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EFFECT OF FOLIAR WITH SOME NUTRIENTS AND HUMIC ACID ON FRUIT SET, YIELD AND QUALITY OF ROOMY AHMAR GRAPEVINES

Abbas, Enas S. ;Sawsan A. Bondok and V. H. Girgis
Hort. Res. Instit., Agric. Res. Center, Giza, Egypt.

ABSTRACT

This study was carried out during the seasons of 2003 and 2004 to study the effect of Humic acid and or K, B and Zn on leaf mineral content, berry set, leaf area, yield and bunch quality of Roomy Ahmar grapevines grown in a clay loam soil under surface irrigation system in EL-Baramoon Experimental Farm, Dakahlia Governorate.

Humic acid and or K, B and Zn were used at 5 %, 2 %, 0.2 % and 0.2 % respectively..K,B and Zn are used as a foliar spray at three times (before bloom, after berry set and when berries reached about two thirds of their normal size.Whereas humic acid is usid as soil treatments in the same times.

Data reveal that all treatments significantly increased NPK, B and Zn content in leaf petioles as compared to control, in the two seasons under study.Furthermore, all treatments, significantly increased berry set, average leaf area, yield per vine bunch weight, number of berries/bunch, compactness coefficient, berry weight and size and juice volume of berries.

Moreover, all treatments significantly increased total soluble solids, SSC/acid ratio and total anthocyanin in berries akin. Yet, significantly decreased total acidity in juice berries.

Humic acid alone or with combination with K, B and Zn treatments presented more pronounced effect .

From our study it was concluded that humic acid as soil applicat at 5 % enhances plant nutrition, increas leaf area., increased yield and improved bunch quality of Roomy Ahmar grapevines.

INTRODUCTION

Roomy Ahmar grape cultvar is one of the most popular cultivars grown in Egypt, it ripens at late season and its cluster is rather loose due to poor berry set which is negatively reflected on bunch quality.Therefore, increasing set, yield and improving bunch qualitie are essential aims for consumer.

Humic acid is the end product of decayed matter and usually contains large qualities of trace minerals (Davies and Ghabbour, 1988 and Demir and Gunes, 2005). Moreover, humic acid is the natural and organic way to provide plants and soil with a concentrated dose of essential nutrients and trace elements enhance the uptake of potassium, calcium, magnesium and phosphorus and reduces other fertilizer requirement.

Potassium as foliar sprays is known to influence grape yield through its effect on berry set, bunch weight and improving berry quality. It is necessary for formation carbohydrates, protein synthesis and cell division and enhances flavor and color of berries.

The mean values of potassium on yield and bunch quality of various grapevine varieties are studies by Shin and Lee (1995); Omar (2000) and Abbas and Mahmoud (2000).

Boron playes a major role in flowering and fruiting process of pollen germination, cell division, nitrogen metabolism, sugar translocation and the movement of hormones. The great value of boron on yield and bunch quality of various grapevine cultivars was studied by many workers such as Nijjar (1985) on Thompson Seedless, Ahmed and EL-Dawwey (1992) on Red Roomy grapevines and EL-Shobaky *et al.* (2001) on Ruby Seedless grapevines.Also,Zinc plays a role in the carbonic anhydrous chloroplast enzyme system which controls CO_2 fixation in photosynthesis (Thorne, 1957). Tthe aim of this investigation was to study the effect of, K, B and Zn foliar spray and Humic acid which used as safe fertilizers and environment friendly on the yield and quality of Roomy Ahmar grapes.

MATERIALS AND METHODS

This study was carried out during the two successive seasons of 2003-2004 on Roomy Ahmar grapevines grown at EL-Baramoon Experimental Farm, Dakahlia Governorate. The vines were 8-years-old, cultivated at 2 x 2.5 meters apart, and double cardon trained. The vines received to the normal agricultural practices as in the commercial grape vineyards under Dakahlia conditions.

During each season, 72 vines of almost similar vigor were shosen arranged in a randomized complete block design, 3 vines were selected at random and replicated 3 times as to receive one of the following treatments:

1- Control (sprayed with water).
2- Humic acid at (5 %).
3- K at (2 %) as potassium sol.
4- B at (0.2 %) as boric sulphate.
5- Zn at (0.2 %) as zinc sulphate.
6- Humic acid at (5 %) + K at (2 %).
7- Humic acid at (5 %) + B at (0.2 %).
8- Humic acid at (5 %) + Zn at (0.2 %).

Note :

I- Composition and properties of Humic acid :

Humic acids	18 %
Nitrogen (N)	10 %
P_2O_5	4 %
K_2O	6 %
Fe	0.2 %
pH	8.9
Density	1.23 kg/L
CEC	300 - 500 meg/100 g

II- K,B and Zn were sprayed at three times :

a- Before bloom.

b- After berry set.

c- When berries reached about two third of its normal size.

Humic acid is used as a soil application at the same times of foliar application

Table (1) : Some physical and chemical analysis of the experimental soil.

Soil depth (cm)	E.C (ds.m)	pH (1:25)	ESP	Available nutrients (ppm)				
				N	P	K	B	Zn
0-30	0.9	7.8	4.8	30	11.5	400	0.07	1.7
30-60	1.3	7.8	4.8	28	11.0	400	0.06	1.7
60-90	1.4	7.9	5.0	28	10.0	400	0.05	1.7

Particle size distribution						
Soil depth (cm)	Sand %	Silt %	Clay %	OM %	$CaCO_3$ %	Texture
0-30	25.0	31.5	43.5	2.2	3.3	Clay loam
30-60	25.5	31.6	42.9	1.1	3.3	
60-90	26.0	31.9	43.1	1.1	3.3	

Leaf samples of 20 leaves per each replicate were taken from the first fully mature leaves from the tip of the growing shoots in mid June in both seasons for analysis.. The concentration of leaf mineral content of petioles was determined. Nitrogen was determined according to micro-kjeldahl method as described by Peregl (1945). Phosphorus according to Chapman and Pratt (1961), Potassium using a flame photometer according to Brown and Lillelan (1946). Boron and Zn were determined using the Perkin-Elmar atomic absorption spectrophotometer model 305B.

During both growing seasons of this study three cluster per vine from each replicate were bagged in polyethylene to determine berry set percentage.

The average leaf area(m^2/vine) was also determined at full bloom stage by taken twenty mature leaves to determine leaf area by using digital planimeter and then multiplay by leaves number/vine to determin the total leaf area/vine

Average yield /vine weight (kg), cluster weight (g) and number, cluster length, compactness coefficeant was also estimated by dividing the number of berries per cluster of cluster length (cm) according to Winkler *et al.*, (1974). Physical and chemical properties of berries were determined. Berries weight and size, juice volume, total soluble solids (SSC) expressed as Brix by using hand refractometer, total acidity percentage according to A.O.A.C (1985), total soluble solids/acid ratio (SSC/acidity) and total anthocyanin in berries skin (mg/g fw) was also determined according to Hisa *et al.* (1965).

Data obtained were statistically analyzed according to Snedecor and Cochran (1990) and LSD test at 0.5 level was used .

RESULTS AND DISCUSSION

Effect of Humic acid, K, B and Zn on :

1- leaf mineral content :

Data presented in Table (2) indicated that Humic acid, K, B and Zn treatment significantly increased NPK, B and Zn leaf content as compaead to the control. The highest values were obtained from Humic acid either applied alone or in combination with K, B and Zn .

Table (2): Effect of foliar application with some nutrients and humic acid on leaf mineral content of Roomy Ahmar grapevines

Treatments	N (%)		P (%)		K (%)		B (ppm)		Zn (ppm)	
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003
Control	1.90	1.80	0.20	0.19	1.80	1.70	37.00	39.00	40.37	42.37
Humic acid	2.40	2.50	0.26	0.25	2.0	2.1	56.00	58.00	45.70	46.27
K	2.20	2.40	0.24	0.24	2.1	2.0	44.00	46.67	42.07	43.70
B	2.30	2.40	0.24	0.23	1.90	1.80	76.33	79.00	42.70	43.97
Zn	2.20	2.30	0.26	0.23	1.90	1.80	41.33	43.33	52.03	54.80
Humic acid+K	2.30	2.60	0.26	0.25	2.1	2.2	58.00	85.00	47.43	48.13
Humic acid+B	2.30	2.50	0.26	0.26	2.0	2.1	80.00	82.33	46.30	47.47
Humic acid+Zn	2.40	2.50	0.27	0.25	2.1	2.1	56.00	57.67	56.10	57.47
L.S.D at 5 %	0.30	0.40	0.03	0.04	0.05	0.06	2.08	2.19	1.87	2.77

No significantly differences could be detected between Humic acid either alone or combined with K, B and Zn. The increment due to humic acid treatment in leaf mineral content go in line with those presented by Abdel-AL *et al.* (2005); Demir and Gunes (2005); Omar and Abdella (2005) and EL-Seginy (2005) who reported that sprayed young pear and apricot tre which grown in calcareous soils with Actosol (an organic humic acid as liquid fertilizer) at different stages significantly increased N, P, K, Ca content. Concerning the increment occurred due to foliar spray with K leaf mineral content our data go in line with Taitsilashvihi *et al.* (1981), Omar (2000) and Abbas and Mohamed (2000) who mentioned that foliar spray with K significantly increased N and K leaf content.

The increase in N and P leaf content due to spraying Zn the data agreed with the results obtained by Velikar and Toma (1977) and EL-Shobaky *et al.* (2001) who mentioned that foliar sapplication with B and Zn significantly increased both N and P leave content in Ruby Seedless grapes: On the other hand, Nour (1973) and Bacha *et al.* (1998) reported that no obvious increase in leaf macro-nutrient contents by using Z and B sprayed Roumy Red and Thompson Seedless grapevines.

Leaf area :

Data in Table (3) show clearly that all treatments significantly increased average leaf area in comparsion with the control during the two seasons under this study. The highest values of the stimate were obtaind from humic acid either alone or combination with K, B and Zn. The increment in leaf area due to humic acid application may be due to its effect on increasing nutrients availability and its containing treatments vitamins and cytokinin Schintzer and Skinner, (1962) and Yagodin, (1984). Our data go in line with Omar and Abdella (2005) who mentioned that humic acid application significantly increased leaf area of Superior Seedless vines. Also Abd EL-Hameed (2005) indicated that spraying Roomy Red grape with mono potassium phosphate (MPK) significantly increased leaf area compared to contro.

EL-Shabrawy and Badran (2005) mentioned that leaf area (cm^2) was significantly increased by foliar spraying with Zn at 300 ppm

Berry set :

It is obvious from Table (3) that all treatments significantly increased berry set percentageas compaed to the control. Yet, humic acid either alone or in combination with B, Zn and K gave a more pronouncing effect than other thetreatments. The increment due to these treatments reached about 37.0%, 36.5%, 38 %, 37 % and 31 %, respectively. Our data are in line with Padem and Ocal (1999) who reported that foliar spray with humic acid significantly increased fruit set of tomato plants.

Table (3): Effect of foliar spray with some nutrients and humic acid on leaf area, berryt set and yield of Roomy Ahmar grapevine.

Treatments	Leaf area (m^2)		Fruit set %		Yield/vine (kg)	
	2002	2003	2002	2003	2002	2003
Control	14.30	14.70	13.40	14.10	9.00	9.30
Humic acid	16.30	16.50	18.90	18.83	12.94	13.00
K	15.80	16.30	16.80	16.93	12.60	12.80
B	15.70	16.00	17.50	17.80	12.63	13.00
Zn	15.70	16.00	17.03	17.37	12.00	12.30
Humic acid + K	16.20	16.30	18.60	18.07	13.27	13.47
Humic acid + B	16.30	16.40	18.43	19.10	13.13	13.40
Humic acid + Zn	16.50	16.50	18.03	18.03	12.63	13.20
L.S.D at 5 %	1.06	0.93	0.75	1.52	1.47	1.42

The increase obseved in berry set as a result of K spray are agreement with Abd EL-Hameed (2005) on Roomy Red grapevines.

Furthermore, the increment in beery set attributed to B foliar spray could be due to the role of Boron in the flowering procrss and pollen germination. Okamota and Kobayshi (1971) found that spraying Muscat of Alexandria grapevines with B before blooming improved pollen germination and berry set.

The increment in berry set attributed to Zn foliar spray may be due to its effect ona large number of enzymes including auxins (plant growth hormones). It is essential for the enzymes in the synthesis of tryptophane. Our data go in line with Yamdagni (1979) who reported that spraying Thompson Seedless grapevines with Zn sulphate increased fruit set.

Yield / vine:-

Data in Table (3) show clearly that all treatments significantly incrments the yield per vine in the both seasons. The increase in yield over control due to humic acid treatment reached about 42.0 as the mean of the two seasons. These results are confirmed by the results obtained by Paden and Ocel (1999) on Tomato, Demir and Gunes (2005) on *Cacumis sativus* L. and Omar and Abdella (2005) on superior seedless vines. Khiristeva (1999) which presented that humic acid used at early stage of plant development are good source of polyphenols which are respiratory catalysts it increased the plants enzymatic activity, cell division and return increased yield.

The increment in yield attributed to potassium application reached about 33.3 % over the control as a mean of the two seasons. These findings are in agreement with those obtained by Munish *et al.* (1989) and Abbas and Mohamed (2000) who indicated that foliar application with potassium at 2 % at three times significantly increased the yield of Thompson Seedless grapevines.

Furthermore, the increment in the yield per vine due to B application may be due to the increase of berry set.,since the increment reached about 40.0% over the control. These results are in agreement with those of Yamdagni *et al.* (1979), EL-Shahat *et al.* (1996). Bacha *et al.* (1998) and EL-Shobaky *et al.* (2001) which presented that foliar application with B significantly increased the yield of Ruby Seedless grapevines.

Data in the same Tabel reveal that foliar application with Zn treatment significantly increased yield by about 32.5 %over the control. Similar results were obtained by EL-Shahat *et al.* (1996); Bacha *et al.* (1998) and EL-Shobaky *et al.* (2001).Moreover, data also revealed that humic acid combined with K, B and Zn treatments increased yield per vine by about 48.0 %, 45.0 % and 41.0 % respectively over the control as a mean of the two seasons .

Bunch weight :

Data in Table (4) presented that the effect of treatments usd on bunch weight was almost similar to those obtined the yield /vine.

Table (4): Effect of foliar application with some nutrients and humic acid on bunch weight and length, number of berries and compactness coefficient of Roomy Ahmar grapevines.

Treatments	Bunch weight (g)		Bunch length (cm)		Number of berries/bunch		Compactness coefficient	
	2002	2003	2002	2003	2002	2003	2002	2003
Control	450.0	463.3	34.33	33.50	95.00	97.00	2.80	2.90
Humic acid	647.33	650.00	33.33	33.33	132.70	135.70	3.90	3.80
K	630.00	636.67	33.33	33.67	123.70	122.00	3.70	3.60
B	631.00	650.00	33.00	34.00	127.70	128.33	3.90	3.70
Zn	600.00	615.00	33.00	32.67	124.67	126.33	3.80	3.80
Humic acid + K	663.33	673.33	34.00	33.67	133.30	136.70	3.90	4.10
Humic acid + B	656.67	670.00	34.10	33.67	135.60	135.90	3.98	4.03
Humic acid + Zn	626.67	649.33	34.00	33.67	132.33	134.00	3.90	3.93
L.S.D at 5 %	23.40	76.54	N.S	N.S	5.90	5.83	0.22	0.30

Copactness Cofficient :

Data presented in Table (4) disclose that all treatments increased the number of berries per bunch than over control. Humic acid applied either alone or in combination with K, B and Zn gave the highest values in this respect. This result was due to the increment of berry set .Also data from the same table indicated that all treatments increased compactness coefficient than the untreated vines. This increase was due to the increment of berry set and hence number of berries/cluster.

Bunch length :

Data presented in Table (4) show that no significant differences were found between the treatments and control as regades bunch length.

Berry quality :

It is obvious from Table (5) that all treatments significantly increased berry weight and size and juice volume in the berries in comparson with the control. The highest values obtaind as a result of humic acid application either alone or in combined with K, B and Zn. Data also revealed no significantly effect between humic acid applied either alon or combination with K, B and Zn treatments.The increment observed due to humic acid application go in line with Omar and Abdella (2005) who found that humic acid application significantly increased berry weight and size of Superior vines.

The increment in berries weight, size and juice volume due to potassium foliar spray go in line with those obtained by Omar (2000) and Abbas and Mohamed (2000) who indicated that foliar application with potassium at 2 % significantly increased berries weight, size and juice volume of Thompson Seedless grapevines.

The improvement occurred in berries weight due to B was emphasized by results Ahmed and EL-Dawwey (1992) on Red Roomy grapevines. EL-Morsy *et al.* (1993); EL-Shahat *et al.* (1996) and EL-Shobaky *et al.* (2001) who indicated that foliar spray with B increase berry weight, size and juice volume of Ruby Seedless grapevines.

The increas obtained in berry weight as a result of B spray could be attributed to the effect of B on encouraging cell division and increasing synthesis and translocation of carbohydrates in protein formation Nijjar, (1985).

The increase in berries weight, size and juice volume due to Zn foliar spray go in line with results of Yamdagni *et al.* (1979); EL-Shahat *et al.* (1996); Bacha *et al.* (1998) and EL-Shobaky *et al.* (2001) on Ruby Seedless grapevines.

Concerning the effect of humic acid K, B and Zn treatments on soluble solids cotent and total acidity in berry juice, data of the same table revealed that all treatments significantly increased soluble solids content and significantly decreased juice acidity. The highest values of SSC and SSC/acidity as a result of humic acid either alone or combination with K, B and Zn treatments. The improving occurred in SSC and SSC/acidity due to humic acid treatments go in line with the results of Neri *et al.* (2002) on strawberry and Abdel-AL *et al.* (2005) on onion plants.

Moreover, the increment in SSC and SSC/acidity due to K foliar spray go in line with those obtained by Huang *et al.* (1994); Shin and Lee (1995) and Abbas and Mohamed (2000) in Thompson Seedless grapevines.

The same Table indicated that B and Zn foliar sprays significantly increased SSC value and significantly decreased juice acidity compared with the control. Our data go in line with those obtained by Kumar and Bushan (1978); EL-Shahat *et al.* (1996); EL-Shobaky *et al.* (2001) and Usha and Singh (2002).

Table (5) : Effect of foliar spray with some nutrients and humic acid on berry weight and size and juice volume of berries in Roomy Ahmar grapevines .

Treatments	Berry weight of 100 berries (g)		Berry size of 100 berries (ml)		Juice volume of 100 gm berries (ml)	
	2002	2003	2002	2003	2002	2003
Control	418.33	405.00	392.00	381.67	66.00	68.00
Humic acid	570.00	585.00	530.00	540.00	73.00	72.33
K	551.33	562.67	520.00	526.70	72.67	72.33
B	564.00	558.00	530.00	510.00	72.67	73.00
Zn	520.00	500.00	490.00	470.00	70.67	71.67
Humic acid + K	570.00	576.70	535.00	540.00	72.67	73.00
Humic acid + B	574.00	580.70	542.00	545.00	73.00	72.33
Humic acid + Zn	573.00	580.00	535.00	546.00	72.00	72.50
L.S.D at 5 %	35.61	34.44	41.80	30.50	1.50	1.89

Data presented in Table (6) indicated that all treatments significantly increased total anthocyanin in the skin of berries as compard to the control. The highest of values of thies estimate wer obtained from humic acid applied either alone or in combination with K, B and Zn.

Table (6): Effect of foliar application with some nutrients and humic acid on SSC acidity,SSC/acid ratio and anthocyanin content in the skin of berries in Roomy Ahmar grapevine .

Treatments	SSC %		Acidity %		SSC/acid ratio		Anthocyanin (mg/g)	
	2002	2003	2002	2003	2002	2003	2002	2003
Control	15.00	15.00	0.68	0.69	22.10	21.70	0.36	0.32
Humic acid	17.00	17.70	0.63	0.61	27.00	29.00	0.76	0.78
K	16.50	17.00	0.65	0.64	25.40	26.60	0.69	0.68
B	16.70	16.50	0.65	0.62	26.00	26.60	0.68	0.69
Zn	16.00	16.30	0.64	0.64	25.00	25.50	0.57	0.54
Humic acid + K	17.70	17.40	0.63	0.62	28.10	28.10	0.77	0.79
Humic acid + B	16.70	17.40	0.64	0.63	26.10	27.60	0.78	0.78
Humic acid + Zn	16.50	16.30	0.64	0.64	24.20	25.50	0.75	0.79
L.S.D at 5 %	1.20	0.89	0.02	0.02	1.65	2.39	0.04	0.03

In addition, humic acid increased yield and quality by increasing the availability of nutrients through its chelating capacity with micronutrients (Schnitzer and Skinner, 1962). Furthermore, humic acid contains some micro elements and can be consider as a safe fertilizer and environment friendly.

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تأثير الرش ببعض العناصر الغذائية وحمض الهيوميك علـــى العقـــد والمحـــصول وجودة الثمار للعنب الرومى الأحمر.

إيناس صابر عباس ، سوسن عبد الوهاب بندق و فيكتور حبيب جرجس
معهد بحوث البساتين – مركز البحوث الزراعية – الجيزة – مصر .

أجرى هذا البحث خلال موسمى ٢٠٠٣ و ٢٠٠٤ لدراسة تـــأثير حمـــض الهيوميـــك، البوتاسيوم ، البورون والزنك على محتوى الأوراق من العناصر الغذائية والعقد والمساحة الورقية وجودة الثمار للعنب الرومى الأحمر المنزرع فى تربة طميية طينية تحت نظام الـــرى الـــسطحى ومنزرع فى المحطة البحثية بالبرامون محافظة الدقهلية .

وكانت المعاملات هى المقارنة بين حمض الهيوميك بتركيز ٥ % والبوتاسيوم بتركيـــز ٢ % والبورون والزنك كلا بتركيز ٠,٢ % وإستخدم أيضا حمض الهيوميك مختلطا مع كل من البوتاسيوم والبورون والزنك بنفس التركيزات وإستخدمت معاملات البوتاسيوم والبورن والزنـــك رشا فى ثلاثة مواعيد هى " قبل الإزهار ، بعد العقد وفى مرحلة تحول العيون) .واستخدم حمض الهيوميك كسماد ارضى فى نفس مواعيد.التسميد الورقى

وقد أوضحت الدراسة أن جميع المعاملات أدت إلى زيادة العناصر الغذائيـــة N, P, K والزنك والبورون فى أعناق الأوراق وكذلك المساحة الورقية ونسبة العقـــد ، المحـــصول ووزن العنقود ، عدد الحبات بالعنقود ، معامل الإزدحام ، ووزن وحجم وكمية العصير للحبات ، المـــواد الصلبة الذائبة الكلية والنسبة بين المواد الصلبة الذائبة والحموضة والأنثوسيانين فى قشرة الثمـــار. وقد أدت جميع المعاملات إلى إنخفاض معنوى فى محتوى عصير الحبات من الحموضة. وكانت أفضل النتائج المتحصل عليها هى إستخدام حمض الهيوميك بتركيز ٥ % منفردا أو مختلطا مـــع البوتاسيوم بتركيز ٢,٠ % أو البورون بتركيز ٠,٢ % أو الزنك بتركيز ٠,٢ % .

حيث اوضحت الدراسة أن حمض الهيوميك كطريقة تسميد طبيعية أدت إلـــى تحـــسين الحالة الغذائية للكرمة وزيادة نسبة العقد والمحصول وكذلك جودة الثمار للعنب الرومى الأحمر .