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PROMOTING PRODUCTIVITY OF THOMPSON SEEDLESS GRAPEVINES BY APPLICATION OF SOME ANTIOXIDANTS AND NUTRIENTS

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ABSTRACT

Role of certain antioxidants and nutrients in promoting productivity of Thompson seedless grapevines was investigated over two seasons (٢٠١٠ and ٢٠١١). The tested antioxidants were vitamins of E, K , B & A (each at ٢٥ ppm), citric acid (at ١٠٠٠ ppm), Folic acid (at ٢٥ ppm) and amino acids (at ٢٥٠ ppm) However the tested nutrients were N, P, K, Mg, Zn, Fe, Mn and B. The tested elements were used singly or in combinations. Yield, cluster weight, berry weight, T.S.S % and total acidity % of the treated vines were investigated.

The obtained results showed that treatment with the tested nutrients or antioxidants considerably improved the yield expressed in weight and number of clusters per vine, cluster weight, berry weight and total soluble solids and responsible for reducing total acidity % in comparison to the check treatment. Application of micro and macro nutrients together was favourable than using each alone in this connection. The best antioxidant in this respect, in ascending order were citric acid, four vitamins, folic acid and amino acids. Combined applications of these

antioxidants were preferable than using each antioxidant alone in this respect.

The effect of antioxidants and nutrients on thompson seedless grapevines

INTRODUCTION

Recently many attempts were carried out for promoting the yield of Thompson seedless grapevines. Different antioxidants enriched with various nutrients were used instead of using synthetic auxins that cause a great pollution in our environment. Using different antioxidants especially along with different nutrients was accompanied with protecting cells from damage and improving the biosynthesis of plant pigments and organic foods (Samiullah *et al*., ١٩٨٨ and Sandermann *et al*., ١٩٩٨).

Previous studies emphasized the beneficial effect of using antioxidants (Abada and Abd El- Hameed, ٢٠٠٩ and ٢٠١٠; Abd El-Kariem, ٢٠٠٩; Ahmed *et al*., ٢٠١٠; Ahmed *et al*., ٢٠١١ a; El- Hanafy, ٢٠١١; Wassel *et al*., ٢٠١١; El- Kady- Hanaa, ٢٠١١; Mekawy, ٢٠١٢ and Ahmed *et al*., ٢٠١٢) especially when they were applied with different nutrients (El- Sawy ٢٠٠٩; Sayed- Heba, ٢٠١٠; El- Kady, ٢٠١١; Ahmed *et al*., ٢٠١١a and ٢٠١١b and El- Kady- Hanaa, ٢٠١١).

The main objective of this work to study the impact of some antioxidants and nutrients on productivity of Thompson seedless grapevines grown in sandy soil.

MATERIALS AND METHODS

The present study was carried out during ٢٠١٠ and ٢٠١١ seasons. ١٩٢ uniform in vigour ١٠- years old cane trained Thompson seedless grapevines were used. The experimental vines were grown in vineyard located at New Farm Fac. of Agric. Sohag Univ., El-Kawthar region, Sohag district, Sohag Governorate. The texture of the soil is sandy. Supporting system was T shape. Winter pruning was conducted on the middle of Jan during both seasons. Cane pruning system was applied through leaving ten canes × six eyes plus six renewal spurs × two eyes. All the selected vines had been planted at ١.٧٥ × ٢.٥ meters apart. Surface irrigation system using well water (١٢٠٠ ppm salinity) and canal water reciprocally was followed. Analysis of the tested soil was done according to method of Chapman and Pratt (١٩٦٥) which are shown in Table (١).

Table ١: Analysis of the tested soil:

Constituents	values
Particle size distribution:	
Sand %	: ٧٨.٧٠
Silt %	: ١٠.٢٨
Clay %	: ١١.٠٢
Texture	: Sandy
pH (١:٢.٥ extract)	: ٧.٥
EC (١: ٢.٥ extract) (dS $m^{-١}$)	: ٣.٣٩
O.M. %	: ٠.٦٤
$CaCO_٣$ %	: ١٢.٠
Total N %	: ٠.٩٥
Available P (Olsen, ppm)	: ١٣.٠
Available K (ammonium acetate, ppm)	: ٢٣٢

The selected vines (١٩٢ vines) received the usual horticultural practices that are commonly used in the vineyard, in addition to treatment with antioxidants and nutrients.

This study included two factors (A & B). The first factor (A) consisted of four treatments from different nutrients namely $a_١$) Untreated, $a_٢$) Using micro nutrients (Zn, Fe, Mn & B), $a_٣$) Using macro nutrients (N, P, K & Mg), and $a_٤$) Using both micro and macro nutrients. The second factor (B) contained from sixteen treatments from single and combined applications of the four antioxidants namely citric acid at ١٠٠٠ ppm, vitamins E, K, B & A each at ٢٥ ppm, Folic acid at ٢٥ ppm and amino acids (tryptophane, methionene and cysteine) at ٢٥٠ ppm. Therefore, ٦٤ treatments were evolved. Each treatment was replicated three times, one vine per each. The four macro nutrients applied were urea (٤٦.٥ % N) at ٠.٥ %, orthophosphoric acid at ٠.١ %, potassin (٤٠ % $K_٢O$) at ٠.١ % and magnesium sulphate (٩.٦ Mg) at ٠.٢٥ %. The four micro nutrients applied were Zn, Fe and Mn in chelated form at ٠.٠٥ % and boric acid (١٧ % B) at ٠.٠٢٥ %. Antioxidants and nutrients were applied four times during each season at growth start (٢nd week of Feb.), just after berry setting (٣rd week of Apr.) and at three weeks intervals (٢nd week

of May and ١st week of June). Triton B as a wetting agent was applied at ٠.٠٥ % to all antioxidant and nutrient solutions. Complete randomized block design in split plot arrangement was followed. The four nutrient treatments and the sixteen antioxidant treatments occupied the main and subplots, respectively.

At harvesting date when T.S.S/ acid ratio reached at least ٢٥/ ١ (Weaver, ١٩٧٦), clusters were harvested and the yield expressed in weight (kg) per vine and number of clusters was recorded. Five clusters/ vine were taken for measuring average cluster weight (g.), berry weight (g.), total soluble solids % and total acidity as g tartaric acid/ ١٠٠ ml juice, A.O.A.C., (١٩٩٥).

All the obtained data were tabulated and statistically analyzed using new L.S.D at ٥ % for comparison among the investigated treatment means according to Mead *et al.*, (١٩٩٣).

RESULTS AND DISCUSSION

١- Yield and cluster weight:

It is clear from the data in Tables (٢ & ٣ & ٤) that spraying macro (N, P, K & Mg) and/ or micro (Zn, Fe, Mn & B) significantly improved the yield expressed in weight (kg.) and number of clusters per vine and cluster weight in coparison to the control treatment. Number of clusters per vine did not change significantly with varying nutrient treatments in the first season of study. Application of macronutrients was significantly preferable than using micro nutrients in improving the yield and cluster weight. Using micro and macro nutrients together significantly enhanced the yield rather than application of each group alone. These results were similar during both seasons.

Single or combined application of the four antioxidants (citric acid, vitamins E & K & B & A, folic acid or amino acids) significantly improved the yield and cluster weight comparing with the check treatment. Combined applications of these antioxidants greatly helped in improving the yield than using each antioxidant alone. Efficacy of the applied materials in increasing yield and cluster weight could be arranged in the following descending order as

follows: citric acid, vitamins E & K & B & A, folic acid and amino acids. Using all antioxidants together effectively maximized the yield and cluster weight during both seasons.

Table ٢: Effect of some nutrients and antioxidants on the number of clusters per vine of Thompson seedless grapevines during ٢٠١٠ and ٢٠١١ seasons.

Kinds of antioxidants (B)	٢٠١٠					٢٠١١				
	Micro and macro nutrients treatments (A)									
	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)
b_1 Untreated	٢٤.٠	٢٤.٠	٢٤.٠	٢٥.٠	٢٤.٣	٢٥.٠	٢٧.٠	٢٩.٠	٣١.٠	٢٨.٠
b_2 Citric acid at ١٠٠ ppm	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٢٧.٠	٢٩.٠	٣١.٠	٣٤.٠	٣٠.٣
b_3 Vitamins E& K& B& A at ٢٥ ppm	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٢٨.٠	٣١.٠	٣٣.٠	٣٥.٠	٣١.٨
b_4 Folic acid at ٢٥ ppm	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٢٩.٠	٣٢.٠	٣٥.٠	٣٦.٠	٣٣.٠
b_5 Amino acids at ٢٥٠ ppm	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٣١.٠	٣٣.٠	٣٦.٠	٣٧.٠	٣٤.٣
b_6 Citric + vitamins	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٣٢.٠	٣٤.٠	٣٦.٠	٣٧.٠	٣٤.٨
b_7 Citric + Folic	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٣٢.٠	٣٤.٠	٣٦.٠	٣٧.٠	٣٤.٨
b_8 Citric + amino acids	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٣٢.٠	٣٤.٠	٣٦.٠	٣٧.٠	٣٤.٨
b_9 Vitamins + Folic	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٣٢.٠	٣٤.٠	٣٦.٠	٣٧.٠	٣٤.٨
b_{10} Vitamins + amino acids	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٣٢.٠	٣٤.٠	٣٦.٠	٣٧.٠	٣٤.٨
b_{11} Folic + amino acids	٢٤.٠	٢٤.٠	٢٥.٠	٢٥.٠	٢٤.٥	٣٢.٠	٣٤.٠	٣٦.٠	٣٧.٠	٣٤.٨
b_{12} Citric + vitamins + Folic	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٣٣.٠	٣٥.٠	٣٧.٠	٣٨.٠	٣٥.٨
b_{13} Citric + vitamins + amino acids	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٣٣.٠	٣٥.٠	٣٧.٠	٣٨.٠	٣٥.٨
b_{14} Citric + Folic + amino acids	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٣٣.٠	٣٥.٠	٣٧.٠	٣٨.٠	٣٥.٨
b_{15} Vitamins + Folic + amino acids	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٣٣.٠	٣٥.٠	٣٧.٠	٣٨.٠	٣٥.٨
b_{16} All antioxidants	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٢٥.٠	٣٤.٠	٣٦.٠	٣٧.٠	٣٩.٠	٣٦.٥
Mean (A)	٢٤.٣	٢٤.٣	٢٤.٩	٢٥.٠		٣١.١	٣٣.٣	٣٥.٣	٣٦.٦	
New L.S.D at ٥ %	A		B		AB	A		B		AB
	NS		NS		NS	١.٣		١.٣		٢.٦

Table ٣: Effect of some nutrients and antioxidants on the yield/ vine (kg.) of Thompson seedless grapevines during ٢٠١٠ and ٢٠١١ seasons.

Kinds of antioxidants (B)	٢٠١٠					٢٠١١				
	Micro and macro nutrients treatments (A)									
	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)
b_1 Untreated	٧.٨	٨.٠	٨.٣	٩.٢	٨.٣	٨.٣	٩.٢	١٠.٢	١١.٥	٩.٨
b_2 Citric acid at ١٠٠ ppm	٨.٠	٨.٢	٨.٩	٩.٥	٨.٧	٩.٢	١٠.٢	١١.٢	١٣.٠	١٠.٩
b_3 Vitamins E& K& B& A at ٢٥ ppm	٨.٣	٨.٥	٩.١	٩.٧	٨.٩	٩.٩	١١.٣	١٢.٣	١٣.٨	١١.٨
b_4 Folic acid at ٢٥ ppm	٨.٥	٨.٨	٩.٤	١٠.٠	٩.٢	١٠.٦	١٢.٠	١٣.٤	١٤.٥	١٢.٦
b_5 Amino acids at ٢٥٠ ppm	٨.٨	٩.٠	٩.٨	١٠.٤	٩.٥	١١.٧	١٢.٩	١٤.٢	١٥.٧	١٣.٦
b_6 Citric + vitamins	٩.٠	٩.٤	١٠.٠	١٠.٦	٩.٨	١٢.٤	١٣.٦	١٤.٨	١٦.٠	١٤.٢
b_7 Citric + Folic	٩.١	٩.٤	١٠.٠	١٠.٦	٩.٨	١٢.٥	١٣.٧	١٤.٩	١٦.٠	١٤.٣
b_8 Citric + amino acids	٩.١	٩.٤	١٠.٠	١٠.٦	٩.٨	١٢.٥	١٣.٧	١٤.٩	١٦.١	١٤.٣
b_9 Vitamins + Folic	٩.٢	٩.٤	١٠.١	١٠.٦	٩.٨	١٢.٥	١٣.٧	١٥.٣	١٦.٥	١٤.٥
b_{10} Vitamins + amino acids	٩.٢	٩.٥	١٠.١	١٠.٦	٩.٩	١٢.٥	١٣.٧	١٥.٣	١٦.٥	١٤.٥
b_{11} Folic + amino acids	٩.٢	٩.٥	١٠.١	١٠.٦	٩.٩	١٢.٦	١٣.٨	١٥.٤	١٦.٦	١٤.٦
b_{12} Citric + vitamins + Folic	٩.٩	١٠.١	١٠.٤	١١.٠	١٠.٤	١٣.٣	١٤.٦	١٦.٢	١٧.٤	١٥.٤
b_{13} Citric + vitamins + amino acids	٩.٩	١٠.٢	١٠.٤	١١.١	١٠.٤	١٣.٤	١٤.٦	١٦.٣	١٧.٥	١٥.٥
b_{14} Citric + Folic + amino acids	٩.٩	١٠.٢	١٠.٥	١١.١	١٠.٤	١٣.٤	١٤.٧	١٦.٣	١٧.٥	١٥.٥
b_{15} Vitamins + Folic + amino acids	٩.٩	١٠.٢	١٠.٥	١١.٢	١٠.٥	١٣.٤	١٤.٧	١٦.٣	١٧.٥	١٥.٥
b_{16} All antioxidants	١٠.١	١٠.٣	١٠.٨	١١.٥	١٠.٧	١٤.٢	١٥.٥	١٦.٧	١٨.٤	١٦.٢
Mean (A)	٩.١	٩.٤	٩.٩	١٠.٥		١٢.٠	١٣.٢	١٤.٦	١٥.٩	
	A	B	AB			A	B	AB		
New L.S.D at ٥ %	٠.٣	٠.٣	٠.٦			٠.٨	٠.٨	١.٦		

Table ٤: Effect of some nutrients and antioxidants on the average cluster weight (g.) of Thompson seedless grapevines during ٢٠١٠ and ٢٠١١ seasons.

Kinds of antioxidants (B)	٢٠١٠					٢٠١١				
	Micro and macro nutrients treatments (A)									
	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)
b_1 Untreated	٣٢٥.٠	٣٣٥.٠	٣٤٦.٠	٣٦٦.٠	٣٤٣.٠	٣٣١.٠	٣٤١.٠	٣٥١.٠	٣٧١.٠	٣٤٨.٥
b_2 Citric acid at ١٠٠ ppm	٣٣٥.٠	٣٤٣.٠	٣٥٦.٠	٣٧٩.٠	٣٥٣.٣	٣٤٢.٠	٣٥٢.٠	٣٦٢.٠	٣٨٢.٠	٣٥٩.٥
b_3 Vitamins E& K& B& A at ٢٥ ppm	٣٤٥.٠	٣٥٥.٠	٣٦٥.٠	٣٨٦.٠	٣٦٢.٨	٣٥٣.٠	٣٦٤.٠	٣٧٣.٠	٣٩٤.٠	٣٧١.٠
b_4 Folic acid at ٢٥ ppm	٣٥٦.٠	٣٦٦.٠	٣٧٦.٠	٤٠٠.٠	٣٧٤.٥	٣٦٥.٠	٣٧٥.٠	٣٨٤.٠	٤٠٤.٠	٣٨٢.٠
b_5 Amino acids at ٢٥٠ ppm	٣٦٧.٠	٣٧٧.٠	٣٩٠.٠	٤١٥.٠	٣٨٧.٣	٣٧٦.٠	٣٩٠.٠	٣٩٥.٠	٤٢٥.٠	٣٩٦.٥
b_6 Citric + vitamins	٣٧٧.٠	٣٩٠.٠	٤٠١.٠	٤٢٢.٠	٣٩٧.٥	٣٨٧.٠	٤٠١.٠	٤١٢.٠	٤٣٢.٠	٤٠٨.٠
b_7 Citric + Folic	٣٧٩.٠	٣٩١.٠	٤٠١.٠	٤٢٢.٠	٣٩٨.٣	٣٩٠.٠	٤٠٢.٠	٤١٣.٠	٤٣٣.٠	٤٠٩.٥
b_8 Citric + amino acids	٣٨١.٠	٣٩١.٠	٤٠١.٠	٤٢٢.٠	٣٩٨.٨	٣٩٠.٠	٤٠٢.٠	٤١٤.٠	٤٣٤.٠	٤١٠.٠
b_9 Vitamins + Folic	٣٨٢.٠	٣٩٢.٠	٤٠٢.٠	٤٢٣.٠	٣٩٩.٨	٣٩١.٠	٤٠٣.٠	٤٢٤.٠	٤٤٥.٠	٤١٥.٨
b_{10} Vitamins + amino acids	٣٨٣.٠	٣٩٤.٠	٤٠٣.٠	٤٢٤.٠	٤٠١.٠	٣٩١.٠	٤٠٣.٠	٤٢٥.٠	٤٤٥.٠	٤١٦.٠
b_{11} Folic + amino acids	٣٨٥.٠	٣٩٥.٠	٤٠٤.٠	٤٢٥.٠	٤٠٢.٣	٣٩٤.٠	٤٠٥.٠	٤٢٧.٠	٤٤٨.٠	٤١٨.٥
b_{12} Citric + vitamins + Folic	٣٩٥.٠	٤٠٥.٠	٤١٧.٠	٤٤١.٠	٤١٤.٥	٤٠٤.٠	٤١٧.٠	٤٣٧.٠	٤٥٧.٠	٤٢٨.٨
b_{13} Citric + vitamins + amino acids	٣٩٦.٠	٤٠٦.٠	٤١٧.٠	٤٤٢.٠	٤١٤.٣	٤٠٥.٠	٤١٨.٠	٤٤٠.٠	٤٦٠.٠	٤٣٠.٨
b_{14} Citric + Folic + amino acids	٣٩٧.٠	٤٠٦.٠	٤١٨.٠	٤٤٥.٠	٤١٦.٥	٤٠٦.٠	٤١٩.٠	٤٤٠.٠	٤٦١.٠	٤٣١.٥
b_{15} Vitamins + Folic + amino acids	٣٩٧.٠	٤٠٧.٠	٤١٩.٠	٤٤٦.٠	٤١٧.٣	٤٠٦.٠	٤٢٠.٠	٤٤١.٠	٤٦٢.٠	٤٣٢.٣
b_{16} All antioxidants	٤٠٤.٠	٤١٣.٠	٤٣٠.٠	٤٦٠.٠	٤٢٦.٨	٤١٧.٠	٤٣١.٠	٤٥١.٠	٤٧٢.٠	٤٤٢.٨
Mean (A)	٣٧٥.٣	٣٨٥.٤	٣٩٦.٦	٤١٩.٩		٣٨٤.٣	٣٩٦.٤	٤١١.٨	٤٣٢.٨	
New L.S.D at ٥ %	A		B		AB	A		B		AB
	٨.٠		٩.٠		١٨.٠	٧.٠		٨.٠		١٦.٠

The maximum yield and cluster weight were recorded with using all nutrients with all antioxidants together. Similar results were obtained in both seasons of the study.

The promoting effect of different nutrients on the yield and cluster weight was supported by the results of El- Kady (٢٠١١); Ahmed *et al*., (٢٠١١a) and (٢٠١١b) and El- Kady- Hanaa (٢٠١١). The obtained results that indicat to the positive effect of antioxidants on the yield and cluster weight are in agreement with those obtained by El- Hanafy (٢٠١١); Wassel *et al*., (٢٠١١); El- Kady- Hanaa (٢٠١١); Mekawy (٢٠١٢) and Ahmed *et al*., (٢٠١٢).

٢- Physical and chemical characteristics of the grapes:

Data in Tables (٥ & ٦ & ٧) clearly reveal that foliar application of micro and or macro nutrients significantly was followed by improving quality of the grapes in terms of increasing berry weight and T.S.S % and reducing total acidity % in comparison to the control treatment. Using all nutrients was significantly favourable in improving quality of the berries than using micro or macro nutrients each alone.

Quality of the berries significantly enhanced with using the four antioxidants (citric acid, vitamins K, E, B & A, folic acid or amino acids) either singly or in various combinations rather than non-application. Quality improving was associated with using citric acid, vitamins K, E, B & A, folic acid and amino acids, in ascending order. Using all antioxidants together gave the best results.

Treating the vines four times with a mixture of nutrients (N, P, K, Mg, Zn, Fe, Mn & B) and antioxidants (citric acid, vitamins K, E, B & A, folic acid and amino acids) resulted in the best results with regard to physical and chemical characteristics of the grapes during both seasons.

The promoting effect of different nutrients on the physical and chemical characteristics was supported by the results of El- Kady (٢٠١١); Ahmed *et al*., (٢٠١١a) and (٢٠١١b) and El- Kady- Hanaa (٢٠١١).

Table ٥: Effect of some nutrients and antioxidants on the average berry weight (g.) of Thompson seedless grapevines during ٢٠١٠ and ٢٠١١ seasons.

Kinds of antioxidants (B)	٢٠١٠					٢٠١١				
	Micro and macro nutrients treatments (A)									
	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)
b_1 Untreated	١.٥٥	١.٥٩	١.٦٤	١.٦٨	١.٦٢	١.٥٤	١.٦٠	١.٦٦	١.٧٢	١.٦٣
b_2 Citric acid at ١٠٠ ppm	١.٦١	١.٦٦	١.٧١	١.٧٦	١.٦٩	١.٦٢	١.٦٧	١.٧٣	١.٨٠	١.٧١
b_3 Vitamins E& K& B& A at ٢٥ ppm	١.٦٦	١.٧١	١.٧٦	١.٨٣	١.٧٤	١.٦٧	١.٧٢	١.٧٩	١.٨٨	١.٧٧
b_4 Folic acid at ٢٥ ppm	١.٧١	١.٧٦	١.٨١	١.٨٧	١.٧٩	١.٧١	١.٧٧	١.٨٤	١.٩٢	١.٨١
b_5 Amino acids at ٢٥٠ ppm	١.٧٦	١.٨٢	١.٨٨	١.٩٤	١.٨٥	١.٧٧	١.٨٢	١.٨٩	١.٩٧	١.٨٦
b_6 Citric + vitamins	١.٨٢	١.٨٧	١.٩٤	٢.٠٠	١.٩١	١.٨٣	١.٨٩	١.٩٦	٢.٠٤	١.٩٣
b_7 Citric + Folic	١.٨٣	١.٨٧	١.٩٤	٢.٠٠	١.٩١	١.٨٤	١.٩٠	١.٩٧	٢.٠٤	١.٩٤
b_8 Citric + amino acids	١.٨٣	١.٨٧	١.٩٤	٢.٠٠	١.٩١	١.٨٤	١.٩٠	١.٩٧	٢.٠٤	١.٩٤
b_9 Vitamins + Folic	١.٨٣	١.٨٨	١.٩٤	٢.٠٠	١.٩١	١.٨٤	١.٩٠	١.٩٧	٢.٠٥	١.٩٤
b_{10} Vitamins + amino acids	١.٨٣	١.٨٩	١.٩٤	٢.٠٢	١.٩٢	١.٨٤	١.٩٠	١.٩٨	٢.٠٥	١.٩٤
b_{11} Folic + amino acids	١.٨٣	١.٨٩	١.٩٤	٢.٠٢	١.٩٢	١.٨٥	١.٩٠	١.٩٨	٢.٠٦	١.٩٥
b_{12} Citric + vitamins + Folic	١.٨٨	١.٩٤	١.٩٩	٢.٠٨	١.٩٧	١.٨٩	١.٩٥	٢.٠٣	٢.١١	٢.٠٠
b_{13} Citric + vitamins + amino acids	١.٨٨	١.٩٩	٢.٠٠	٢.١٠	١.٩٨	١.٩٠	١.٩٥	٢.٠٣	٢.١١	٢.٠٠
b_{14} Citric + Folic + amino acids	١.٨٨	١.٩٥	٢.٠٠	٢.١٠	١.٩٨	١.٩٠	١.٩٥	٢.٠٣	٢.١١	٢.٠٠
b_{15} Vitamins + Folic + amino acids	١.٨٨	١.٩٥	٢.٠٠	٢.١٠	١.٩٨	١.٩٠	١.٩٦	٢.٠٣	٢.١١	٢.٠٠
b_{16} All antioxidants	١.٩٣	١.٩٩	٢.٠٥	٢.١٥	٢.٠٣	١.٩٥	٢.٠١	٢.٠٨	٢.١٩	٢.٠٦
Mean (A)	١.٧٩	١.٨٥	١.٩١	١.٩٨		١.٨١	١.٨٦	١.٩٣	٢.٠١	
New L.S.D at ٥ %	A	B	AB			A	B	AB		
	٠.٠٤	٠.٠٥	٠.١٠			٠.٠٥	٠.٠٥	٠.١٠		

Table ٦: Effect of some nutrients and antioxidants on the percentage of total soluble solids in the grapes of Thompson seedless grapevines during ٢٠١٠ and ٢٠١١ seasons.

Kinds of antioxidants (B)	٢٠١٠					٢٠١١				
	Micro and macro nutrients treatments (A)									
	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)
b_1 Untreated	١٧.١	١٧.٤	١٧.٨	١٨.٠	١٧.٦	١٧.٥	١٨.٠	١٨.٤	١٨.٧	١٨.٢
b_2 Citric acid at ١٠٠ ppm	١٧.٥	١٧.٧	١٨.١	١٨.٤	١٧.٩	١٧.٩	١٨.٤	١٨.٨	١٩.١	١٨.٦
b_3 Vitamins E& K& B& A at ٢٥ ppm	١٧.٩	١٨.٣	١٨.٦	١٩.٠	١٨.٥	١٨.٣	١٨.٨	١٩.٢	١٩.٥	١٩.٠
b_4 Folic acid at ٢٥ ppm	١٨.٢	١٨.٥	١٩.١	١٩.٥	١٨.٨	١٨.٦	١٩.١	١٩.٥	١٩.٩	١٩.٣
b_5 Amino acids at ٢٥٠ ppm	١٨.٥	١٨.٩	١٩.٦	٢٠.٠	١٩.٣	١٨.٩	١٩.٤	١٩.٨	٢٠.٤	١٩.٦
b_6 Citric + vitamins	١٨.٩	١٩.٣	٢٠.١	٢٠.٤	١٩.٧	١٩.٤	١٩.٩	٢٠.٤	٢٠.٧	٢٠.١
b_7 Citric + Folic	١٩.٠	١٩.٤	٢٠.٢	٢٠.٤	١٩.٨	١٩.٤	١٩.٩	٢٠.٥	٢٠.٨	٢٠.٢
b_8 Citric + amino acids	١٩.٠	١٩.٤	٢٠.٢	٢٠.٥	١٩.٨	١٩.٥	٢٠.٠	٢٠.٥	٢٠.٨	٢٠.٢
b_9 Vitamins + Folic	١٩.٠	١٩.٤	٢٠.٢	٢٠.٥	١٩.٨	١٩.٥	٢٠.٠	٢٠.٥	٢٠.٩	٢٠.٢
b_{10} Vitamins + amino acids	١٩.٠	١٩.٥	٢٠.٢	٢٠.٦	١٩.٨	١٩.٥	٢٠.٠	٢٠.٥	٢٠.٩	٢٠.٢
b_{11} Folic + amino acids	١٩.١	١٩.٥	٢٠.٢	٢٠.٧	١٩.٨	١٩.٥	٢٠.٠	٢٠.٥	٢١.٠	٢٠.٢
b_{12} Citric + vitamins + Folic	١٩.٤	١٩.٨	٢٠.٧	٢١.٠	٢٠.٢	٢٠.٠	٢٠.٥	٢١.٠	٢١.٧	٢٠.٨
b_{13} Citric + vitamins + amino acids	١٩.٥	٢٠.١	٢٠.٧	٢١.٠	٢٠.٣	٢٠.٠	٢٠.٥	٢١.٠	٢١.٩	٢٠.٨
b_{14} Citric + Folic + amino acids	١٩.٥	٢٠.١	٢٠.٨	٢١.٠	٢٠.٣	٢٠.١	٢٠.٦	٢١.١	٢٢.٠	٢٠.٩
b_{15} Vitamins + Folic + amino acids	١٩.٥	٢٠.١	٢٠.٩	٢١.١	٢٠.٣	٢٠.١	٢٠.٦	٢١.١	٢٢.١	٢٠.٩
b_{16} All antioxidants	١٩.٩	٢٠.٥	٢١.٤	٢٢.٢	٢١.٠	٢٠.٥	٢١.١	٢١.٨	٢٢.٦	٢١.٥
Mean (A)	١٨.٨	١٩.٢	١٩.٩	٢٠.٣		١٩.٣	١٩.٨	٢٠.٣	٢٠.٨	
New L.S.D at ٥ %	A ٠.٢	B ٠.٣	AB ٠.٦			A ٠.٢	B ٠.٣	AB ٠.٦		

Table ٧: Effect of some nutrients and antioxidants on the percentage of total acidity in the grapes of Thompson seedless grapevines during ٢٠١٠ and ٢٠١١ seasons.

Kinds of antioxidants (B)	٢٠١٠					٢٠١١				
	Micro and macro nutrients treatments (A)									
	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)	a_1 untreated	a_2 Micro	a_3 Macro	a_4 Both	Mean (B)
b_1 Untreated	٠.٦٨٠	٠.٦٦٤	٠.٦٤٧	٠.٦٢٠	٠.٦٥٣	٠.٦٩٤	٠.٦٦٠	٠.٦٤٠	٠.٦١١	٠.٦٥١
b_2 Citric acid at ١٠٠ ppm	٠.٦٦٠	٠.٦٤٠	٠.٦٢٠	٠.٦٠٠	٠.٦٣٠	٠.٦٧٥	٠.٦٤٠	٠.٦٢٠	٠.٥٩٠	٠.٦٣١
b_3 Vitamins E& K& B& A at ٢٥ ppm	٠.٦٤١	٠.٦٢٠	٠.٦٠٠	٠.٥٨١	٠.٦١١	٠.٦٦٠	٠.٦٠٩	٠.٦٠٠	٠.٥٧٠	٠.٦١٠
b_4 Folic acid at ٢٥ ppm	٠.٦٢١	٠.٦٠٠	٠.٥٨١	٠.٥٦١	٠.٥٩١	٠.٦٤٥	٠.٥٩٠	٠.٥٧١	٠.٥٥١	٠.٥٨٩
b_5 Amino acids at ٢٥٠ ppm	٠.٦٠٠	٠.٥٨٠	٠.٥٦٠	٠.٥٤١	٠.٥٧٠	٠.٦٣١	٠.٥٧٥	٠.٥٥٠	٠.٥٢٩	٠.٥٧١
b_6 Citric + vitamins	٠.٥٨٠	٠.٥٦٠	٠.٥٤١	٠.٥٢٢	٠.٥٥١	٠.٦١١	٠.٥٦٠	٠.٥٣٠	٠.٥٠٠	٠.٥٥٠
b_7 Citric + Folic	٠.٥٧٧	٠.٥٥٧	٠.٥٣٧	٠.٥١٧	٠.٥٤٧	٠.٦١٠	٠.٥٥٥	٠.٥٢٧	٠.٥٠٠	٠.٥٤٨
b_8 Citric + amino acids	٠.٥٧٥	٠.٥٥٥	٠.٥٣٦	٠.٥١٦	٠.٥٤٦	٠.٦١٠	٠.٥٥٠	٠.٥٢٦	٠.٥٠٠	٠.٥٤٧
b_9 Vitamins + Folic	٠.٥٧٤	٠.٥٥٥	٠.٥٣٥	٠.٥١٤	٠.٥٤٥	٠.٦٠٢	٠.٥٤٩	٠.٥٢٥	٠.٥٠٠	٠.٥٤٤
b_{10} Vitamins + amino acids	٠.٥٧٣	٠.٥٥٢	٠.٥٣٣	٠.٥١٣	٠.٥٤٣	٠.٦٠٠	٠.٥٤٩	٠.٥٢٠	٠.٤٩٧	٠.٥٤٢
b_{11} Folic + amino acids	٠.٥٧١	٠.٥٥٠	٠.٥٣١	٠.٥١١	٠.٥٤١	٠.٥٩٧	٠.٥٤٧	٠.٥١٨	٠.٤٩٥	٠.٥٣٩
b_{12} Citric + vitamins + Folic	٠.٥٥٠	٠.٥٣٠	٠.٥٠٠	٠.٤٨٠	٠.٥١٥	٠.٥٧١	٠.٥٢٠	٠.٤٩١	٠.٤٧١	٠.٥١٣
b_{13} Citric + vitamins + amino acids	٠.٥٤٢	٠.٥٢٠	٠.٤٩١	٠.٤٧٧	٠.٥٠٨	٠.٥٧٠	٠.٥١٧	٠.٤٧٥	٠.٤٧٠	٠.٥٠٨
b_{14} Citric + Folic + amino acids	٠.٥٤٠	٠.٥١٨	٠.٤٩٠	٠.٤٧٥	٠.٥٠٦	٠.٥٦٨	٠.٥١٦	٠.٤٧١	٠.٤٦٦	٠.٥٠٥
b_{15} Vitamins + Folic + amino acids	٠.٥٤٠	٠.٥١٦	٠.٤٨٨	٠.٤٧١	٠.٥٠٤	٠.٥٦٦	٠.٥١٥	٠.٤٧١	٠.٤٦٦	٠.٥٠٥
b_{16} All antioxidants	٠.٥٠٥	٠.٤٨٠	٠.٤٦٠	٠.٤٣٠	٠.٤٦٩	٠.٥٤٦	٠.٤٨٠	٠.٤٤٩	٠.٤٠٥	٠.٤٧٠

Mean (A)	٠.٥٨ ٣	٠.٥٦ ٢	٠.٥٤ ١	٠.٥٢ ١		٠.٦١ ٠	٠.٥٥ ٨	٠.٥٣ ٠	٠.٥٠ ٨	
	A		B		AB	A		B		AB
New L.S.D at ٥ %	٠.٠١٢		٠.٠١٤		٠.٠٢٨	٠.٠١١		٠.٠١٤		٠.٠٢٨

These results are in agreement with those obtained by El- Hanafy (٢٠١١); Wassel *et al*., (٢٠١١); El- Kady- Hanaa (٢٠١١); Mekawy (٢٠١٢) and Ahmed *et al*., (٢٠١٢).

The positive action of nutrients and antioxidants on fruiting of the vines might be attributed to their essential roles in the biosynthesis of plant pigments and organic foods as well as enhancing enzymes activities and cell division. The beneficial effect of antioxidants on counteracting the adverse effects of salinity and drought on fruiting could give another explanation (Nijjar, ١٩٨٥; Samiullah *et al*., ١٩٨٨ and Sandermann *et al*., ١٩٩٨).

As a conclusion, supplying Thompson seedless grapevines with N, P, K, Mg, Zn, Fe and B fertilizers along with citric acid, vitamins K, E, A & B, folic acid and amino acids via leave was beneficial for promoting yield quantitively and qualitatively.

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تحسين إنتاجية كرمات العنب الطومسون سيدلس عن طريق استخدام بعض مضادات الأكسدة والعناصر الغذائية

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تم رش كرمات العنب الطومسون سيدلس النامية في التربة الرملية أربعة مرات ببعض مضادات الأكسدة (فيتامينات هـ ، ك ، ب ، أ بتركيز ٢٥ جزء في المليون ، حامض ألستريك بتركيز ١٠٠٠ جزء في المليون – حامض الفوليك بتركيز ٢٥ جزء في المليون – والأحماض الأمينية بتركيز ٢٥٠ جزء في المليون) مع بعض العناصر الغذائية (النيتروجين – الفوسفور – البوتاسيوم – الماغنيسيوم – الزنك – الحديد – المنجنيز – البورون) إما بصورة فردية أو بجميع التوليفات المختلفة وذلك خلال موسمي ٢٠١٠، ٢٠١١ ولقد تم دراسة درجة استجابة كمية المحصول ووزن العنقود ووزن الحبة والمواد الصلبة الذائبة الكلية والحموضة الكلية لهذه المعاملات.

وقد أوضحت النتائج أن الاستخدام الفردي والمشترك للعناصر الغذائية والمواد المضادة للأكسدة يساعد على تحسين كمية محصول الكرمة معبرا عنه في صورة عدد العناقيد والوزن بالكيلو جرام ووزن العنقود ووزن الحبة والنسبة المئوية للمواد الصلبة الذائبة الكلية ونقص النسبة المئوية للحموضة الكلية وذلك بالمقارنة بمعاملة الكونترول. وكان استخدام العناصر ألصغري والكبرى معا أفضل من استخدام أي منهما بمفرده في هذا الصدد كذلك كان الاستخدام المشترك للمواد المضادة للأكسدة أفضل من استخدام أي مادة مضادة للأكسدة بمفردها.

The effect of antioxidants and nutrients on thompson seedless grapevines

أمكن الحصول علي أفضل النتائج بخصوص المحصول كما ونوعا في كرمات العنب الطومسون سيدلس النامية في التربة الرملية عند رش الكرمات بجميع العناصر الغذائية (نيتروجين – فوسفور – بوتاسيوم – ماغنيسيوم– زنك – حديد – منجنيز – بورون) جنبا إلي جنب مع حامض ألستريك – فيتامينات هـ ، ك ، ب ، أ – حامض الفوليك والأحماض الأمينية.