

Effect of Ethephon (2-chloroethyl phosphonic acid) on quality and ripening of Beauty Seedless grape

by

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Der Einfluß von Ethephon (2-Chloräthylphosphonsäure) auf die Qualität und Reife der Rebensorte Beauty Seedless

Zusammenfassung. — Ethephon (2-Chloräthylphosphonsäure) wurde, neben einer Kontrollbehandlung, in den Konzentrationen 125, 250 und 500 ppm auf Reben der Sorte Beauty Seedless gesprüht; die Behandlung erfolgte nach dem Schnitt noch während der Dormanz, nach dem Beerenansatz und beim Weichwerden der Beeren. Anwendung von 500 ppm Ethephon während des Weichwerdens verbesserte die Traubenqualität durch Erhöhung des Zucker/Säure-Verhältnisses, durch Steigerung der Farbstoffausbeute und durch Abbau der Säure. Diese Behandlung beschleunigte auch die Reife und verkürzte die Dauer der Ernte.

Introduction

Uneven ripening is one of the serious problems in Beauty Seedless grape, which is an early cultivar recommended for commercial cultivation in north India. Ethephon has been found effective in accelerating the ripening and improving the quality of many fruits (ECK 1970, GERDITS and OBENAUF 1972, CHUNDAWAT *et al.* 1977). Dipping experiments with Ethephon have resulted in enhanced anthocyanin development and an increase in total soluble solids to acid ratio in Doradillo grapes (HALE *et al.* 1970). RAO *et al.* (1974) reported that ripening response of Ethephon in Pusa Seedless (Sultanina) grape varies with stage of treatment. Looking at the usefulness of this chemical on grapes, the present study was designed to work out the proper concentration of Ethephon with standard timings of its application for uniform colour development and early maturity of Beauty Seedless grapes.

Materials and methods

8-year-old vines of Beauty Seedless growing in the Experimental Vineyard of the Department of Horticulture, Haryana Agricultural University, Hissar, were used. The vines were trained on double wire Kniffin and spur-pruned to 2 buds (Jan. 21, 1976). To maintain uniformity, 20 canes/vine were retained. Ethephon at the concentration of 0, 125, 250 and 500 ppm was applied as dormant spray after 3 weeks of pruning (S_1), after berry set (S_2) and at veraison (S_3). Control vines were sprayed with water containing wetting agent (Tween-20). Each treatment consisted of a single vine replicated 3 times in a randomised block design. Altogether 36 vines were used in the experiment. Ripe berries were used to determine the berry weight and

percent juice. Total soluble solids were determined by hand refractometer and total acidity by titrating the juice against n/10 NaOH from the berries harvested at optimum harvest. To determine the colour intensity, the extraction and measurement methods described by SINGH (1976) were followed.

Results and Discussion

Berry weight

Ethephon increased the berry weight significantly when applied as dormant spray. Ethephon applied at berry set and veraison did not show any significant effect on berry weight (Table 1). JENSEN *et al.* (1973) also observed that berries treated with Ethephon did not show any effect on berry weight in table grapes. The increase of berry weight by dormant spraying Ethephon in the present investigation

Table 1

Effect of Ethephon on berry weight and juice content in Beauty Seedless grape
Der Einfluß von Ethephon auf Beerengewicht und Saftmenge der Sorte Beauty Seedless

Ethephon conc. (ppm)	Berry wt. (g)				Juice (%)			
	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean
0	1.5	1.4	1.5	1.47	56.9	61.5	58.7	58.9
125	1.6	1.5	1.5	1.53	58.3	60.4	59.8	60.5
250	1.7	1.3	1.5	1.50	57.3	59.6	60.4	60.0
500	1.6	1.2	1.4	1.40	56.9	59.9	58.5	55.0
Mean	1.6	1.4	1.4		57.3	59.6	61.1	
C.D. at 5 %								
For stages			0.13				2.2	
For concentration			NS				NS	
For interaction			NS				NS	

Table 2

Effect of Ethephon on TSS and acidity in Beauty Seedless grape
Der Einfluß von Ethephon auf TSS- und Säure-Gehalt der Sorte Beauty Seedless

Ethephon conc. (ppm)	TSS (%)				Acidity (%)			
	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean
0	16.1	13.9	14.0	14.6	0.88	1.24	1.21	1.11
125	16.0	16.3	16.9	16.4	0.86	0.87	0.78	0.84
250	16.0	16.6	17.2	16.6	0.84	0.85	0.75	0.81
500	16.1	16.8	17.4	16.8	0.84	0.82	0.73	0.80
Mean	16.05	15.90	16.37		0.86	0.95	0.87	
C.D. at 5 %								
For stages			0.06				0.02	
For concentration			0.07				0.02	
For interaction			0.12				0.04	

may possibly be due to longer retention of berries on the vines as compared to other stages of treatment.

Juice content

Percent juice in grape berries was increased when Ethephon was applied at berry set and at veraison (Table 1). Similarly table grapes treated with Ethephon were also found to be juicier than untreated control without affecting the juice quality adversely (JENSEN *et al.* 1973).

TSS

Ethephon applied after berry set and at veraison increased the percent soluble solids in grape juice (Table 2). The most effective treatment was 500 ppm when applied at veraison. WEAVER and POOL (1971) also observed a significant increase in total soluble solids in Carignane grapes when Ethephon was applied at the beginning of colour development.

Acidity

Total acidity of Beauty Seedless grape juice was significantly reduced by all the treatments with Ethephon (Table 2). The greatest reduction was found in berries treated with 500 ppm of Ethephon at veraison. Decreased acidity in wine cultivars of grapes with Ethephon has also been reported by WEAVER and MONTGOMERY (1974).

TSS/acid ratio

TSS/acid ratio was remarkably increased by Ethephon applied at veraison followed by the treatment given after berry set (Table 3). The differences were reduced by both acidity and increased TSS. WEAVER and MONTGOMERY (1974) reported increased TSS/acid ratio by Ethephon in Ruby Cabernet grape mainly due to reduced acidity.

Colour

The development of colour in berries was enhanced by Ethephon when berries were treated after berry set and at veraison. 500 ppm at veraison was the most effective treatment (Table 3). The overall increase in colour with Ethephon applica-

Table 3

Effect of Ethephon on TSS/acid ratio and colour development in Beauty Seedless grape
Der Einfluß von Ethephon auf das TSS/Säure-Verhältnis und die Farbstoffentwicklung der
Sorte Beauty Seedless

Ethephon conc. (ppm)	TSS/acid ratio				Colour (absorbance at 530 nm)			
	S ₁	S ₂	S ₃	Mean	S ₁	S ₂	S ₃	Mean
0	18.2	11.1	11.1	13.6	0.43	0.41	0.40	0.41
125	18.5	18.8	21.5	19.6	0.46	0.60	0.68	0.56
250	19.0	19.6	22.8	20.5	0.49	0.62	0.67	0.60
500	19.2	20.5	23.6	21.1	0.49	0.64	0.77	0.63
Mean	18.7	17.5	19.8		0.47	0.56	0.63	
C.D. at 5 %								
For stages			0.50				0.018	
For concentration			0.58				0.015	
For interaction			1.01				0.03	

T a b l e 4
Effect of Ethephon on ripening in Beauty Seedless grape
Der Einfluß von Ethephon auf die Reife der Sorte Beauty Seedless

Treatment	Optimum date of harvest			Duration of harvest (d)		
	S ₁	S ₂	S ₃	S ₁	S ₂	S ₃
Control	7th June	7th June	7th June	6	6	6
Ethephon 125 ppm	7th June	27th May	30th May	6	3	2
Ethephon 250 ppm	7th June	26th May	30th May	6	3	2
Ethephon 500 ppm	7th June	26th May	29th May	6	3	2

tion would be specially useful in varieties and locations where natural colour development is poor. An increased colour development in Emperor grapes has also been observed by WEAVER and POOL (1971) with Ethephon.

Ripening

Dormant spray did not alter the dates for optimum ripening (Table 4). However, Ethephon application after berry set and at veraison enhanced ripening by 13 and 10 d, respectively. Whereas duration of harvest was 7 d under control and dormant spray treatments, it was reduced to 2 to 3 d in Ethephon application after berry set and at veraison. These effects have been mainly due to the effect of ethylene, released by Ethephon, which is known as fruit ripening hormone which helped in early attainment of optimum TSS/acid ratio and early colour development. Similar results have been obtained by HALE *et al.* (1970) in Doradillo and Shiraz grapes and RAO *et al.* (1974) in Pusa Seedless grapes.

Summary

Ethephon (2-chloroethyl phosphonic acid) at 0, 125, 250 and 500 ppm was applied as spray to Beauty Seedless grapes on dormant vines after pruning, after berry set and at veraison. Ethephon (500 ppm) application at veraison improved the quality by increasing total soluble solids to acid ratio and colour development and by reducing the acidity. This treatment also enhanced ripening and reduced the duration of harvest.

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