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The effect of ethephon on ruby seedless grapes

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مفعول "الإيثوفون" على شجرة العنب صنف "غوبي سيدليس"

أجريت تجربة لدراسة تأثير أربعة مقادير (240, 480, 720 و 960 ب. ب. م) من "الإيثوفون" على شجرة العنب صنف "غوبي سيدليس" في صيغتين اثنتين. وقد نتج عن ذلك زيادة في وزن حبات العنب خاصة بالنسبة لمقدار 480 ب ب م. ومن ضمن النتائج أيضا زيادة في نسبة السكر ونقص في نسبة الحموضة. كما لوحظ كذلك تحسن في لون حبات العنب إثر استعمال "الإيثوفون"، خاصة بالنسبة لمقداري 720 و 960 ب ب م. بينت هذه الدراسة أن استعمال مقدار 480 من "الإيثوفون" إبان نمو حبات العنب لصنف "غوبي سيدليس" يمكن أن يحسن من جودة المنتوج.

الكلمات المفتاحية : "الإيثوفون" – نمو حبات العنب – جودة العنب – "قيتيس ڤينيڤيرا"

Effet de l'éthephon sur le cépage de vigne Ruby seedless

Un essai a été mené pour étudier l'effet de l'éthephon appliqué à des concentrations de 240, 480, 720 et 960 ppm lors de la véraison, dans deux vignobles différents. L'éthephon a entraîné une augmentation du poids moyen des baies ; cet effet a été significatif à 480 ppm. La teneur en sucres a été légèrement augmentée par l'application de l'éthephon, qui a aussi induit une diminution de l'acidité et une augmentation du pH, d'une manière significative à 240 ppm. La couleur des raisins a été améliorée par l'application de l'éthephon, particulièrement aux doses 720 et 960 ppm qui ont entraîné des effets significatifs. Cette étude a permis de montrer que l'application de l'éthephon à 480 ppm, lors de la véraison, peut améliorer la qualité des raisins du cépage Ruby Seedless.

Mots clés : Ethephon - Véraison - Qualité des fruits - *Vitis vinifera* L.

The effect of ethephon on Ruby seedless grapes

A study was conducted to determine the effects of ethephon applications on yield and fruit composition of *Vitis vinifera* L. (cultivar Ruby Seedless) grapevines grown in Morocco. Ethephon at 240, 480, 720 and 960 ppm was simultaneously applied at veraison in two vineyards. Ethephon increased berry weight, this increase was significant for 480 ppm. Soluble solids concentration was slightly increased by ethephon concentrations. Titratable acidity was generally decreased while pH increased with a significant effect of 240 ppm. Fruit coloration was promoted by ethephon application, with a significant effect of 720 and 960 ppm compared to control fruit.
This study demonstrated that Ethephon at 480 ppm applied at veraison could improve fruit quality.

Key words : Ethephon - Veraison - Fruit quality - *Vitis vinifera* L.

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INTRODUCTION

Ethephon has been reported to hasten maturity of grapes of many cultivars when applied at veraison (Jensen *et al.*, 1975, 1980, 1982 ; Metha & Chundawat, 1979 ; Peacock *et al.*, 1977 ; Weaver & Pool, 1971). However, the magnitude of the response for each cultivar was related to the rate of application. The most effective concentrations ranged from 100 to 300 ppm, for Tokay, Emperor (Jensen *et al.*, 1975, 1982), Red Malaga (Peacock *et al.*, 1977), Thompson Seedless (Jensen *et al.*, 1980), Cardinal and Flame Seedless (Jensen *et al.*, 1982), and 500 ppm for Beauty Seedless (Metha & Chundawat, 1979). If the ethephon concentration is too high it may result in such adverse effects as dullness of color and loss of firmness of the fruit (Jensen *et al.*, 1982), or damage to the apical meristem (Hirschfeld & Lavee, 1980).

The objectives of this study were : 1) determine the effect of ethephon applied at veraison and 2) determine the optimum ethephon concentration in order to enhance fruit development and maturation of Ruby Seedless grapevines.

MATERIAL & METHODS

Ethephon (Tomathrel, CIBA-GEIGY) using 480 g / L, was applied (early in the morning) at 0, 240, 480, 720 or 960 ppm at veraison, on August 3, 1988. The solutions were applied with a dorsal sprayer to runoff. The experimental design was a randomised complete block replicated four times with each plot having five vines. This ethephon trial conducted in Meknes-region, a major grape production area in Morocco, was set in two commercial vineyards located within the same farm in Chlihat. The seven year old Ruby Seedless vines either on their own roots (vineyard 1), or grafted on Teleki 5 B rootstock (vineyard 2) were used in this study. Vine and row spacings were 2 and 3.0 m, respectively. The vines were head-trained at 0.7 m and pruned to four canes of 12 to 14 buds each. The trellis system in this vineyard was a double T (locally called a "Pergolette"). The lower crossarm was 0.4 m wide and located 0.8 m above the soil. The upper crossarm was 0.8 m wide, and located 0.4 m above the first one. The fruiting canes were tied to the lower crossarm. The vineyard soil in Chlihat was a clay-loam and drip irrigated. Vines were fertilised in February with 200 kg/ha of potassium-sulphate (41% K), and 600 kg/ha of urea (46% N). The urea fertilisers were applied as follows: 1/3 in March, 1/3 in May, and 1/3 in June.

At harvest (September 13, 1988), crop yield per vine was recorded and 100 berries per replicate were randomly collected from different parts of the clusters, then analysed for berry weight, soluble solids content (determined by a hand refractometer, American Optical, Model 10430), titratable acidity (determined by titration with 0.133N NaOH using phenolphthalein as indicator), pH with volmatic pH-meter (model PM-14), and coloration.

Fruit coloration was determined, according Kliewer & Weaver (1971), on 7 mm diameter discs of berry skin taken from the apical region of 20 berries from each sample. The discs were placed in screw-cap culture tubes containing 20 ml of 95% ethanol and acidified with 1% HCl. The tubes were tightly capped and then placed in boiling-water for 2 minutes. Afterwards, the discs were incubated in the ethanol solution in the dark for 2 hours, occasionally being stirred. The absorbance of the skin extracts were read at 520 nm with a spectrophotometer (Perkin-Elmer, Lamda 2).

RESULTS

Vineyard 1's yield averaged 20.3 kg/vine, while Vineyard 2 averaged 22.3 kg/vine, respectively (Tables 1, 2 and 3). An increase in berry weight was observed following ethephon application. This increase was significant for the concentration 480 ppm in Vineyards 1 and 2, and also for the concentration 240 ppm in Vineyard 2.

Tableau 1. Effects of ethephon concentrations applied at veraison on yield and fruit composition of ruby seedless grapevines in vineyard 1

Ethephon ppm	Yield kg/vine	Berry wt (g)	°Brix %	Titratable acidity (g/100ml)	pH	Color (absorbance 520 nm)
0	18.6	2.28b	14.0	0.66a	3.22bc	0.154b
240	18.5	2.39b	14.2	0.63c	3.32a	0.263ab
480	20.9	3.13a	14.3	0.63bc	3.20bc	0.417ab
720	23.6	2.66ab	14.2	0.65ab	3.25a	0.494a
960	19.8	2.45b	14.3	0.64abc	3.17c	0.540a

[1] Means followed by a different letter whithin a column are significantly different at the 5% level using Duncan's multiple range test

A slight increase also was observed in soluble solids content following ethephon application. Ethephon treatments also resulted in a decrease in titratable acidity, significant for all applications in Vineyard 2. The pH measurements were significantly increased for 240 ppm in the two vineyards. In vineyard 1, fruit pH was slightly decreased with

ethephon at 480 and 960 ppm but increased with 240 and 720 ppm. In vineyard 2, all ethephon treatments resulted in increased fruit pH with a significant effect of 240 ppm. Fruit coloration was promoted by all ethephon applications, however the 720 and 960 ppm concentrations were significantly greater than the control in the two vineyards.

Tableau 2. Effects of ethephon concentrations applied at veraison on yield components and fruit composition of ruby seedless grapevines in vineyard 2

Ethephon ppm	Yield kg/vine	Berry wt g	°Brix %	Titratable acidity g/100ml	pH	Color absorbance 520 nm
0	21.3b	2.13b	15.0	0.68a	3.16b	0.178b
240	21.3b	2.57a	15.2	0.67b	3.24a	0.457ab
480	21.5b	2.58a	15.5	0.66bc	3.21ab	0.485ab
720	22.4ab	2.40ab	15.8	0.66bc	3.19ab	0.615a
960	25.0a	2.39ab	15.3	0.65c	3.23ab	0.538a

[1]Means followed by a different letter whithin a column are significantly different at the 5% level using Duncan's multiple range test

DISCUSSION

The concentration of 240 and 480 ppm of ethephon applied at veraison induced a significant increase in berry weight in two and one of the vineyards, respectively, while the other concentrations resulted in slight increase in berry weight. An increase in berry weight by ethephon application at veraison in Delight grapes also was reported to be significant with 250 and 500 ppm but not with 1000 ppm (Singh & Chundawat, 1978), whereas for Carignane vineyard a significant increase in berry weight following ethephon application was obtained with 500 and 1000 ppm but not with 2000 ppm (Weaver & Pool, 1971).

The ethephon treatments resulted in a slight increase in soluble solids in both vineyards, with a maximum increase of 0.8 °Brix at 720 ppm in Vineyard 2. A similar increase of 0.6 to 1.2 °Brix also was obtained with Thompson Seedless grapes at 150, 300 and 450 ppm ethephon concentrations (Jensen *et al.*, 1980). An increase of 0.5 °Brix following ethephon application at 150 ppm was observed with Cardinal vines (Jensen*et al., 1982).* Titratable acidity was decreased significantly in Vineyard 2, however in Vineyard 1, the decrease was significant only at the 240 and 480 ppm ethephon concentrations. The decrease was almost rate dependent here as it has been observed with several other cultivars (Jensen *et al.*, 1982). The increase in soluble solids content and decrease in acidity induced a higher soluble solids/acid ratio resulting in earlier fruit ripening. The highest ratio in vineyards 1 and 2 were obtained with the 480 and 720 ppm ethephon concentration.

Fruit coloration was promoted in both trials by all ethephon applications, in agreement with reports on other cultivars (Jensen *et al.*, 1975, 1982). In both trials the 720 and 960 ppm ethephon concentrations resulted in a significant increase in color development compared to the control. The 960 ppm ethephon treatment resulted in color dullness as has been reported for other cultivars following high ethephon concentration applications (Jensen *et al.*, 1982).

The effects of ethephon on grapevines are governed by complex interactions of numerous factors. Ambient environment conditions affect the efficacy of the compound, as does pH, cultivar, concentration, timing and method of application (Szyjewics *et al.*, 1984).

The efficacy of ethephon application may also be dependent upon the physiological stage of fruit development (Weaver & Pool, 1971).

In this study, 480 and 720 ppm would be the optimal concentrations to promote fruit ripening if applied at veraison.

CONCLUSION

The results of this investigation clearly showed that application of ethephon at veraison could hold some promise in increasing berry weight, soluble solids content and coloration, and reducing titratable acidity. The application of ethephon at 480 ppm could achieve this goal. This practice, relatively sample and economical could have an immediate positive impact on Ruby Seedless fruit characteristics in Moroccan vineyards.

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