Actes Inst. Agron. Vet. (Maroc) 1995, Vol. 15 (2): 23 -26

Growth inhibition and fruit thinning in four wine grape cultivars following treatment with Ethephon

Abdelaziz EZZAHOUANI*✧ & Ahmed MAHHOU*

(Reçu le 07/04/1994 ; Accepté le 28/02/1995)

نقصان النمو النباتي و عدد الزهور لشجرة العنب إثر استعمال الإثوفون

أجريت تجربة لدراسة تأثير الإثوفون، (حامض 2 – كلورو إثيل فوصفونيك) على شجر العنب، إبان الإزهار، و ذلك قصد التحكم في النمو النباتي و تخفيف عدد الزهور. المقادير المستعملة (240 ppm لصنف سانصو و 480 ppm لأصناف كارينيان، شاردوني و شونان بلان) أدت إلى نقص في نمو الأغصان و بالتالي المساحة الورقية للأشجار. و قد انخفض الإنتاج كذلك نتيجة المفعول السلبي للإثوفون على عناقيد الأزهار. أما نسب السكر و الحموضة فلم يطرأ عليها أي تغيير.

الكلمات المفتاحية : إثوفون – نمو الأغصان – المساحة الورقية – عنب

Inhibition de la croissance et éclaircissage des raisins de quatre cépages de cuve par l'application de l'éthephon

L'éthephon [(2-chloroethyl)phosphonic acid] a été appliqué sur des vignes adultes en pleine floraison pour contrôler la croissance végétative et entraîner un éclaircissage des fleurs. Les concentrations utilisées (240 ppm sur "Cinsaut" et 480 ppm sur "Carignane", "Chardonnay" et "Chenin blanc') ont entraîné une inhibition de la croissance des rameaux et, par conséquent, une réduction de la surface foliaire. Le rendement par pied a été significativement réduit à cause de l'effet négatif de l'éthephon sur les inflorescences; la teneur en solides solubles et l'acidité des jus n'ont pas été affectées d'une manière significative.

Mots clés: Ethephon - Croissance des rameaux - Surface foliaire -*Vitis vinifera* L.

Growth inhibition and fruit thinning in four wine grape cultivars following treatment with ethephon

Ethephon [(2-chloroethyl)phosphonic acid] was sprayed on vines at bloom to control vegetative growth, and to induce some thinning. The concentrations used (240 ppm for "Cinsaut" and 480 ppm for "Carignane", "Chardonnay" and "Chenin Blanc") inhibited shoot growth and reduced leaf area. Yield per vine was significantly reduced, apprently because of detrimental effects on the inflorescences. Effects upon fruit soluble solids and titratable acidity were generally non-significant.

Key words: Ethephon - Shoot growth - Leaf area - *Vitis vinifera* L.

* Department of Horticulture, Institut Agronomique et Vétérinaire Hassan II, B.P. 6202-Instituts, 10101 Rabat, Maroc
✧ Corresponding author

INTRODUCTION

Many studies have dealt with the use of ethephon to control excessive vigor, which prolongs growth and delays ripening (May & Antcliff, 1963 ; Peterson & Smart, 1975; Szyjewics *et al.,* 1984; Weibe, 1975). Ethephon at 750 ppm, applied at full bloom, inhibited shoot growth of "Muscat de Hambourg" and "Perlette" (Hirschfield & Lavee, 1980). The same results were obtained on "Muscat of Alexandria" at 100 and 1000 ppm (Weaver & Pool, 1969). This inhibition of the terminal growth of the canes was associated with prevention of the opening of lateral buds on shoots (Lavee *et al.*, 1977). The degree of inhibition was related to vine vigor and concentration of ethephon (Lavee, 1982; Shulman *et al.*, 1980).

Some authors have reported a significant reduction in cluster number and yield when ethephon was applied directly to inflorescences during flowering (Mannini *et al.*, 1981; Weaver & Pool, 1971), or within two weeks after bloom (Szyjewicz & Kliewer, 1983).

The purpose of the present study was to determine if ethephon could be used to reduce vegetative growth, and to induce some fruit thinning, thereby hastening fruit maturation.

MATERIALS AND METHODS

Ethephon was applied to mature vines of "Carignane", "Chardonnay", "Chenin Blanc", and "Cinsaut", all growing in a non-irrigated vineyard at the Ecole Nationale Superieure Agronomique de Montpellier in France. Vines were sprayed at bloom (50 to 90% anthesis) with ethephon at 240 ("Cinsaut") or 480 ppm (all other cultivars). No wetting agent was included, and control vines were sprayed with water. Sprays were applied to run-off to the whole vine with a pressurized hand-sprayer. Each treatment was applied to five vines (replicates) in a randomized complete block design.

Two healthy, well-developed shoots were tagged on each vine and shoot length was measured each week from 26 May (before bloom) until 14 July 1987 (near veraison). At harvest, the crop from each vine was weighed, the number of clusters per vine counted, and a sample of 100 berries collected from throughout each vine to determine mean berry weight, total soluble solids (by a hand refractometer), pH, and total acidity (by titration against NaOH to the phenolphthalein endpoint).

After harvest, the tagged shoots were collected and the total leaf area on both main and axillary shoots was determined by weighing all leaves and dividing by the weight of a known leaf area.

RESULTS AND DISCUSSION

• Shoot growth and leaf area

Ethephon depressed shoot growth of "Cinsaut" over a period of approximately two weeks, attaining a maximum of 49% relative to the control (Figure 1). Ethephon was more effective on the other cultivars; the maximum inhibition of shoot growth was about 90% and the inhibition continued over 3 to 4 weeks. On recovery, rate of shoot growth exceeded that of the control. The growth-depressing effect was progressive, with an increase to a maximum, then a decrease.

Leaf area was also affected by ethephon treatment, primarily because shoot growth was restricted (Figure 1). The maximum leaf area reductions observed for one week were about 41, 54, 76, and 90%, respectively, for "Cinsaut", "Carignane", "Chenin Blanc", and "Chardonnay". This simultaneous reduction of shoot growth and leaf area was associated with a reduction of the number of nodes developing on the main and lateral shoots. This agrees with the work of Shulman *et al.* (1980) who noted a decrease in the number of nodes on ethephon-treated shoots of six cultivars of *Vitis vinifera.*

• Fruit crop and its components

Both yield and number of clusters were reduced by ethephon treatment (Table 1). Many treated inflorescences became dry and brown, flowers abscised, and stems became brittle, as reported by Weaver & Pool (1971). In some cases only the apical part of the inflorescence was affected; this may explain the decrease in mean cluster weight recorded. Reduced yield and number of clusters per treated vine were also reported on "Chenin Blanc" treated with ethephon at 750 ppm (Szyjewics & Kliewer, 1983). Mean berry weight was significantly increased in 2 of the 3 cultivars treated with 480 ppm ethephon (Table 1).

Fruit soluble solids were not significantly affected by treatment (Table 1). Weaver and Pool (1969) treated "Muscat of Alexandria" with 1000 ppm ethephon 2 weeks after bloom and noted significant reductions in crop per vine and increases in soluble

solids. However, Szyjewics & Kliewer (1983) reported a significant decrease in both crop per vine and soluble solids in "Chenin Blanc" following ethephon treatment.

Ethephon significantly increased pH and decreased acidity only in "Chenin Blanc" (Table 1).

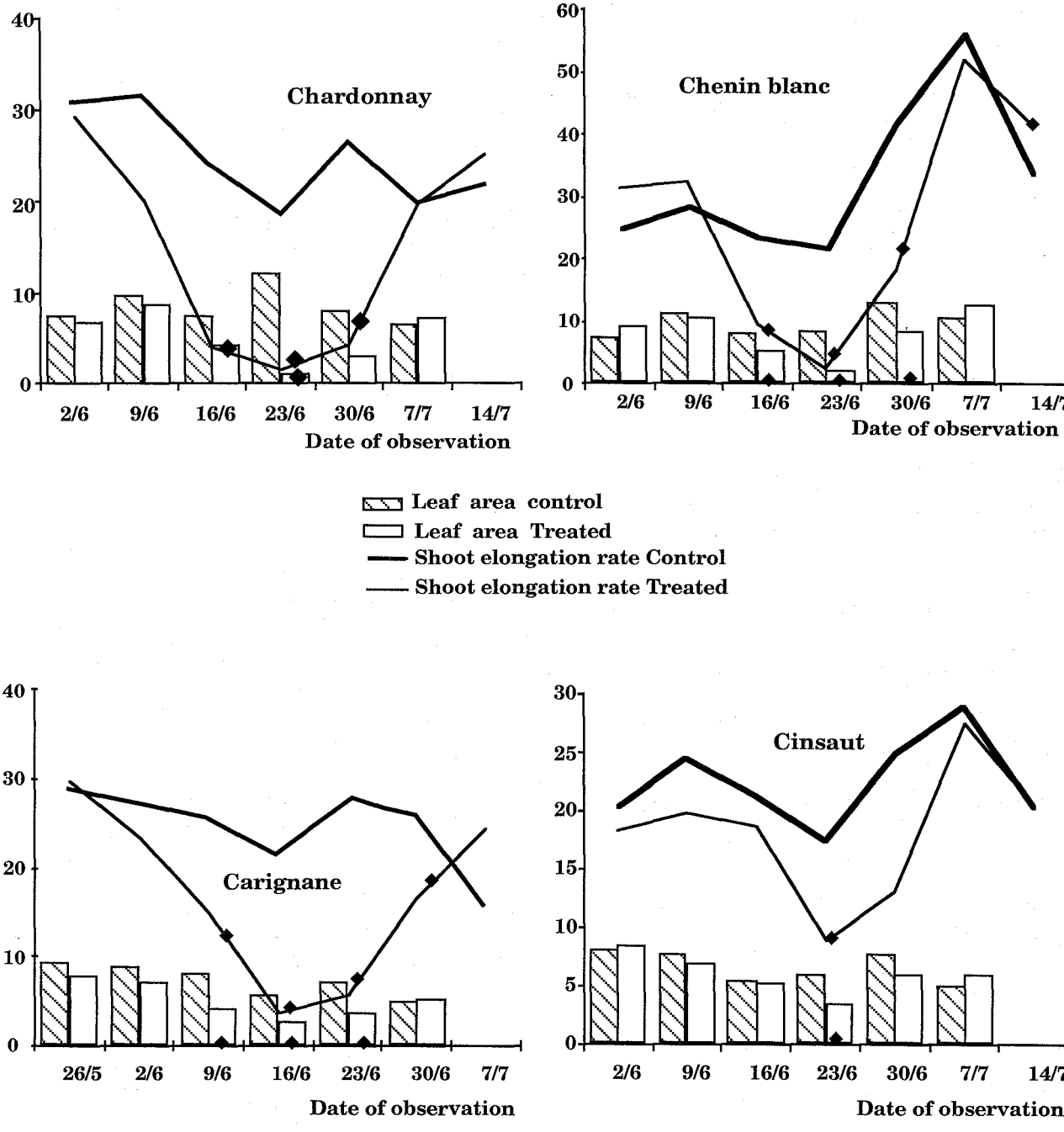

Figure 1. Effects of ethephon application on shoot elongation rate (cm/week), and corresponding leaf area (dm^2) in 4 grape cultivars. Ethephon applied June 4 for "Chardonnay", June 10 for "Chenin blanc", June 12 for "Carignane", and June 16 for Cinsaut"

◆ significantly different from no ethephon at the 5% level by ANOVA

Table 1. Effects of ethephon treatment on cluster and berry size, crop load, and maturity in 4 cultivars (collected at harvest corresponding to October 26, or September 1, 9, or 3 for "Chardonnay", "Chenin Blanc", "Carignane" and "Cinsaut", respectively)

Cultivar	Ethephon (ppm)	Yield (kg/vine)	Clusters/ vine	Cluster wt.(g)	Berry wt.(g)	Brix (%)	pH	Titratable acidity (%)
Cinsaut	0	4.4	15	296	4.46	18.2	3.00	0.66
	240	1.2*	6*	179*	4.42	18.9	3.05	0.65
Carignane	0	4.2	18	245	2.90	18.9	2.90	0.89
	480	0.2*	2*	110*	3.20*	19.7	2.88	0.88
Chenin Blanc	0	2.3	17	139	1.37	20.2	2.91	0.98
	480	0.3*	2*	127	2.28*	21.9	3.03*	0.77*
Chardonnay	0	1.5	13	118	1.26	20.5	3.30	0.81
	480	0.2*	3*	67*	1.14	20.5	3.40	0.88

* Significantly different from no ethephon at the 5% level by ANOVA.

In summary, ethephon application to the whole vine at full bloom reduced growth of shoots and leaf area as well as yield. Such treatments could have economic value as a supplement to topping and manual thinning, both of which require considerable labor. However, application rates must be carefully selected to avoid overthinning.

ACKNOWLEDGEMENTS

This was conducted at Ecole Nationale Superieure Agronomique de Montpellier, France. The authors acknowledge the assistance of Prof. D. Boubals and Mr. F. Champagnol.

REFERENCES CITED

Hirschfield G. & Lavee S.(1980) Control of vegetative growth of grapevine shoots by ethylene-releasing substances, conditions and sites of action. *Vitis* 19: 308-316

Lavee S.(1982) Control of grapevine growth and development using ethylene releasing substances and some aspects of their action. *Proc. Univ. Calif. Davis Grape Wine Cent. Symp.* pp. 126-131

Lavee S., Erez A. & Shulman Y.(1977) Control of vegetative growth of grapevine *Vitis vinifera* with chloroethyl phosphonic acid (ethephon) and other growth inhibitors. *Vitis* 16 : 89-96

Mannini F., Weaver R.J. & Johnson J.O.(1981) Effects of early bloom sprays of ethephon on irrigated and non- irrigated vines of Zinfandel grapes. *Amer. J. Enol. Vitic.* 32 : 277-279

May P. & Antcliff A.J.(1963) The effect of shading on fruitfulness and yield in the Sultana. *J. Hort. Sci.* 38 : 85-94

Peterson J.R. & Smart R.L.(1975) Foliage removal effects on Shiraz grapevines. *Amer. J. Enol. Vitic.* 26: 119-124

Shulman Y., Hirschfeld G. & Lavee S.(1980) Vegetative growth control of six grapevine cultivars by spray application of (2-chloroethyl) phosphonic acid (ethephon). *Amer. J. Enol. Vitic.* 31 : 288-293

Szyjewics E. & Kliewer W.M.(1983). Influence of timing of ethephon application on yield and fruit composition of "Chenin blanc" grapevine. *Amer. J. Enol. Vitic.* 34 : 53-56

Szyjewics E., Rosner N. & Kliewer M.(1984) Ethephon (2-chloroethyl) phosphonic acid, ethrel, CEPA) in viticulture - A review. *Amer. J. Enol. Vitic.* 35 : 117-123

Weaver R.J. & Pool R.M.(1969) Effect of ethrel, abscisic acid, and a morphactin on flower and berry abscission and shoot growth in *Vitis vinifera. J. Amer. Soc. Hort. Sci.* 94 : 474-478

Weaver R.J. & Pool R.M.(1971) Effect of ethephon and morphactin on growth and fruiting of "Thompson Seedless" and "Carignane" grapes. *Amer. J. Enol. Vitic. 22* : 234-239

Weibe J.(1975) Effect of canopy widening and shoot tip removal on the hybrid grape cultivar "De Chaunac". *J. Amer. Soc. Hort. Sci.* 100 : 349-351