were increased with decreasing irrigation intervals.

Concerning the effect of the foliar application with the used antitranspirants on fruit quality characteristics of eggplant, the same data clearly reveal that foliar application with kaolin produced the highest significant values of TSS, vitamin C and titratable acidity in eggplant fruits, in both seasons of this work. These results are in line with Abd El-Aal *et al.,* (2008) on eggplant.

The positive significant effect of foliar application of kaolin on the quality aspects of eggplant fruits in comparison with the other treatments may be attributed to the significant absorption of N, P and K nutrients (Table 3).

With respect to the effect of the interaction on fruit quality characteristics of eggplant fruits, the same data illustrate that irrigation eggplant every 10 days combined with foliar application of kaolin had the highest significant TSS, vitamin C and titratable acidity in eggplant fruits followed by applying the long irrigation interval (15 days) combined with foliar application of kaolin, during both seasons of the study. The results are coincided with those of Ezzat *et al*. (2009) they indicated that under

insufficient water quantity, treating potato plants with kaolin as a foliar application at 4% improved tuber quality.

Table 5: Effect of irrigation intervals and foliar applications with some antitranspirants as well as their interactions on fruit quality characteristics of eggplant during 2013 and 2014 seasons

Treat.	Char.	TSS%		V.C mg/100g		Acidity mg/100 cm juice	
		2013	2014	2013	2014	2013	2014
Interval (days)							
10 days		4.60a	4.65a	1.81a	1.86a	0.439b	0.448b
15 days		4.46b	4.53b	1.71b	1.76b	0.460a	0.470a
Antitranspirants							
Control		4.10d	4.14d	1.51d	1.53d	0.344d	0.361d
$CaCO_3$		4.41c	4.51c	1.69c	1.72c	0.441c	0.450c
$MgCO_3$		4.69b	4.76b	1.84b	1.91b	0.474b	0.480b
Kaolin		4.91a	4.96a	1.99a	2.06a	0.540a	0.546a
Interaction							
10 days	Control	4.22g	4.25g	1.58g	1.61g	0.335h	0.355g
	$CaCO_3$	4.46e	4.56e	1.74e	1.76e	0.433f	0.443f
	$MgCO_3$	4.75c	4.79c	1.87c	1.95c	0.466d	0.472d
	Kaolin	4.97a	4.99a	2.04a	2.11a	0.522b	0.522b
15 days	Control	3.99h	4.03h	1.44h	1.46h	0.352g	0.367g
	$CaCO_3$	4.37f	4.45f	1.63f	1.68f	0.448e	0.456e
	$MgCO_3$	4.63d	4.73d	1.81d	1.88d	0.481c	0.488c
	Kaolin	4.85b	4.93b	1.95b	2.01b	0.557a	0.569a

Means followed by the same letters within each column do not differ significantly according to Duncan's Multiple Range Test at the 5% level.

Economic feasibility:

The economic feasibility of cultivation eggplant as affected by irrigation intervals and foliar applications of some antitranspirants during 2013 and 2014 seasons are presented in Table 6. The results showed that the highest net return (10220 LE fed-1) was obtained with irrigation eggplant every 10 days combined with foliar application of kaolin, followed by irrigation eggplant every 15 days combined with foliar application of kaolin, however, the highest benefit-cost ratio (2.04) in comparison with the other treatments was obtained with irrigation eggplant every 15 days combined with foliar application of kaolin. Therefore, this treatment considered economical for eggplant production under the conditions of the present study.

Table 6: Economic feasibility of cultivation eggplant as affected by irrigation intervals and foliar applications with some antitranspirants during 2013 and 2014 seasons

Treatment		Marketable yield (Ton fed^{-1})$^{(1)}$	Gross return (£E fed^{-1})$^{(2)}$	Treatment cost (£E fed^{-1})$^{(3)}$	Total variable cost (£E fed^{-1})$^{(4)}$	Net return (£E fed^{-1})$^{(5)}$	Benefit cost ratio$^{(6)}$	Order
10 days	Control	15.94	15940	720	9140	6800	1.744	6
	CaCO3	17.16	17160	1400	9820	7340	1.747	5
	MgCO3	19.52	19520	1560	9980	9540	1.956	3
	Kaolin	20.12	20120	1480	9900	10220	2.032	2
15 days	Control	14.22	14220	480	8900	5320	1.598	8
	CaCO3	16.67	16670	1160	9580	7090	1.740	7
	MgCO3	17.90	17900	1320	9740	8160	1.838	4
	Kaolin	19.73	19730	1240	9660	10070	2.042	1

(1) Eggplant marketable yield as average of two seasons, (2) Gross return as marketable yield (ton fed-1) x 1000 £E ton-1, (3) Treatment cost was calculated according to the following prices: irrigation cost 60 £E fed-1, CaCo3= 30 £E kg-1, MgCO3 40 £E kg-1, Kaolin 35 £E kg-1, (4) Total variable cost (£E fed-1) including: Treatment cost plus land leasehold, transplants, N, P and K fertilizers, microelements, pesticides, labors and other agricultural practices, which equal nearly 8420 £E fed-1. (5) = (2)-(4). (6)= (2)/ (4).

Finally, from the previous results of this study, it could be concluded that, irrigation eggplant every 15 days combined with foliar application with kaolin (4%), 4 times during the season) could be recommended to improve the vegetative growth characteristics, chemical composition, total yield and fruit quality, saving about 33% of the total used irrigation water quantity, giving the highest benefit-cost ratio to the farmers in eggplant production under furrow irrigation system in Nile Delta lands.

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تأثير فترات الري وبعض مضادات النتح على النمو والمحصول وجودة ثمار نباتات الباذنجان

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أجريت تجربتان حقليتان خلال موسمي ٢٠١٣ و٢٠١٤ في مزرعة خاصة بناحية كفر الوكالة، شربين، محافظة الدقهلية، مصر وذلك لدراسة فترتين من الري وهما الري كل عشرة أيام والري كل ١٥ يوماً مع الرش الورقي ببعض مضادات النتح (كربونات الكالسيوم وكربونات المغنيسيوم والكاؤلين) وذلك على النمو والمحصول وجودة ثمار نباتات الباذنجان تحت نظام الري بالغمر في أراضي دلتا النيل وقد اوضحت النتائج أن ري نباتات الباذنجان كل عشرة أيام مع الرش الورقي بالكاؤلين كان له أفضل تأثير في الحصول علي أعلي زيادة معنوية في جميع صفات النمو الخضري تحت الدراسة وتشمل عدد الأفرع والوزن الطازج الجاف والمساحة الورقية، كما أدي ري نباتات الباذنجان كل عشرة أيام مقترناً مع الرش الورقي بالكاؤلين يلي ذلك الري كل خمسة عشر يوماً مع الرش الورقي بالكاؤلين إلى الحصول على أفضل تأثير معنوي فيما يخص محتوي أوراق النبات من الكلوروفيل الكلي وكذلك عناصر النيتروجين والفوسفور والبوتاسيوم والحديد. أدي الري كل عشرة أيام مع الرش الورقي بالكاؤلين إلى الحصول علي أعلي زيادة معنوية في صفات المحصول متمثلة في عدد الثمار للنبات ومتوسط وزن الثمرة والمحصول المبكر وكذلك المحصول الكلي للفدان يلي تلك المعاملة في الترتيب الري كل خمسة عشر يوماً مع الرش الورقي بالكاؤلين، أما فيما يخص فيما يخص صفات الجودة للثمار متمثلة في محتوي الثمار من المواد الصلبة الذائبة الكلية وفيتامين ج والحموضة الكلية فقد أدي ري نباتات الباذنجان كل عشرة أيام مقترناً مع الرش الورقي بالكاؤلين إلى الحصول على أفضل تأثير معنوي في هذا الخصوص وقد تلي تلك المعاملة في الترتيب أيضاً ري نباتات الباذنجان كل خمسة عشر يوماً مقترناً مع الرش الورقي بالكاؤلين وعلى ذلك توصي هذه الدراسة أنه يمكن ري نباتات الباذنجان كل خمسة عشر يوماً مع الرش الورقي بالكاؤلين (بتركيز ٤% أربعة مرات خلال موسم النمو) وذلك لزيادة المحصول وتحسين جودة الثمار وتقليل الاحتياجات المائية لنباتات الباذنجان بمعدل ٣٣% من كمية المياه المستخدمة عند الزراعة التقليدية بنظام الري بالغمر في أراضي دلتا النيل.