The Foliar Application of 'Crimson Seedless' Grapes Grown Under Black Net with Abscisic Acid and Potassium Phosphate and Improvement of Its Coloration and Yield

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ABSTRACT: This investigation was carried out during the two successive seasons of both 2016 and 2017 on seven years old 'Crimson Seedless' grape trees (*Vitis vinifera* L.). Trees were planted in sandy soil conditions in a private orchard located at El-Nobaria, El-Beheira, Governorate, Egypt. The trees were spaced at 1.5 x 3 m apart and irrigated by drip irrigation system and received similar cultural practices adopted in the orchard. The present investigation aimed at improving coloration, earliness and yield of 'Crimson Seedless' grape grown under black net by foliar application of abscisic acid and potassium phosphate. This experimentation comprise fourteen treatments arranged in a spilt plot design with four replicates per treatment and one vine for each replicate. The first independent variable (i.e. open field and black net) was arranged in the main plot, and the second independent variable, i.e. pre-harvest treatments abscisic acid at 100, 150 and 200 mg / l and potassium phosphate at 2.5, 5 and 7.5 g / l was arranged in the sub plot. The obtained results revealed that black net; gave rise to the highest mean values of physical characters (i.e. berry length, berry diameter, weight of 100 berry, volume of 100 berry and fruit firmness). Also, all yield and yield components (i.e., cluster length, cluster diameter, cluster weight, yield / vine and yield / fed.) recorded the maximum mean values under black net and all chemical compositions (i.e., total sugars, reducing sugars, non-reducing sugars, total carbohydrates and anthocyanin content), which recorded the significant increased mean values under black net, but vitamin C recoded the best results under open field treatments. On the other side, potassium phosphate at 7.5 g / l; gave rise to the highest mean values of berry length, berry diameter, weight of 100 berry, fruit firmness, total sugars, non-reducing sugars and total carbohydrates, while abscisic acid at 200 mg / l recorded the maximum values of volume of 100 berry, cluster length, cluster diameter, cluster weight, yield / vine, yield / fed., reducing sugars, anthocyanin content and vitamin C content as compared with the control treatment, which recorded the lowest mean values of the studied characters during both seasons.

Keywords: 'Crimson Seedless' grape, shade, net, open field, abscisic acid, potassium phosphate, yield, fruit quality, chemical compositions.

INTRODUCTION

Grapes regarded the second predominant fruit crop after citrus due to the fact of its valuable properties. During the closing few years especially in the newly reclaimed lands, its reached about 196993 feddans with a complete manufacturing about 1686706 tons according to the statistics of the Ministry of Agriculture (2016).

'Crimson Seedless' *(Vitis vinifera*) is a late maturing red seedless grape cultivar with firm berries. It ripens is in mid-September and can be stored on vines until mid-November. Also, it possible to store grapes until early of winter under Egyptian climate (El-Sayed, 2013). The color of red grape berries is an important factor for the market acceptance of crimson table grapes but it remains poorly colored, especially when vines grown in regions or seasons with high or fluctuation temperature (Cantin *et al.,* 2007). 'Crimson Seedless' is a table grape cultivar that often fails to advance enough red shade in Mediterranean climates. Application of abscisic acid (ABA) may be also an

resource for enhancing color; however, its workable effects on general great, and ABA attracts the attention to be additionally regarded as enhance for berry's color and yield (Ferrara *et al.,* 2013).

Abscisic acid (ABA) has a profound effect on grape ripening, specifically shade development; however, its position in the initiation of anthocyanin synthesis stays unclear. To elucidate this point, ABA treatment has been used to be a simple *Vitis vinifera* model, consisting of 'Cabernet Sauvignon' telephone suspensions that do not spontaneously produce anthocyanin beneath laboratory conditions. These outcomes demonstrate that ABA promotes anthocyanin synthesis in grape telephone culture (Gagne *et al.,* 2017).

The shade of the berry grapes is due to existence of anthocyanin and their accumulation looks to be regulated, at least in part, via abscisic acid. Therefore, exogenous functions of this plant growth regulator may be, additionally, increase the anthocyanin concentration in the grapes skin (Neto *et al.,* 2017).

Various studies have shown that phosphorus and potassium could affect the appearance of the fruit quality due to the function of potassium element in increase the volume of grapes, extending the shelf-life, increasing hardness, beautiful color, and effective anti-browning simultaneously (Zhenming *et al.,* 2011)

The investigation aims to improve coloration, earliness and yield of 'Crimson Seedless' grapes grown under black net by foliar application of abscisic acid (ABA) and potassium phosphate.

MATERIALS AND METHODS

This study was carried out during two successive seasons of both 2016 and 2017 on seven years old 'Crimson Seedless' grape trees (*Vitis vinifera* L.). Trees were planted under sandy soil conditions in a private orchard located at El-Nobaria, El-beheira, Governorate, Egypt. The trees were spaced at 1.5 x 3 m apart and irrigated using drip irrigation system and received similar cultural practices adopted in the orchard. The present investigation aimed at study the improving coloration, earliness and yield of 'Crimson Seedless' grapes grown under black net by foliar application of abscisic acid and potassium phosphate. This experiment consisted of fourteen treatments arranged in a spilt plot design with four replicates for each treatment and one tree for each replicate.

Samples of soil were collected at depth 0-30 from the experimental orchard for all treatments for all treatment, some physical and chemical properties of the experimental soil in 2016 as shown in Table (1).

Table (1). The initial physical and chemical properties of the experimental soil in 2016 season

Parameter	Value	Unit
Mechanical Analysis		
Sand	68.30	%
Silt	12.02	%
Clay	19.68	%
Textural class	**Sandy loam**	
pH (1:1)	7.46	-
$CaCO_3$	3.0	%
EC(1:1, water extract)	0.61	dS/m
O.M	0.21	%
Soluble cations		
Ca^{2+}	2.0	meq/l
Mg^{2+}	1.0	meq/l
Na^{+}	2.7	meq/l
K^{+}	0.4	meq/l
Soluble anions		
$HCO3^{-}$	3.8	meq/l
Cl^{-}	1.8	meq/l
SO_4^{2-}	1.5	meq/l
Available nutrients		
Nitrogen (N)	210	mg/l
Phosphorus (P)	67.25	mg/kg
Potassium (K)	750	mg/kg

Experimental design

The experiment was arranged in spilt plot design on 56 trees as 14 treatments, which were applied, and each treatment comprised of four trees. The applied treatments were arranged as follows:

A) Main plots (shading method)

- Open field
- Black net

B) Sub-plots (Pre-harvest treatments)

- Control
- Abscisic acid at 100 mg/l
- Abscisic acid at 150 mg/l
- Abscisic acid at 200 mg/l
- Potassium phosphate 2.5 g/l
- Potassium phosphate 5 g/l
- Potassium phosphate 7.5 g/l

Data recorded

A) **Yield (kg / vine)**

Five clusters per vine were harvested at the ripening stage when juice TSS% reach to 16% to determine the average values of cluster characteristics as length(cm), diameter (cm), weight (g), yield / vine (kg) and yield / fed (kg).

B) Physical properties

A sample of 5 clusters / vine was taken for determining berry attributes as length (cm), diameter (cm), weight of 100 berry (g), volume of 100 berry (cm^3), and fruit firmness ($lb/inch^2$), which was measured using an electronic firmness tester (FG-5020, Lutron).

C) Chemical fruit characteristics:

Regarding fruit chemical characteristics, samples from each replicate were picked, randomly, at harvest time to determine the following parameters:

Total sugars percentage, which was determined in fresh fruit samples according to Malik and Singh (1980). Sugars were extracted from 5 gram fresh weight and determined by phenol sulfuric and Nelson arsenate-molybadate colorimetric methods for total and reducing sugars, respectively. The non-reducing sugars were calculated by difference between total sugars and reducing sugars. Total Carbohydrates percentage was determined according to Jahnel *et al*. (1998).

Vitamin C (mg /100 ml juice), the ascorbic acid content of the juice was determined by titration with 2, 6 dichlorophenol-indo-phenol (AOAC, 1985) and calculated as milligram per 100 ml of juice. Anthocyanin content (mg / 100g) was determined at the stage of coloration (mg / 100g fresh weight) according to Rabino *et al*. (1977).

Statistical analysis:

The collected data of the measured parameters were subjected to computerized statistical analysis using MSTAT package for analysis of variance (ANOVA) in spilt plot design and means of treatments were compared using LSD at 0.05 level of probability according to Snedecor and Cochran (1990).

RESULTS AND DISCUSSION

A) Yield and yield components

The results concern the effect of studied foliar applications with abscisic acid and potassium phosphate concentration under black net on cluster length, cluster diameter, cluster weight, yield/ vine and yield/fed. of 'Crimson Seedless' grapes are listed in Table (2) and elicited the highest mean values of cluster length (18.57 and 21.36 cm), cluster diameter (14.75 and 16.96 cm), cluster weight (295.96 and 336.32 g), yield / vine (9.02 and 10.25 kg), and yield / fed., (8.40 and 9.54 ton) were recorded under black net treatment; while, the open field treatment; recorded the lowest mean values of cluster length (16.17 and 18.59 cm), cluster diameter(14.23 and 16.47 cm), cluster weight (258.91 and 294.21 g), yield / vine (8.56 and 9.72kg), and yield / fed. (7.94and 9.05 ton), during both seasons (2016 and 2017), respectively.

The findings might be taken place due to the protection of bunch under the shade, which restricts the entry of more ultraviolet radiations that might have helped to achieve higher berry weight and bunch weight. This is in accordance with Richard *et al.* (2012) who reported that the fruit weight and volume was

larger under the blue and gray nets than white and control. Similar results were reported by (Shahak *et al.,* 2004; Ramteke and Somkuwar, 2007) in Table grapes. Less yield in black and red shade net was observed. The black and red shade net essentially acts as opaque material, which gives less reflection of all light spectra; thereby, reducing the photosynthetic activity and fruit yield (Shahak, 2008), and thus could reduce yield in higher intensity of shading.

In this concerning, increasing abscisic acid concentration up to 200 mg / l; resulted in the higher mean values of cluster length (20.49 and 23.56 cm), cluster diameter(17.25 and 19.83 cm), cluster weight (323.49 and 367.60 g), yield / vine (10.59 and 12.03 kg) and yield / fed. (9.74 and 11.19 ton) as compared with control treatment which recorded minimum values of cluster length (14.95 and 17.19 cm), respectively, during both seasons.

The interaction among shade and pre-harvest treatments was highly significant ($p \leq 0.01$) of cluster length, cluster diameter, cluster weight, yield/plant and yield/fed. of 'Crimson Seedless' grapes, during both seasons (2016 and 2017).

Table (2). Effect of some pre-harvest applications under shading method on yield and yield components of 'Crimson Seedless' grapes during 2016 and 2017 seasons

Treatments	Cluster length (cm)		Cluster diameter (cm)		Cluster weight (g)		Yield / vine (kg)		Yield /fed (ton)	
	2016 season	2017 season	2016 season	2017 season	2016 season	2017 season	2016 season	2017 season	2016 season	2017 season
A shading method										
Open field	16.17b	18.59b	14.32b	16.47b	258.91b	294.21b	8.56b	9.72b	7.94b	9.05b
Black net	18.57a	21.36a	14.75a	16.96a	295.96a	336.32a	9.02a	10.25a	8.34a	9.54a
LSD (0.05)	**0.49**	**0.57**	**0.39**	**0.45**	**5.26**	**5.97**	**0.17**	**0.19**	**97.17**	**181.28**
B) Pre-harvest treatments										
Control	14.95g	17.19f	12.57g	14.45g	235.82g	267.98g	7.72f	8.77f	7.19f	8.16f
Abscisic acid at 100 mg/l	16.60e	19.09e	13.97e	16.06e	262.03e	297.75e	8.57d	9.74d	7.98d	9.07d
Abscisic acid at 150 mg/l	18.44c	21.21c	15.52c	17.85c	291.14c	330.84c	9.53b	10.83b	8.87b	10.08b
Abscisic acid at 200 mg/l	20.49a	23.56a	17.25a	19.83a	323.49a	367.60a	10.59a	12.03a	9.74a	11.20a
Phosphate potassium at 2.5 g/l	15.31f	17.61f	12.68f	14.58f	247.95f	281.76	7.51g	8.53g	6.99c	7.94g
Phosphate potassium at 5 g/l	16.96d	19.50d	14.09d	16.20d	275.50d	313.07d	8.34e	9.48e	7.77e	8.86f
Phosphate potassium at 7.5 g/l	18.84b	21.67b	15.65b	18.00b	306.12b	347.86b	9.27c	10.53c	8.63c	9.81c
LSD (0.05)	**0.20**	**0.23**	**0.09**	**0.10**	**2.91**	**3.31**	**0.08**	**0.10**	**150.99**	**90.26**
Interactions										
A X B	**	**	**	**	**	**	**	**	**	**

Means in the same column followed by the same letter are statistically equalled according to LSD (0.05) probability level.
*, * *: Significant at (0.05) and 0.01 level of probability, respectively.

A) Physical characteristics:

Results presented in Table (3) revealed that black net; brought about the highest mean values of berry length(2.14 and 2.20 cm), berry diameter (1.59 and 1.67cm), weight of100 berry (400.05 and 404.48 g),volume of 100 berry (304.50 and 319.67cm^3) and fruit firmness (18.14 and 19.05 lb/ inch^2), respectively during both seasons, as compared with open field treatment which recorded the lowest mean values of berry length(2.08 and 2.19 cm), berry diameter (1.52 and 1.59cm), weight of100 berry (383.66 and 387.79g), volume of 100 berry (307.00 and 310.81cm^3) and fruit firmness (15.72 and 16.50 lb/ inch^2), respectively, during both seasons.

These results are in agreement with those obtained by Andhale (2012) who reported that the fruit length, fruit diameter and number of fruit per plant were more in green color shade net than other shade net colors. Similar results were recorded by Shahak *et al.* (2004); Elad *et al.* (2007); Shahak (2008).

On the other hand, it is clear from the obtained results in the same Table that all pre-harvest treatments significantly($p \leq 0.05$) affected on berry length, berry diameter, weight of100 berry, volume of 100 berry and fruit firmness. Increasing of potassium phosphate up to 7.5 g / l; recorded the highest mean values of berry length (2.28 and 2.33 cm), berry diameter (1.83and 1.92 cm), weight of100 berry (479.19 and 482.60 g) and fruit firmness (19.79 and 20.78 lb/ inch^2), while, foliar spraying of abscisic acid at 200 mg / l; recorded the maximum volume of 100 berry (345.64 and 362.87cm^3) as compared with the other treatments and control, during both seasons.

Cantin *et al*. (2007) found no effect for foliar application with ABA on berry firmness; while, in the present study, foliar spraying of ABA-treated-grapes were softer than control treatment.

These results are agreement with those researches by Strydom and Loubser (2008); Farag *et al.* (2012).

The interaction between the two factors (shade and pre-harvest treatments) was highly significant ($p \leq 0.01$) of berry length, berry diameter, weight of100 berry volume of 100 berry and fruit firmness, during both seasons (2016 and 2017).

Table (3). Effect of some pre-harvest applications under shading method on physical berry characteristics of 'Crimson Seedless' grapes during 2016 and 2017 seasons

Treatments	Berry length (cm)		Berry diameter (cm)		Weight of100 berry (g)		volume of 100 berry (cm^3)		Fruit firmness ($lb/ inch^2$)	
	2016 season	2017 season	2016 season	2017 season	2016 season	2017 season	2016 season	2017 season	2016 season	2017 season
A) shading method										
Open field	2.08b	2.19a	1.52b	1.59b	383.66b	387.79b	307.00a	310.81b	15.72b	16.50b
Black net	2.14a	2.20a	1.59a	1.67a	400.05a	404.48a	304.50a	319.67a	18.14a	19.05a
LSD (0.05)	**0.03**	**0.03**	**0.04**	**0.04**	**3.36**	**5.55**	**6.59**	**1.76**	**0.23**	**0.27**
B) Pre-harvest harvest treatments										
Control	2.25b	2.33a	1.73b	1.81b	305.67g	310.57g	275.94f	264.53g	13.75g	14.44g
Abscisic acid at 100 mg/l	2.13d	2.19c	1.55d	1.63d	339.64f	345.08f	289.46e	293.92e	15.28f	16.05f
Abscisic acid at 150 mg/l	2.03e	2.12d	1.40f	1.47f	377.38e	383.41e	316.07c	326.58c	16.98d	17.83d
Abscisic acid at 200 mg/l	1.92f	2.04e	1.26g	1.32g	421.69c	390.91d	345.64a	362.87a	18.87b	19.81b
Phosphate potassium at 2.5 g/l	2.03e	2.14d	1.48e	1.55e	388.14d	426.02c	272.93f	286.57f	16.03e	16.83e
Phosphate potassium at 5 g/l	2.18c	2.24b	1.64c	1.72c	431.27b	343.34b	303.25d	318.41d	17.81c	18.70c
Phosphate potassium at 7.5 g/l	2.28a	2.33a	1.83a	1.92a	479.19a	482.60a	336.95b	353.80b	19.79a	20.78a
LSD (0.05)	**0.02**	**0.02**	**0.02**	**0.02**	**1.55**	**1.22**	**5.92**	**0.59**	**0.42**	**0.44**
Interactions										
A X B	**	**	**	**	**	**	**	**	*	*

Means in the same column followed by the same letter are statistically equalled according to LSD (0.05) probability level.
*, * *: Significant at (0.05) and 0.01 level of probability, respectively.

B) Chemical fruit characteristics:

Results in Table (4) reveal that significant effect (p≤0.05) of different treatments (shade net and pre-harvest applications) on total sugars, reducing sugars, non-reducing sugars, total carbohydrates, anthocyanin content and vitamin C during 2016 and 2017 seasons. The results showed that black net treatment; recorded the maximum total sugars percentage (12.58 and 13.19%), reducing sugars (7.96 and 8.14%), non-reducing sugars (4.87 and 5.84%), total carbohydrates (16.31 and 16.62%), anthocyanin content (39.23 and 42.76 mg/100g f.w.) and vitamin C (63.5 and 64.40 mg / 100 ml juice) during both seasons compared with open field treatment, which recorded the lowest mean values of total sugars percentage (11.99 and 12.57%), reducing sugars (7.12 and 6.74%), non-reducing sugars (4.61 and 5.05%), total carbohydrates (15.04 and 15.87%), anthocyanin content (31.53 and 334.37 mg/100g f.w.) and vitamin C (54.00 and 55.15 mg / 100 ml juice) during both seasons, respectively.

On another side, potassium phosphate at 7.5 g / l; gave rise to the highest mean values of total sugars (14.15 and 14.85 %), non-reducing sugars (5.60 and 6.82%), total carbohydrates (18.16 and 19.19 %), while, abscisic acid up to 200 mg / l; recorded the highest mean values of reducing sugars (8.61 and 8.68 %), anthocyanin content (40.09 and 43.70 mg / 100 g f.w.) and vitamin C (68.70 and 70.06 mg/100ml juice), as compared with control treatment which recorded the lowest mean values of total sugars (10.08 and 10.58%), reducing sugars (5.87 and 6.34%), non-reducing sugars (4.21 and 4.25%), total carbohydrates (12.83 and 13.59%), anthocyanin content (28.56 and 31.13 mg / 100 g f.w.) and vitamin C (50.08 and 51.07 mg / 100 ml juice) during 2016 and 2017 seasons.

The gained findings of potassium phosphate treatments agree with those obtained by Keller and Shrestha (2014) who observed that vacuolar potassium concentration was positively correlated with total vacuolar sugar concentration in both ‘Merlot’ and ‘Concord’ berries. On the other hand, the same trends of these results of ABA treatments were found by Peppi *et al.* (2006) who reported that application of abscisic acid (ABA) on 'Flame Seedless' grapes; led to increase anthocyanin content and fruit colour of berries. Lacampagne *et al.* (2010) reported a positive effect of ABA on berry colour of grapes. Roberto *et al.* (2013) found that ABA improved the colour of grapes, especially when applied twice (7 days after veraison + 15 days before harvest) at 400 mg l^{-1} in 'Rubi' table grapes.

On the contrary, some studies indicated that foliar applications of K on 'Crimson Seedless' increased anthocyanin concentration (Mohsen, 2011). Topalović *et al.* (2011) also, found that foliar sprays of grape 'Cardinal' cv. with a liquid of mineral fertilizer containing P and K; increased total anthocyanin of the interaction between shade and pre-harvest treatments was not significant effect (p≤0.01) on total sugars percentage, during both seasons. Also, no significant during the first season and high significant in the second season on reducing sugar and non-reducing sugars.

Table (4). Effect of some pre-harvest applications under shading method on chemical composition of 'Crimson Seedless' grapes during 2016 and 2017 seasons

Treatments	Total sugars (%)		Reducing sugars(%)		Non- reducing sugars(%)		Total Carbohydrates (%)		Anthocyanin (mg/ 100 g f.w.)		Vitamin C (mg/100 ml juice)	
	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017	2016	2017
A) shading method												
Open field	11.99b	12.57b	7.12b	6.74b	4.87a	5.05b	16.31a	16.62a	31.53b	34.37b	63.57a	64.40a
Black net	12.58a	13.19a	7.96a	8.14a	4.61a	5.84a	15.04b	15.87a	39.23a	42.76a	54.00b	55.15b
LSD (0.05)	**0.14**	**0.16**	**0.37**	**0.21**	**0.46**	**0.14**	**0.30**	**1.72**	**3.28**	**3.57**	**0.14**	**1.18**
B) Pre-harvest treatments												
Control	10.08g	10.58g	5.87d	6.34d	4.21d	4.25f	12.83g	13.59de	28.56 c	31.13c	50.08g	51.07g
Abscisic acid at 100 mg/l	11.20f	11.76f	6.84c	6.80c	4.36d	4.96e	14.25f	13.22e	38.86a	42.36a	55.52e	56.74e
Abscisic acid at 150 mg/l	12.44d	13.07d	7.91b	7.88b	4.54cd	5.21de	15.84d	16.63bc	37.04a b	40.38a b	61.83c	63.05c
Abscisic acid at 200 mg/l	13.83b	14.52b	8.61a	8.68a	5.22ab	5.84 b	17.60b	18.48ab	40.09a	43.70a	68.70a	70.06a
Potassium phosphate at 2.5 g/l	11.46e	12.03e	7.01c	6.65cd	4.45cd	5.38cd	14.71e	15.44cd	29.24c	31.87c	52.41f	53.06f
Potassium phosphate at 5 g/l	12.84c	13.37c	8.01b	7.71b	4.83bc	5.65cb	16.35c	17.16bc	35.26b	38.44b	58.24d	58.95d
Potassium phosphate at 7.5 g/l	14.15a	14.85a	8.54a	8.03b	5.60a	6.82a	18.16a	19.19a	38.60a	42.08a	64.72b	65.51b
LSD (0.05)	**0.13**	**0.10**	**0.39**	**0.35**	**0.39**	**0.37**	**0.11**	**1.91**	**3.07**	**3.35**	**0.57**	**0.35**
Interactions												
A X B	**ns**	**ns**	**ns**	**	**ns**	**	**	**ns**	**ns**	**ns**	**	**

Means in the same column followed by the same letter are statistically equalled according to LSD (0.05) probability level.
ns: not significant *, * *: Significant at (0.05) and 0.01 level of probability, respectively.

Season and not significant in the second season on total carbohydrates, was not significant on anthocyanin content during both seasons and high significant vitamin C content during both seasons.

CONCLUSION

This study elucidate that black net, gave rise to the highest mean values of physical characters. Also, all yield and yield components recorded their maximum mean values under black net and all chemical compositions were recorded significant increases under black net, but vitamin C; recoded the best results with open field treatments. On the other side, potassium phosphate at 7.5 g / l led to the higher mean values, while abscisic acid at 200 mg / l achieved the maximum values as compared with the control treatment, which recorded the lowest values of the studied characters during both seasons.

REFERENCES

Andhale, R. P. (2012). Effect of shade net intensity and colours on micrometeorological parameters growth, yield and quality of capsicum. Ph.D. thesis submitted to MPKV., Rahuri, Dist. Ahmad nagar (M.S) India.

AOAC (1985). Official methods of analysis pp 490-510. Association of Official Analytical Chemists Washington, D. C.

Cantın, C. M., M. W. Fidelibus and C. H. Crisosto (2007). Application of abscisic acid (ABA) at veraison advanced red color development and maintained postharvest quality of 'Crimson Seedless' grapes. Postharvest Biol. &Techn., 46: 237–241.

Elad, Y., Y. Messika, M. Brand, D. R. David and A. Sztejnberg (2007). Effect of coloured shade nets on pepper powdery mildew. Leveillla taurica. Phyto parasitica, (**35**): 285-299.

El-Sayed, M.E.A. (2013). Improving fruit quality and marketing of 'Crimson Seedless' grape using some pre-harvest treatments. J. Hort. Sci. Ornamen. Plants, 5: 218–26.

Farag, K. M., A. M. Haikal, N. M.N. Nagy and Y. S. Hezema (2012). Enhancing coloration and quality of 'Crimson Seedless' grape berries cultiver using modified ethrel formulations. J. Agric. & Env. Sci. Alex. Univ., Egypt, 11(3):1-23.

Ferrara, G., A.Mazzeo, A. Maria, S.Matarrese, C.Pacucci, A.Pacifico, G.Gambacorta, M.Faccia, A.Trani, V. Gallo, I.Cafagna and P.Mastrorilli (2013). Application of abscisic acid (S-ABA) to 'Crimson Seedless' grape berries in a mediterranean climate: effects on color, chemical characteristics, metabolic profile, and S-ABA concentration. J. Plant Growth Regul., 32:491–505

Gagne, S., S. Cluzet, J. Me´rillon and L. Geny (2017). ABA Initiates anthocyanin production in grape cell cultures. J. Plant Growth Regul., 30: 1–10

Jahnel, J., P. Ilieva and F. Frimmel (1998). Asensitive method for the determination of carbohydrates. fresenius journal of analytical chemistry, 360(7-8), 827–829.

Keller, M. and P. Shrestha (2014). Solute accumulation differs in the vacuoles and apoplast of ripening grape berries. Planta, 239: 633–642.

Lacampagne, S., S. Gagné and L.Geny (2010). Involvement of abscisic acid in controlling the proanthocyanidin biosynthesis pathway in grape skin: new elements regarding the regulation of tannin composition and leuco anthocyanidin reductase (lar) and anthocyanidin reductase (anr) activities and expres. J. Plant Growth Regul., 29: 81–90.

Malik, C. P. and M. B. Singh (1980). Plant enzymology and histoenzymology. A Text Manual, Kalyani publishers, New Delhi.

Ministry of Agriculture (2016). Agriculture Economics Vol**. 2**., September

Mohsen, A.T. (2011). Attempts to improve the berry quality and storability of grape 'Crimson Seedless' with potassium compounds under desert conditions. J. Hort. Sci. & Ornamen. Plants 3, 75-85.

Neto, F. J. D., M. A. Tecchio, A. P. Junior, B. T. F. Vedoato, G. P. P. Lima and S. R. Roberto (2017). Effect of ABA on colour of berries, anthocyanin accumulation and total phenolic compounds of 'Rubi' table grape (*Vitis vinifera*). Aust0 J. Crop Sci., 11(02):199-205

Peppi, M.C., M.W. Fidelibus and N. Dokoozlian (2006). Abscisic acid application timing and concentration affect firmness, pigmentation, and color of 'Flame Seedless' grapes. Hortic. Sci., 41: 1440–1445.

Rabino, I., A.L. Mancinelli and K.H. Kuzman (1977). Photon control of anthocyanin synthesis VI. Spectral sensitivity, irradiance dependence and reciprocity relationship. Plant Phy., 59: 569- 573.

Ramteke, S. D and R. G. Somkuwar (2007). Effect of shade nets on berry growth and quality in Cv. Tas-A-Ganesh grapes. Asian J. Hort., 2 (1):224-226.

Richard, M. B., M. Luigi, and C. G. Luca (2012). Exploring the potential use of photo-selective nets for fruit growth regulation in Apple. Chilean J. Agri. Res., 72 (2): 224-230.

Roberto, S.R., A.M. De Assis, L.Y. Yamamoto, L.C.V. Miotto, R. Koyama, A.J. Sato and R.S. Borges (2013). Ethephon use and application timing of abscisic acid for improving color of 'Rubi' table grape. Pesqui. Agropecu. Bras., 48: 797–800.

Shahak, Y., (2008). Photo selective netting for improved performance of horticultural crops. A review of ornamental and vegetable studies carried in Israel. Acta Hort., In press.

Shahak, Y., E. E. Gussa kovsky, Y. Cohen, S. Lurie, R. Stern, S. Kfir, A. Naor, I. Atzmon, I. Doron and Y. Greenblat -Avron (2004). Colour nets: A new approach for light manipulation in fruit trees. Acta Hort., (636): 609-616.

Snedecor, G. W and W. G. Cochran (1990). Statistical methods. Oxford and J. B. H. Bub. Com.6th Edition. pp: 507.

Strydom, G.J. and J.T. Loubser (2008). The effect of metalosate calcium and metalosate potassium on sugar accumulation in 'Waltham Cross' (table grapes). In: Albion Conference on Plant Nutrition, Midway, UT, pp. 141–156.

Topalović, A., A. Slatnar, F. Stampar, M. Knežević and R. Veberič (2011). Influence of foliar fertilization with P and K on chemical

constituents of grape cv. 'Cardinal'. J. Agric. Food Chem. 59, 10303-10310.

Zhenming ,N., Y. Wang, Y.Lu, X.Xu and Z. Han (2011). Transportation pathway of potassium and phosphorous in grape fruit applications in physical sciences, prof. nirmal singh (ed.), ISBN: 978-953-307-510-5, intech, available from.

الملخص العربي

رش العنب صنف 'كريمسون' النامي تحت الشباك السوداء بحامض الأبسيسك وفوسفات البوتاسيوم لتحسين تلوينه ومحصوله

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أجريت هذه الدراسة خلال الموسمين المتتاليين ٢٠١٦ و ٢٠١٧ على أشجار العنب صنف 'كريمسون' عمرها سبع سنوات. وزرعت الأشجار في تربة رملية لبستان خاص في منطقة النوبارية، محافظة البحيرة، مصر. ومنزرعة على مسافة ١,٥ × ٣ م وتروى بنظام الري بالتنقيط، بهدف دراسة تلوين العنب صنف كريمسون ونموه ومحصوله تحت الشباك السوداء عن طريق الرش الورقي لحمض الأبسيسيك وفوسفات البوتاسيوم. وتكونت كل وحدة تجريبية من أربعة عشر معاملة في تصميم قطع منشقة مرة واحدة مع أربعة مكررات لكل معاملة وشجرة واحدة لكل مكررة. وتكونت التجربة من (الحقل المكشوف والشباك السوداء) مرتبة في القطع الرئيسية ومعاملات ما قبل الحصاد بتركيزات حمض الأبسيسيك (١٠٠ ، ١٥٠ و ٢٠٠ مجم / لتر) وفوسفات البوتاسيوم (٢,٥ و ٥ و ٧,٥جم / لتر) مرتبة في القطع تحت الرئيسية.

كشفت النتائج أن الشباك السوداء أعطت أعلى القيم المتوسطة للصفات الطبيعية للثمار ، أي (طول الحبة، قطر الحبة، وزن ١٠٠ حبة، حجم ١٠٠ حبة وصلابة الحبة) ، أيضًا، جميع مكونات المحصول (طول العنقود ، قطر العنقود ، وزن العنقود، المحصول/ كرمة والمحصول/ فدان) سجلت أعلي متوسط القيم تحت الشباك السوداء وجميع المكونات الكيميائية (السكريات الكلية ، السكريات المختزلة، السكريات غير المختزلة ، الكربوهيدرات الكلية ومحتوى الأنثوسيانين)، سجلت زيادة معنوية تحت الشباك السوداء، لكن فيتامين سي سجل أفضل النتائج تحت ظروف الحقل المفتوح، وعلى الجانب الآخر، أعطى فوسفات البوتاسيوم عند ٧,٥ جم/ لتر القيم العليا لكلا من طول الحبة، قطر الحبة، وزن ١٠٠ حبة، وصلابة الحبة، والسكريات الكلية والسكريات غير المختزلة والكربوهيدرات الكلية، بينما سجل حمض الأبسيسيك عند ٢٠٠ مجم / لتر القيم القصوى لحجم ١٠٠ حبة وطول العنقود وقطر العنقود ووزن العنقود والمحصول/ كرمة والمحصول/ فدان والسكريات المختزلة ومحتوى الأنثوسيانين ومحتوى فيتامين سي مقارنة بمعاملة الكنترول التي سجلت القيم الدنيا لهذه الصفات المدروسة، خلال كلا الموسمين.