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Effect of Some Treatments on Heat Stress Tolerance of Flame Seedless Vineyards

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Abstract

This research was conducted during 2019 & 2020 seasons in Afak farm located at Balat district, New Valley Governorate. To evaluate the effect of some horticultural practices treatments to tolerant heat stress on vegetative growth, yield and berry quality of Flame Seedless grapevines. The experiment was set up in a complete randomized block design with eleven treatments, using three replicates, two grapevines each.

It could be summarized the current results are as follow:

- The weight of pruning wood and leaf area as well as leaf potassium and proline contents were significantly increased due to spraying any potassium or amino acids sources or vine shading and clusters pagging comparison with untreated ones (check treatment). In most studied traits no significant differences were recorded between using any treatment compared to other.
- Also, using any previous treatments or cluster pagging increased yield and improved berry quality compared to untreated ones. In general, using thiosulfate or amino acids gave the highest values of these studied traits.
- The foregoing results indicated the vegetative growth and fruiting traits significantly improved du to potassium and amino acids sources spraying, as well as, it minimized the harmful effects of heat stress.

Keywords: *Potassium, Amino acids, yield, heat stress, Flame seedless.*

Introduction

Grapevines are considered the first main fruit trees in their production all over the world. World cultivated area about 7.5 million ha. produced about 67 m tons (FAO, 2015). In Egypt, grapes rank third among fruit crops followed by citrus and mangoes. Especially in the reclaimed lands, the cultivated area of grapevines increased rapidly. It attained about 190486 feddans, the fruitful vines are 174715 feddans, whereas, the total annual production attained 1594782 tons according to the statistics of the Ministry of Agriculture and soil Reclamation in 2019. The grapevines require ideal horticultural practices appropriate climatic conditions and suitable soil.

The potential influence of the forthcoming climate change comperes elevation of annual temperature and the cumulation of excessive weather events, like frequent and severe heat waves, a phenomenon known as global warming. The emissions of greenhouse gases, especially CO2, due to different anthropogenic activities are respected as the major source of climate change and in specific global warming (Quenol *et al*., 2017; Raza *et al*., 2019 and Venios *et al*., 2020).

Shifts in climate patterns leading to abiotic stresses involve the set of environmental conditions that decrease growth and fruiting pennants elective levels. Excessive temperatures are prone to reduce berry quality and decrease economic income, because of harmful effects on berry ripening. Abiotic stresses highly affect in the plant growth and agricultural production and induce more than 50% of worldwide yield loss of man crop annually. it is a major global problem that limits crop and productivity (Kumari *et al*., 2019). The most common abiotic stresses include high temperature, drought, salinity, soil acidification and extreme radiation exposure, being hard to distinguish the individual impacts of each stress in an open field status, where, all these environmental factors are interrelated (Tester and Bacic 2005; Skirycz and Inze, 2010; Kumari *et al*., 2019 and Liu and Fang, 2020). Many attempts were accompanied to alleviate the adverse effect of heat stress on yield and berries quality of grapevines grown under hot conditions. Therefore, the idea of using potassium, amino acids or some of the compounds that contain them. Also, some horticultural practices, such as cluster pagging or vines shading to resist heat stress damages.

Potassium is essential for grapevines growth and fruiting and serves an important purpose in several different plant functions. It may be involved in carbohydrate transport and metabolism, as well as used as an osmotic agent in the opening and closing of stomata, an important mechanism of vine water relations and heat stress resistance (Mullins *et al*., 1992; Mpelasoka *et al*., 2003; Fogac *et al*., 2007 and Cuellar *et al*., 2013).

Amino acids are responsible for enhancing proteins, cell division, plant pigments and natural hormones such as IAA, GA_3 and ethylene. Amino acids can directly or indirectly be effective in the physiological activities in the growth and development of plants. Exogenous of amino acids spraying had been improved the growth and fruiting (Rai, 2002 and Khan *et al*., 2012). cumulation of anthocyanins was Increased by ABA treated and repressed by NAA and shading. ABA enhanced the mRNA cumulation of Vuonyb A1 a supposed regulatory gene of anthocyanin biosynthesis of grape, and all the examined enzyme genes of the anthocyanin biosynthetic pathway, while NAA and shading repressed and retarded them (Joeng *et al.* 2004). Used shade covering of plants has demonstrated changes in biomass allocation or yield reduction. These reductions ar due to reducing the photosynthetic rate (Grassi and Minotta, 2000 and Cohen *et al.,* 2005). By contrast shading, under extreme heat conditions, had increased the photosynthesis rate due to reduce the effect of exposed temperature as a result of reducing the irradiance (Cohen *et al*., 2005 and Greer and Sicard, 2009).

Therefore, the goal of this investigation was to examine the effect of some treatments on tolerance the harmful effects of heat stress and improve the Flame Seedless grapevines fruiting under extreme heat conditions.

Materials and Methods

The current research has been executed during two seasons, 2019 and 2020 on Flame Seedless grapevines grown in Afak farm situated at Blat district, New Valley Governorate, Egypt. The soil of vineyard is silty clay, where, physical and chemical properties were accounted according to Wilde *et al*. (1985) and are tabulated in Table (1). The vines were 10 years old and spaced at 1.5x3 meters apart. The vines trained as a dual system cordon and supported with a Gable shape. Pruning was done out in the second week of December by leaving 14 fruiting spurs with 3 buds on each spur plus four replacement spurs with 2 buds each. Sixty-six healthy vines at almost uniform in their vigor, with no visual nutrient deficiency symptoms were chosen. The eleven different treatments were as follows:

1- Potassium thiosulfate 1 cm^3/L (T1).
2- Potassium thiosulfate 2 cm^3/L (T2).
3- Amino acids 1 cm^3/L (T3).
4- Amino acids 2 cm^3/L (T4).
5- Manvert kinofol 1 cm^3/L (T5).
6- Manvert kinofol 2 cm^3/L (T6).
7- Agromaster 5 g/L (T7).
8- Agromaster 10 g/L (T8)
9- Cluster pagging (T9).
10- Vine shading (T10).
11- Control (T11)

Potassium thiosulfate, amino acids and Manvert kinofol (as a source of amino acids and algae) solutions were prepared by adding 1 or 2 cm3/L, as well as agromaster(as a source of potassium) prepared by the solution of 5 or 10 g/L. In addition, vine shading or cluster pagging were done using 50-60% shaded thin net. The selected vines received two sprays from each substance the 1st spray was after two weeks of berry set and the 2nd spray was ten days later, whereas, vine shading and cluster pagging were done at veraison stage. The study was arrangement as a complete randomized block design with three replicates, two vines each.

Table 1. Some physical and chemical properties of the experiment soil.

Soil properties	Values	Soil properties	Values
Sand %	20.0	Total nitrogen	0.19
Silt %	26.0	Available-P (ppm)	5.18
Clay %	54.0	E-c (1:2.5 extract) m mmhas	2.3
Texture grade	Silty clay	K mg/100g	6.6
PH (1:2.5)	7.76	Fe (ppm) DTPA Extractable	7.50
$CaCO_3$ %	1.9	Mn (ppm) DTPA Extractable	5.20
Organic matter %	1.22	Zn (ppm) DTPA Extractable	1.80

To evaluate the effect of these treatments on growth, nutrient status, yield and berry quality, the following parameters were studied.

1- Vegetative growth criteria:

All vegetative growth criteria, leaf area and pruning wood weight (kg/vine), percentages of K and proline in leaves were measured in the mid of July. Leaf area (cm^2): (Ahmed and Morsy, 1999).

Samples of 30 leaves for each treatment were collected from the first fully mature leaves from the top of shoots in mid of July and leaf petioles were separated from the blades. The petioles were washed with tap water, distilled water, air-dried, oven-dried at 70°C to constant weight, then ground in a stainless-steel mill. Wet digestion was done by using concentrated sulphuric acid and hydrogen peroxide for over-night. Percentages K (on dry weight basis) was determined in the digestion according to Wilde *et al*. (1985). In addition, free proline content in the leaf tissues was estimated as the method suggested by Bates *et al*. (1973).

2- Yield:

At harvest date, the yield per vine was recorded in terms of weight (kg) per vine.

3- Cluster and berry characteristic:

Two clusters were randomly taken from each vine, at harvest date to determine the cluster and berry properties. Berry quality i.e., berry weight, reducing sugar percentages, total soluble solids and total acidity (expressed as g tartaric acid per 100 ml juice), berry traits were estimated according to A.O.A.C. methods (1985). In addition, the anthocyanin content was determined according to Markham (1982). All the obtained data were tabulated and analyzed according to Gomez and Gomez, (1984) using New L.S.D. test for distinguishing the significant differences between various treatment means according to Steel and Torrie (1980).

Data of monthly air temperatures and relative humidity as the average during the two studied seasons, are present in Table (2).

Table 2. Monthly air temperature and relative humidity during the two seasons.

Year / Month	2019				2020			
	Temperature (°C)			R. humidity	Temperature (°C)			R. humidity
	Max.	Min.	Mean		Max.	Min.	Mean	
April	30.6	14.4	22.2	24.2	30.1	14.2	22.0	26.3
May	37.8	21.0	29.3	14.1	35.4	19.6	27.4	21.3
Jun	39.4	24.0	31.8	19.4	38.4	22.4	30.4	19.2
July	39.6	25.0	32.4	20.7	38.2	23.4	31.0	21.1
Aug	39.4	24.7	32.1	21.1	38.8	23.9	31.4	21.9

After New Valley weather station.

The overall optimum temperature of grapevines growth is 25 to 32°. temperature under this optimum range become limited the vegetative growth to. Temperatures above the optimum range decrease photosynthesis rate due to increase the respiration and impact the berry quality balance. Under elevated temperature, an imbalance occurs in accumulation of sugar and anthocyanin, a consequence reduces the yield and berry quality (Jones *et al*., 2004).

Results

1- Vegetative growth and leaf nutritional status:

Data represented in Table (3) declared the effect of potassium and amino acids as well as vine shading and cluster pagging on pruning wood weight (kg/vine) and leaf area as well as leaf K% and proline % of Flame Seedless grapevines during 2019 and 2020 seasons. It is apparent from the obtained data that the results followed the same trend during the two studied seasons.

In a general view, data in the previous table cleared that application forms of amino acids and potassium as well as shading significantly stimulated the pruning wood weight, leaf area as well as K and proline contents of leaves more than cluster pagging or untreated ones (control). The maximum values of pruning wood weight, leaf area, K% and proline % were recorded on the shaded vines (T10), Manvert kinofol (T6), potassium (T1) and amino acids (T4), respectively. On the other side, the least amount of the growth criteria as well as

K and proline contents were obtained on the vines that were untreated (check vines) followed by cluster bagging. Then the highest pruning wood weight was (1.68 & 1.73 kg/vine), leaf area (163.8 & 171.58 cm^2), K% (0.74 & 0.76%) and proline % (50.38 & 54.66%) during the two studied seasons, respectively. On other hand, the least ones due to control (T11) was (1.54 & 1.58 kg/vine), (152.3 & 158.0 cm^2), (0.58 & 0.59%) and (27.93 & 30.85) during the two studied seasons, respectively. Therefore, the corresponding increment of pruning wood weight was (9.09 & 9.49%), leaf area (7.55 & 8.59%), K% (27.59 & 28.81%) and proline % (80.38 & 77.18%), due to T10, T6, T1 and T4 compared to the check treatment (T11) during the two studied seasons, respectively. No significant differences were found in pruning wood weight and leaf area due to spray with any potassium or amino acids sources or vine shading. Whereas, the highest values of leaf-K % were recorded due to spray potassium as well as leaf-proline were recorded due to amino acids. No significant differences were found in leaf-proline due to spray amino acid or manvert kinofol, as well as vine shading done.

Therefore, spraying of potassium thiosulfate, agromaster, as a source of potassium, amino acids, and manvert kinofol, as a source of amino acids and algae, as well as shading the vines significantly improved the total leaf surface area, nutritional status and vegetative growth of vines as well as reduced the adverse effects of heat stress. Certainly, the positive effects of these treatments on improving growth and nutritional status due to resist the heat stress bading. It will improve production and berry characteristics.

Table 3. Effect of different sources of potassium and amino acids, as well as shading on some vegetative growth aspects of Flame Seedless grapevines during 2019 and 2020 seasons.

Treat-ments	Pruning wood weight (kg/vine)		Leaf area (cm^2)		K %		Proline %	
	2019	2020	2019	2020	2019	2020	2019	2020
T_1	1.66 A	1.71 A	162.22 A	169.64 A	0.74 A	0.76 A	37.82 C	39.34 D
T_2	1.65 A	1.68 A	163.01 A	170.46 A	0.72 AB	0.75 AB	38.71 C	40.04 D
T_3	1.66 A	1.71 A	163.8 A	171.28 A	0.66 BC	0.68 B	49.92 A	52.72AB
T_4	1.66 A	1.71 A	163.01 A	170.46 A	0.66 BC	0.68 B	50.38 A	54.66 A
T_5	1.67 A	1.75 A	163.8 A	171.28 A	0.64 C	0.67 B	45.63 B	48.23BC
T_6	1.64 A	1.69 A	163.8 A	171.58 A	0.65 C	0.69 B	46.67 B	51.37AB
T_7	1.66 A	1.71 A	162.57 A	170.34 A	0.68 BC	0.70 B	38.74 C	43.25CD
T_8	1.68 A	1.73 A	163.02 A	171.01 A	0.69 B	0.72 A	40.14 C	45.57 C
T_9	1.53 B	1.59 B	150.5 B	156.1 B	0.57 D	0.60 C	28.41 D	29.61 E
T_{10}	1.68 A	1.73 A	162.02 A	171.67 A	0.65 C	0.66 B	45.36 B	50.54 B
T_{11}	1.54 B	1.58 B	152.3 B	158.0 B	0.58 D	0.59 C	27.93 D	30.85 E
New LSD5%	**0.08**	**0.09**	**9.56**	**10.12**	**0.04**	**0.05**	**2.93**	**3.11**

1- Potassium thiosulfate 1 cm^3/L (T_1), 2- Potassium thiosulfate 2 cm^3/L (T_2), 3- Amino acids 1 cm^3/L (T_3), 4- Amino acids 2 cm^3/L (T_4), 5- Manvert kinofol 1 cm^3/L (T_5), 6- Manvert kinofol 2 cm^3/L (T_6), 7- Agromaster 5 g/L (T_7), 8- Agromaster 10 g/L (T_8), 9- Cluster bages (T_9), 10- Vine shading (T_{10}), 11- Control (T_{11}).

2- Yield and cluster characters:

Data existing in Table (4) declared that the effect of potassium and amino acids, as well as, vine shading and cluster pagging on yield, cluster weight and during 2019 and 2020 seasons. Spraying with potassium thiosulfate, amino acids, agromaster (as potassium source) or Manvert kinofol (as amino acid source) as well as vine shading and cluster pagging significantly increased the yield/vine, cluster weight and 25 berry weight compared to untreated one (control). The obtained highest values of cluster weight were (324.37 & 325.90 g) and (329.09 & 330.64 g) and yield/vine (9.73 & 9.77 kg) and (9.87 & 9.92 kg/vine) due to spray with Manvert kinofol cm^3/L (T5) or Manvert kinofol 2 cm^3/L (T6) during the two studied seasons, respectively. Contrarly, these values on check vines were (270.58 & 277.63 g) and (8.10 & 8.38 kg/vine), respectively. Hence the corresponding increment percentages for these traits over check treatment were (19.88 & 20.44%) and (18.54 & 19.09%) as well as (20.12 & 20.62%) and (17.78 & 18.38%), respectively.

Moreover, no significant differences were recorded due to using any treatment compared to other. Also, the treatments significantly increased the berry weight compared to untreated ones (control).

The heaviest 25 berry weight registered on vines that sprayed with potassium thiosulfate 2 cm3/L (T2) or amino acids 2 cm3/L (T4) (55.11 & 54.92 g) and agromaster 5 g/L (T7) or agromaster 10 g/L (T8) (55.35 & 55.45 g) during the first and second seasons, respectively, whereas, the least 25 berry weight was recorded on vines that untreated (control, T11) (44.54 & 45.73 g), respectively. Then, the corresponding increment percentage of berry weight due to such treatments over control (T11) was (23.73 & 23.30%) and (21.10 & 21.25%). No significant differences were found either due to use any treatment compared to other. The increase in berry weight and size are important target as grapes quality due to the increase in berry weight and size result in an increase in packable yield.

In general, it could be concluded that use of potassium, amino acid or one of their sources, improving the productivity of Flame Seedless grapevines.

Table 4. Effect of different sources of potassium and amino acids, as well as shading on cluster weight of Flame Seedless grapevines during 2019 and 2020 seasons.

Treat-ments	Yield/vine (kg)		Cluster weight (g)		25 berry weight (g)	
	2019	2020	2019	2020	2019	2020
T_1	9.59 A	9.73 A	319.80 A	324.46 A	53.18 A	54.35 A
T_2	9.64 A	9.78 A	321.33 A	326.05 A	55.11 A	54.68 A
T_3	9.59 A	9.75 A	319.80 A	325.07 A	53.25 A	54.27 A
T_4	9.68 A	9.82 A	322.85 A	327.55 A	54.92 A	55.24 A
T_5	9.73 A	9.87 A	324.37 A	329.09 A	53.86 A	54.75 A
T_6	9.77 A	9.92 A	325.90 A	330.64 A	54.83 A	55.01 A
T_7	9.64 A	9.79 A	321.33 A	326.62 A	54.36 A	55.35 A
T_8	9.68 A	9.82 A	322.85 A	327.55 A	54.47 A	55.45 A
T_9	9.67 A	9.85 A	322.55 A	328.47 A	54.04 A	54.91 A
T_{10}	9.65 A	9.75 A	321.94 A	325.08 A	54.26 A	55.24 A
T_{11}	8.10 B	8.38 B	270.58 B	277.63 B	44.54 B	45.73 B
New LSD5%	**0.61**	**0.64**	**17.11**	**16.25**	**2.38**	**2.90**

1- Potassium thiosulfate 1 cm^3/L (T_1), 2- Potassium thiosulfate 2 cm^3/L (T_2), 3- Amino acids 1 cm^3/L (T_3), 4- Amino acids 2 cm^3/L (T_4), 5- Manvert kinofol 1 cm^3/L (T_5), 6- Manvert kinofol 2 cm^3/L (T_6), 7- Agromaster 5 g/L (T_7), 8- Agromaster 10 g/L (T_8), 9- Cluster bages (T_9), 10- Vine shading (T_{10}), 11- Control (T_{11}).

3- Berry quality:

Data of chemical constituents of berry juice as affected by different potassium and amino acids as well as vine shading and cluster pagging during 2019 and 2020 seasons are presented in Table (5). Data indicated that spraying any potassium or amino acid sources, as well as vine shading or cluster pagging induce a significant improving the chemical constituents of berry juice in term of raise values of the reducing sugars and anthocyanin content and unsignificantly effects in total soluble solids and the total acidity compared to check treatment. The highest total soluble solids, reducing sugars and anthocyanin content and least total acidity obtained on vines that treated with cluster pagging (T9), potassium thiosulfate (T2) and potassium thiosulfate (T1) during the two studied seasons, respectively. Contrary, the least values of these traits and highest acidity were recorded in vines that sprayed with amino acids (T3), untreated ones (T11) and vine shading (T10), respectively. The amounts were TSS T9 (17.6 & 17.4%), reducing sugar, T2 (13.28 & 13.83), anthocyanin, T2 (2.08 & 2.09) and total acidity, T1 (0.577 & 0.582) during the two studied seasons, respectively. On other hand, these values on vines that untreated (T11) were, TSS (17.1 & 17.2%), reducing sugar (11.93 & 12.35%), anthocyanin (1.61 & 1.64 mg/g) and total acidity (0.583 & 0.591%) during the two studied seasons, respectively. Hence, the corresponding percentage of increase these attributes due to use previous treatments over control (T11) attained (2.92 & 1.16%) for TSS, (11.31 & 11.98%) for reducing sugars and (29.19 & 27.44%) for anthocyanin, respectively. Also, amending with (T1 or T8) induce decrement percentage in total acidity attained (1.03 & 0.17) and (1.86 & 0.85%), respectively.

Table 5. Effect of different sources of potassium and amino acids, as well as shading on chemical properties of berry of Flame Seedless grapevines during 2019 and 2020 seasons.

Treat-ments	TSS %		Reducing sugar %		Anthocyanin(mg/g)		Acidity %	
	2019	2020	2019	2020	2019	2020	2019	2020
T_1	17.3AB	17.5AB	13.19AB	13.76A	2.06AB	2.07AB	0.577B	0.582B
T_2	17.2AB	17.4AB	13.28AB	13.83A	2.08A	2.09A	0.586B	0.591B
T_3	16.6B	16.3C	12.94B	13.10BC	1.99B	2.02B	0.589AB	0.594AB
T_4	16.8B	16.6BC	12.90B	13.19BC	2.01B	2.05AB	0.592AB	0.595AB
T_5	16.8B	16.5BC	12.68BC	12.92C	2.03B	2.04AB	0.591AB	0.599AB
T_6	16.6BC	16.4C	12.78BC	13.12BC	2.01B	2.04AB	0.585B	0.597AB
T_7	17.3AB	17.3AB	13.24AB	13.36B	2.05AB	2.06AB	0.582B	0.588B
T_8	17.2AB	17.0B	13.25AB	13.50AB	2.05AB	2.01B	0.580B	0.586B
T_9	17.6AB	17.4AB	12.98B	13.10BC	1.89C	1.90C	0.601AB	0.603AB
T_{10}	16.8B	16.5BC	12.28CD	12.65CD	1.86C	1.88C	0.604A	0.607AB
T_{11}	17.1AB	17.2AB	11.93D	12.35D	1.61D	1.64D	0.583B	0.591B
New LSD5%	**0.51**	**0.55**	**0.45**	**0.43**	**0.05**	**0.07**	**0.018**	**0.017**

1- Potassium thiosulfate 1 cm^3/L (T_1), 2- Potassium thiosulfate 2 cm^3/L (T_2), 3- Amino acids 1 cm^3/L (T_3), 4- Amino acids 2 cm^3/L (T_4), 5- Manvert kinofol 1 cm^3/L (T_5), 6- Manvert kinofol 2 cm^3/L (T_6), 7- Agromaster 5 g/L (T_7), 8- Agromaster 10 g/L (T_8), 9- Cluster bages (T_9), 10- Vine shading (T_{10}), 11- Control (T_{11}).

In general, view, it could be seen that all treatments unsignificantly effected on total soluble solids and total acidity. In other hand, they significantly increased the juice sugar content and berry skin anthocyanin dye compared to untreated ones (control).

These findings might be due to tolerance harmful effects of heat stress that cause enhanced maturity and lack of berry coloring.

According to the present results it could be recommended that spraying vines with potassium or amino acid sources as well as cluster pagging improving the berries quality, where that tolerance the harmful effects of heat stress.

Discussion:

Potassium plays a significant role as it is encompassed in metabolic processes such as synthesis of carbohydrates and proteins, enzyme activation, membrane transport, charge balance and the generation of turgor pressure. Potassium to be of special importance for the growth, flowering and fruiting of all fruit trees. In addition, it maintains turgor, reduce water loss and wilting, hence, increases cold hardiness and resistance of plants to biotic and abiotic stresses (Salisbury and Ross, 1992; Walker *et al*., 1998; Leigh, 2001; Dhillon *et al*., 1999; Martin *et al*., 2004 and Dordas, 2008).

Optimum level of potassium in vineyards results in increasing the yield with improving the berry characteristic. These results agree with those of Cawel *et al*. (2000), Pani *et al*. (2003), Shoaib (2002), El-Akkad (2004), Martin *et al*. (2004), Thakur *et al*. (2008), Topolovio *et al*. (2011), Cuellar *et al*. (2013), Belal *et al*. (2017), El-Badawy (2019) and Ahmed-Mona (2020).

Amino acids can directly or indirectly influence the physiological activities of plant growth and development. They are considered as precursors and constituents of proteins, which are important due to stimulate the cell growth. Moreover, the exogenous application of amino acids have been to modulate the growth, yield and biochemical quality of fruit (Rai, 2002; Shiraishi *et al*., 2010, Khan *et al*., 2012).

The essential of amino acids on enhancing growth and vine nutritional status, as well as the positive action on stimulating the physiological activities surely reflected on enhancing growth, advancing maturity and promoting fruit quality. These results are inconsistent with those found by Ahmed and Abd El-Hameed (2003), Ahmed *et al*. (2007), Abdel-Aal *et al*. (2010), Khan *et al*. (2012) and Khan *et al*. (2019).

High temperatures stress affect flowering, slow development of berries and imped sugar cumulation, then delay harvest, reduces yield and berry quality. These findings may be attributable to a sustained reduction of net photosynthesis (Bergqvist *et al*., 2001; Soar *et al*., 2009; Greer and Weston, 2010; Greer and Weedon, 2012 and Greer, 2019). Decreasing in anthocyanin cumulation below high temperature results due to degrade of anthocyanin as well as inhibition of mRNA transcription of anthocyanin biosynthetic genes (Mori *et al*., 2007). Shading has increased the photosynthesis due to reduce the heat stress by reduction of irradiance (Jeong *et al*., 2004 and Cohen *et al*., 2005).

Shading of vines or their bunches with 40 to 70% shade cloth caused average withen-canopy temperatures to decline by over 2°C (Cartechini and Palliotti, 1995). Whereas, shade covering over whole vines reduced canopy temperature by about 6-10°C (Spayd *et al*., 2002 and Rana *et al*., 2004).

Shading bunches had no effect on sugar contents and reduce anthocyanins in the skin (Spayd *et al*., 2002 and Downey *et al*., 2004).

Conclusion:

On the light of the current results, it could be concluded that foliar application of potassium thiosulfate, agromaster (as potassium source), amino acids, or Manvert kinofol (as amino acid source) as well as vine shading or cluster pagging are useful in the improvement of nutritional status grapevines and produced a high crop with good cluster traits and berry quality, where that tolerated the harmful effects of heat stress.

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تأثير بعض المعاملات علي تحمل الاجهاد الحراري في مزارع العنب الفليم عديم البذور

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الملخص

أجريت هذه الدراسة خلال موسمي ٢٠١٩ ، ٢٠٢٠ لدراسة تأثير بعض المعاملات الزراعية علي تحمل الإجهاد الحراري في شجيرات العنب الفليم عديم البذور المنزرعة بمزرعة آفاق بمنطقة بلاط بالوادي الجديد، حيث تم دراسة تأثير الرش ببعض مركبات البوتاسيوم والأحماض الأمينية وكذلك تظليل الشجيرات وتكييس العناقيد علي النمو الخضري والمحصول وخصائص الحبات وتقليل الآثار الضارة للإجهاد الحراري.

وقد أظهرت النتائج:

- أدي استخدام مصادر مختلفة للبوتاسيوم أو الأحماض الأمينية أو تظليل الشجيرات إلي زيادة مؤكدة في وزن خشب التقليم ومساحة الأوراق ومحتوي الأوراق من البوتاسيوم والبرولين مقارنة بالكنترول أو تكييس العناقيد.
- سبب استخدام المعاملات السابقة أو تكييس العناقيد تحسين صفات العنقود والثمار مقارنة بمعاملة الكنترول.
- أظهرت النتائج تفوق استخدام ثيوسلفات البوتاسيوم أو الأحماض الأمينية مقارنة باستخدام التظليل أو تكييس العناقيد.

من نتائج هذه الدراسة يمكن التوصية بأهمية رش ثيوسلفات البوتاسيوم أو الأحماض الأمينية مرتين وذلك لتحسين النمو الخضري والحالة الغذائية لشجيرات العنب مع تحمل الكرمات لأضرار درجات الحرارة المرتفعة وإنتاج محصول عال ذو خصائص ثمرية جيدة.

الكلمات الدالة: *البوتاسيوم – الأحماض الأمينية – المحصول –الإجهاد الحراري – الفليم عديم البذور.*