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EFFECT OF BORON, BERRY THINNING, GIRDLING AND GA_3 ON YIELD AND FRUIT QUALITY OF RUBY SEEDLESS GRAPES

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ABSTRACT

This work was conducted during two successive seasons of 2004 & 2005 on ten-years-old Ruby Seedless grapevines grown in a sandy soil at El-Khatatba, Menoufiya governorate. The aim of this investigation was to study the influence of some treatments as spraying of boron at 0.2% (as Borax) at 75% bloom, GA_3 at 20 ppm when berry diameter reached 2-3mm, berry thinning by retention of five shoulders at the base of the cluster with the alternative removal of the branches and removing the terminal third of the cluster at 2-3 mm berry diameter and girdling of trunk by removing a narrow ring of the bark (2-3mm) at 2-3 mm berry diameter on cluster quality, increasing yield and minimizing number of shot berries in "Ruby Seedless" clusters.. The used treatments were solitarily, double, triple and tetra combinations compared with the control treatment.

Results showed that combination treatment of boron + girdling + GA_3 positively increased yield / vine and cluster weight. While, the increase in cluster width, decrease in shot berries and berry physical characteristics were also increased especially when tetra combination treatment boron + berry thinning + girdling + GA_3 was applied. The lowest acidity % and the highest TSS% and anthocyanine content were found in treated "Ruby Seedless" grapevines with single thinning treatment.

INTRODUCTION

"Ruby Seedless" grapevine also called “King Ruby” is a hybrid of "Emperor” and “Provano 75” (Olmo *et al*., 1981). "Ruby Seedless" is a late maturing cultivar, medium berry size, oval berries, red to purple colour, very susceptible to powdery mildew and bunch rot, ripens in mid to late August (Harry *et al*., 1991). Shot berries are one of the main problems in this cultivar (El-Shobaky *et al*., 2001). Boron plays an important major role in flowering and fruiting process, however, boron deficiency does not help in the pollen germination on the stigma and pollen tube growth down to the ovary which was reflected failures in fertilization and shot berries formation (Gartol 1974; El-Shobaky *et al*., 2001 and El Gendy *et al*., 2006). In addition, boron encourages both cell division and cell enlargement (Nijjar, 1985). Christensen *et al.,* (1978) reported that the shot berries phenomenon is correlated with low boron level.

Thinning, which is a common practice carried out by table grape growers led to the reduction of the yield as to be within the limits of the normal load with a high quality (Echenique *et al*., 1998; Fayek *et al*., 2003; Abd El-Hameed and Abo El-Ez 2004; Omran *et al*., 2004 and Abd El-Wahab, 2006).

Girdling or ringing has been used commercially to increase the accumulation of carbohydrates in the parts above the wounds. After fruit set,

girdling has a positive effect on berry weight and size, bunch weight and yield (Fayek *et al*., 2003; Abd El-Hameed and Abo El-Ez, 2004; Omar and Girgis, 2005 and Abd El-Wahab 2006).

Gibberellic acid (GA_3) is used extensively to increase berry size of *Vitis vinifera* seedless table grapes. Gibberellins primarily affect growth by controlling cell elongation and division, which is reflected on yield and its components and fruit quality of various grape cultivars (Omar and El-Morsy 2000 and Omar and Girgis, 2005).

The goal of this study is to detect the effect of foliar applications of boron, manual thinning, girdling and GA_3 alone or in combinations on shot berries, yield and quality characteristics of Ruby Seedless grapes.

MATERIAL AND METHODS

]This investigation was conducted in two successive seasons (2004 & 2005) in a private vineyard located at El-Khatatba, Menoufiya governorate, on mature Ruby Seedless grapevines. The vines were ten-years-old, spaced 1.75 X 2.5 meters apart and irrigated by the drip irrigation system, bilateral cordon trained with spur pruning and trellised with “Y” shape system. The vines were pruned during the third week of January with bud load 40 buds/vine. One hundred and forty four uniform Ruby Seedless grapevines were chosen (16 treatments x 3 replicates x 3 vines / replicate).

The treatments were as follows: five single treatments (control, boron at 0.2% (as Borax) at 75% bloom, berry thinning (Retention of five shoulders at the base of the cluster with the alternative removal of the branches and removing the terminal third of the cluster) at 2-3 mm berry diameter, girdling (by removing a narrow ring of the bark (2-3mm) entirely around the trunk) at 2-3 mm berry diameter and spraying the clusters by GA_3 at 20 ppm when berry diameter reached 2-3mm (GA_3)). Six double treatments (boron + berry thinning, boron + girdling, boron + GA_3, berry thinning + girdling, berry thinning + GA_3 and girdling + GA_3) , four triple treatments (boron + berry thinning + girdling , boron + berry thinning + GA_3, boron + girdling + GA_3 and berry thinning + girdling + GA_3) and one tetra treatment (boron + berry thinning + girdling + GA_3).

When the check berries reached maturity stage (16-17% TSS according to Tourky *et al.,* (1995) or TSS/acid ratio reached about 22-24 according to El-Banna (1968), representative samples of 3 clusters /replicate were harvested from all considered vines to determine cluster characteristics. Berries were gathered from each cluster separately, grouped into normal and shot berries and each were counted. Normal berries were taken at random from each replicate to determine berry characteristics.

The following characteristics were determined:

1) **Yield and physical characteristics of clusters:**

   Average yield in kg per vine was estimated at maturity stage.

   Average cluster weight (g), Average cluster width (cm) and shot berries (%) was calculated by dividing number of shot berries by total number of berries per cluster.

2) **Physical properties of berries**: Average berry weight (g), berry size (cm^3), berry dimensions (cm), berry firmness (gm/cm using Stations's instrument), and berry adherence strength (gm/cm using Stations's instrument).
3) **Chemical properties of berries**: Juice total soluble solids (TSS %), Juice total titratable acidity (as tartaric acid %) according to the A.O.A.C. (1970) and skin anthocyanin content (mg/100g F.W.) according to (Husia *et al.,* 1965).

- Statistical analysis: The complete randomized block design was used. The statistical analysis of the present data was carried out according to Snedecor and Chocran (1972). Averages were compared using the new L.S.D. values at 5% level.

RESULTS AND DISCUSSION

1) **Yield and physical characteristics of clusters:**

Yield: Data presented in Table (1) revealed that all treatments with the exception of berry thinning treatment had significantly increased the vine yield than the control in both seasons. The most pronounced increases in yield per vine were obtained with all GA_3 treatments solely or in combination with other treatments. For example, boron + girdling + GA_3 treatment gave the highest yield followed by girdling + GA_3 treatment compared with the control in both seasons.

Cluster weight: The highest cluster weight was obtained from vines treated with boron + girdling + GA_3 treatments, while thinning treatments gave the lowest cluster weight compared with the control in both seasons. Thus, the increase in vine yield was mainly due to the increase in cluster weight due to GA_3 treatment.

The obtained results are in agreement with those obtained by Omar & Girgis, (2005); Omar & El - Morsy (2000) and Omran *et al*., (2005) who found that GA_3 treatment sprayed after fruit set significantly increased the vine yield and cluster weight. Also, El-Banna, (1981) and Rizk (1998) indicated that girdling of trunk at the fruit set stage increased yield. As for the effect of berry thinning, El-Hammady *et al.,* (2000) noticed a reduction in total yield and cluster weight.

Cluster width: Data in Table (1) also cleared that tetra combination treatment (boron + berry thinning + girdling + GA_3) significantly increased the cluster width compared with untreated vines in both seasons. Our results are in harmony with the findings of Pires *et al.,* (2003) which showed that GA_3 treatment increased the cluster width. Moreover, Fayek *et al.,* (2003) recorded that berry thinning and girdling of trunk at the fruit set stage increased cluster width.

Shot berries percentage: Percentages of shot berries in Ruby seedless cluster are presented in Table (1). All applied treatments reduced shot berries and improved the shape of cluster than control in both seasons of study. It is clear that boron + berry thinning + girdling + GA_3 treatment was the most effective compared with other treatments followed by berry thinning + girdling + GA_3 treatment. On the other hand the highest percentage of shot berries/cluster was noticed on control clusters in the two seasons.

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Controlling shot berries % through hand thinning was reported by Khajuria and Bakhshi; (1988), El-Hammady *et al*., (2000), Fayek *et al.,* (2003); Fadi (2004) and Abd El Baky (2004). As for the effect of boron, Christensen *et al.,* (1978); Sirakhov & Kolyankovskii (1985) and El – Shobaky *et al.,* (2001) noticed that boron spray before blooming reduced the shot berries percentage. Moreover, Zabadal & Dittmer (2000) and Josan *et al.,* (2001); Fayek *et al*., (2003) and Abd El-Wahab (2006) found that girdling applications after fruit set reduced the shot berries percentage.

2) Physical characteristics of berries:

It was clear from Table (2) that berry weight, size, dimensions, firmness and berry adherence strength were significantly increased in all treatments except boron singly compared to untreated vines. The highest increments of physical berry characteristics were obtained in vines treated with boron + berry thinning + girdling + GA_3 treatment followed by berry thinning + girdling + GA_3 treatment and boron + girdling + GA_3 treatment and girdling + GA_3 treatment and then boron + berry thinning + girdling in the tow seasons of study. Spraying the cluster with GA_3 treatment solely or in combination with the other treatment increased physical berry characteristics. The control in both seasons gave the lowest physical berry characteristics. These results are in agreement with those obtained by El-Shobaky *et al.,* (2001) and El Gendy *et al.*, (2006) on boron. Moreover, Abd El-Ghany (2001) and Omar & El–Morsy (2000) reported that GA_3 sprayed when berry size reached 6-8 mm in diameter significantly improved physical berry characteristics. Fayek *et al*., (2003) and Abd El-Wahab (2006) recorded that thinning and girdling applications after fruit set improved the physical berry characteristics.

3) Chemical characteristics of berries:

Total soluble solids: The data regarding the effect of boron, GA_3, thinning and girdling and their combinations on TSS in the berries of Ruby Seedless cv. in both seasons are presented in Table (3). It is apparent that different treatments gave similar values of TSS to that of the control in both seasons of study. Thinning treatment gave the highest TSS content in berries compared with the control in both seasons.

Acidity: Data in Table (3) also revealed that different treatments did not affect acidity%. Whereas, the thinning as single treatment gave the lowest significant acidity followed by boron + berry thinning treatment and then thinning + GA_3 treatment compared with control in both seasons.

The obtained data are in line with those obtained by Echenique *et al*., (1998), Sanjay (1995) and Moon & lee (1996) as they reported that berry thinning increased the percentage of total soluble solids and decreased of acidity percentage of the juice.

Anthocyanine: It is evident from data in Table (3) that anthocyanine content of berry skin of Ruby Seedless grapes was not significantly affected by different treatments compared with the control in both seasons. Whereas, the relatively highest content was only recorded by thinning treatment compared with control . These results are agree with those obtained by Fayek *et al*., (2003) and Abd El-Wahab (2006) recorded that berry thinning increased the anthocyanin content of berries skin.

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From the above results it could be concluded that the best results with regard to yield and cluster weight of Ruby Seedless grapes were observed owing to boron + girdling + GA_3 treatment, while the most significant treatment was boron + berry thinning + girdling + GA_3 treatment for cluster width. In addition, to avoid the incidence of shot berries disorder, the most effective treatment was boron + berry thinning + girdling + GA_3 treatment. Also, the same treatment gave the highest berry weight, berry size berry dimensions, berry firmness and berry adherence strength. Moreover, the thinning treatment was the most effective in reducing juice acidity and increasing TSS and anthocyanine content of berries skin for Ruby Seedless grapes**.**

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تأثير البورون والخف والتحليق وحمض الجبريليك على المحصول وصفات الجودة لثمار العنب الروبى سيدلس

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****معهد بحوث البساتين – مركز البحوث الزراعية بالجيزة - مصر**

أجرى هذا البحث خلال موسمي٢٠٠٤& ٢٠٠٥ على كرمات عنب روبى سيدلس عمر ١٠ سنوات منزرعة فى ارض رملية بالخطاطبة - محافظة المنوفية لدراسة تاثير بعض المعاملات وهى الرش بالبورون بتركيز٢,. % عند ٧٥% تزهير , الرش بحمض الجبريليك بتركيز ٢٠ جزء فى المليون عندما يكون متوسط قطرالحبة ٢ -٣ مم، الخف اليدوى للحبات بترك الخمسة أكتاف الأولى وإزالة التفرعات الجانبية الأخرى بالتبادل ثم إزالة الثلث الطرفى من العنقود عندما يكون متوسط قطرالحبة ٢ -٣ مم وتحليق الجذع بازالة حلقة بعرض ٢-٣ مم عندما يكون متوسط قطرالحبة ٢ -٣ مم على صفات الثمار و زيادة المحصول والحد من حدوث ظاهرة حبات الحصرم. وقد استخدمت المعاملات منفردة أو فى تراكيب زوجية أوثلاثية أو رباعية مقارنة بمعاملة الكنترول (كرمات غير معاملة).

أظهرت النتائج حدوث زيادة واضحة على كمية المحصول للكرمة ووزن العنقود عند استخدام البورون وحمض الجبريليك والتحليق كما زاد عرض العنقود و قلت ظاهرة حبات الحصرم وتحسنت الصفات الطبيعية للحبات بالمعاملة الرباعية بالبورون وحمض الجبريليك والخف والتحليق، بينما أدت معاملة الخف منفردة الى خفض نسبة الحموضة ورفع نسبة المواد الصلبة الذائبة ومحتوى الانثوسيانين فى قشرة الثمار.

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