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Effect of hydrogen cyanamide on Cardinal and Perlette grapevines

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مفعول هيدروجين سيانميد على شجر العنب

أجريت تجربة لدراسة تأثير ثلاثة مقادير (2.5، 5.0 و 7.5 ٪) من "هيدروجين سيانامید" على النمو المبكر لبراعم شجرة العنب من صنف "كاردينال" و "بيرليت". و قد نتج عن ذلك نمو مبكر (3 إلى 5 أسابيع) لبراعم العقل و زيادة ملحوظة في عدد البراعمالمتفتحة. أما استعمال هذه المادة الكيماوية على أشجار العنب، 42، أو 30 يوما قبل التفتح الطبيعي للبراعم فقد جعل هذه الأخيرة تتفتح مبكرا خاصة بالنسبة لصنف "كاردينال" حيث تراوحت المدة بين 19 و 25 يوما. و من ضمن النتائج أيضا زيادة في كمية العنب و في عدد العناقيد و كذلك في وزن حبات العنب. هذه الأخيرة عرفت زيادة في نسبة السكر و نقصا في نسبة الحموضة مما يؤشر على نضجها المبكر.

الكلمات المفتاحية : نمو البراعم- عنب المائدة- نضج العنب- "هيدروجين سيانامید".

Effet de la cyanamide d'hydrogène sur la vigne Cardinal et Perlette

Afin de stimuler le débourrement des bourgeons et avancer la maturité des raisins des cépages Cardinal et Perlette, la cyanamide d'hydrogène (H_2CN_2) a été appliquée à des doses de 2.5 , 5.0 et 7.5 % (v/v) sur des boutures à œil dormant et sur des vignes adultes. L'application de H_2 CN_2 sur les boutures a entraîné un débourrement précoce d'environ 5 semaines pour Cardinal et 3 à 5 semaines pour la Perlette. Le nombre total de bourgeons débourrés a été légèrement augmenté pour les deux cultivars par rapport aux témoins. Sur des vignes adultes, H_2CN_2 a été appliquée à 42 ou 30 jours avant la date du débourrement. La première application a avancé le débourrement de 25 et 5 jours, respectivement pour les cépages Cardinal et Perlette. La seconde application a entraîné une précocité de débourrement de 19 jours pour Cardinal mais sans effet pour la Perlette. Le traitement des vignes a été accompagné d'une augmentation de la récolte et du nombre de grappes par cep, et aussi du poids moyen des baies. La teneur en solides solubles a été significativement augmentée alors que l'acidité a été diminuée entraînant ainsi une maturité précoce des raisins des souches traitées.

Mots clés: Régulateurs de croissance - Débourrement - Maturation des baies - *Vitis vinifera* L.

Effect of hydrogen cyanamide on Cardinal and Perlette grapevines

To stimulate budbreak and enhance fruit maturation of Cardinal and Perlette grapevines, H_2CN_2 was applied at 2.5, 5.0, and 7.5% (v/v) on hard wood cuttings and mature vines. The application of H_2CN_2 to one node cuttings induced a hastening of budbreak by about 5 weeks for Cardinal and 3 to 5 weeks for Perlette. Total number of buds that burst was slightly increased for both cultivars when compared to the controls. On mature vines, H_2CN_2 was applied on two dates (42 or 30 days before estimated date of normal budbreak). The first application date advanced budbreak by 25 and 5 days for Cardinal and Perlette, respectively, while the second application date enhanced budbreak by 19 days for Cardinal and none for Perlette. Vines sprayed with H_2CN_2 showed an increase in yield, cluster number and berry weight. Soluble solids were significantly ($p < 0.05$) increased while the acidity was significantly decreased, reflecting an earlier maturation of berries from the treated vines at harvest.

Key words: Growth regulators - Budbreak - Berry maturation - *Vitis vinifera* L.

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INTRODUCTION

Hydrogen cyanamide has been used in many countries as a dormancy breaking agent for grapevines (Fernandez & Pouget, 1986; Foott,1987; Lin *et al.*,1983; Shulman *et al.*,1986; Williams,1987). Most reports indicate that hydrogen cyanamide (H2CN2) can induce an earlier and more uniform budbreak (Fernandez and Pouget, 1986 ; Lin *et al.*,1983; Mattioda *et al.*,1986), and sometimes an earlier maturation date of the grapes (McCool,1986; Wicks *et al.*,1984). These results depend upon concentration of cyanamide used, time of application, and variety. The application of H_2CN_2 at different concentrations on Perlette grapevines resulted in an increase in the number of buds that developed and an earlier date of budbreak (Shulman *et al.*,1986). Hydrogen cyanamide application also resulted in an earlier date of bloom, fruit set, veraison and maturity and increased yield per vine for three seedless cultivars (Wicks *et al.*,1984). The application of 2.5% H_2CN_2 on Cardinal vines, 4 to 8 weeks before budbreak induced an earlier date of budbreak, bloom and maturity by 2 to 3 weeks (McCool,1986). However, in another trial conducted over a two year period, Thompson Seedless grapevines sprayed with 2.5% H_2CN_2 just subsequent to pruning, did not show any significant difference in fruit maturation characteristics, despite an earlier date of budbreak (Williams,1987).

The objective of this study was two folds : (i) to determine the usefulness of H_2CN_2 for nursery purposes (inducing more buds to develop earlier in the greenhouse), and (ii) for earlier maturation of Perlette and Cardinal grapes under climatic conditions found in Morocco.

MATERIALS AND METHODS

The trial was conducted in a commercial, non-irrigated vineyard near Rabat-Skhirat, with 12 year-old Cardinal and Perlette vines, grafted on 41B rootstock. The vines were planted to a 3.0 x 1.5 m row and vine spacing, respectively, and trained to a simple three wire trellis system. The vines were head-trained at 0.50 m, the lower wire was located at 0.70 m above the vineyard floor, while the second and the upper wire were at 1.00m and 1.30 m above the soil, respectively. Cardinal vines were pruned to 8 spurs of 2 buds each, while Perlette vines were pruned to 2 canes of about 7 buds with two replacement spurs of 2 buds each.

Before pruning, canes of Cardinal and Perlette vines were taken to the laboratory and one node cuttings were made, divided into 4 lots (each lot was composed of 60 cuttings) and sprayed with either water or H_2CN_2 (Dormex [SKW 83010] containing 50% active ingredient, supplied by BASF, Trostberg, AG) at 2.5, 5.0, or 7.5% (v/v) with a hand sprayer. All cuttings were placed in a greenhouse. The number of buds that developed were counted biweekly. The same treatment rates of H_2CN_2 mentioned above, were applied either 42 or 30 days before the estimated date of normal budbreak for both cultivars grown in the field. The H_2CN_2 mixture was applied with a hand sprayer until runoff. The experimental design of the field study was a randomized complete block replicated 3 times with each plot having 5 vines. Budbreak was evaluated weekly.

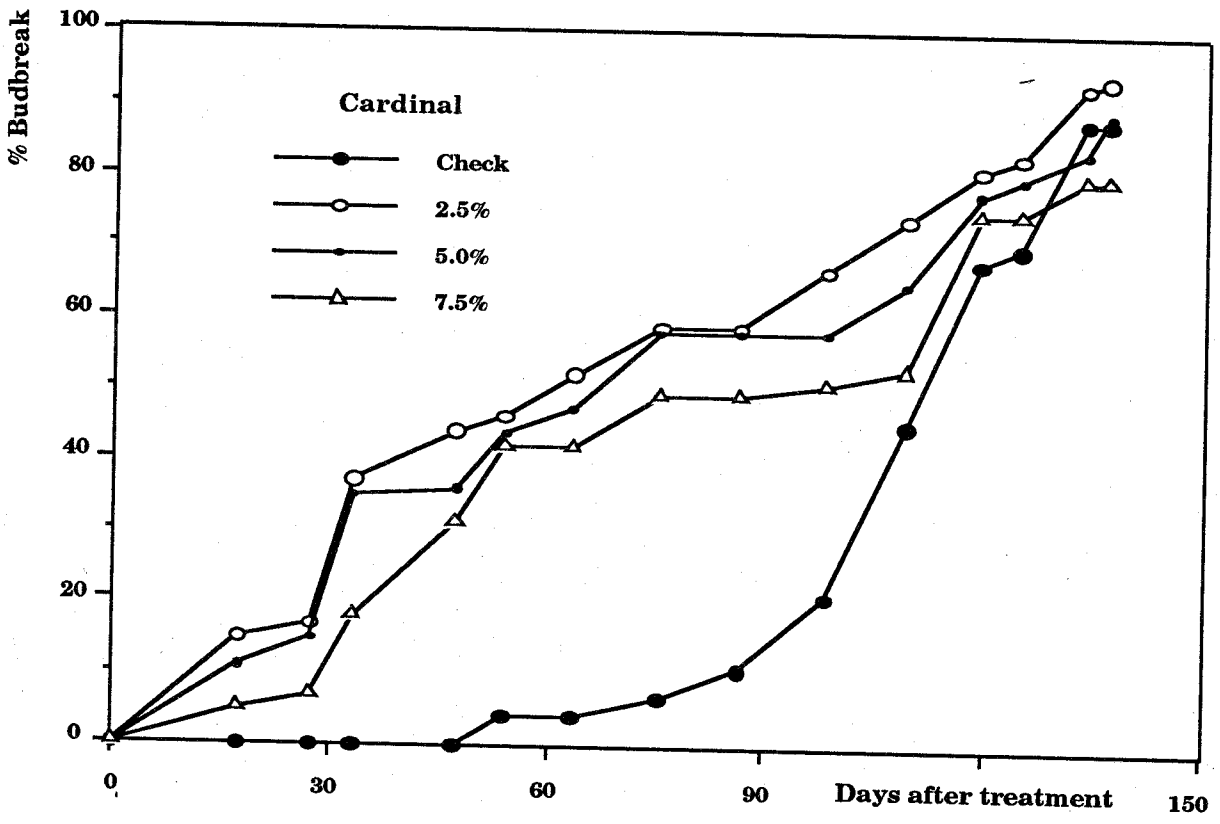
The number of clusters per vine was counted before bloom. Berry development and maturation were measured by collecting 100 berries per plot, chosen randomly from different parts of the clusters. Berry weight, total soluble solids (determined by a hand refractometer type ADT/C), and total acidity (determined by titration with NaOH (0.133N) using phenolphthalein as indicator) were measured. At harvest, yield per vine for each replicate was recorded and berry samples taken.

The data were analyzed using analysis of variance for a randomized complete block design.

RESULTS

Budbreak as determined by the appearance of green tissue at each node was first observed on treated one node cuttings 2 weeks after treatment, and on the control cuttings 5 weeks later for both cultivars (Figure1). The enhancement of budbreak by H_2CN_2, based on the date when 50% of the total buds had burst, was about 7, 6, and 4 weeks relative to the control for Cardinal cuttings sprayed with 2.5, 5.0, and 7.5 % H_2CN_2, respectively. The greatest difference between H_2CN_2 applied to cuttings and the controls relative to date of 50% budbreak for Perlette cuttings was one week. The total number of buds that developed was increased by H_2CN_2 treatments for both cultivars, however, the increase was dependent upon the concentration of H_2CN_2 used. The application of a 2.5% H_2CN_2 concentration resulted in the greatest number of buds that pushed for both cultivars compared to the other treatments.

Hydrogen cyanamide applied to mature vines in the field (Figure 2) enhanced the rate of budbreak for Cardinal vines when sprayed on both dates. However, the effect of H_2CN_2 on Perlette was not as great. The degree of enhancing budbreak of Cardinal was 2 weeks with the 2.5% rate, and 3



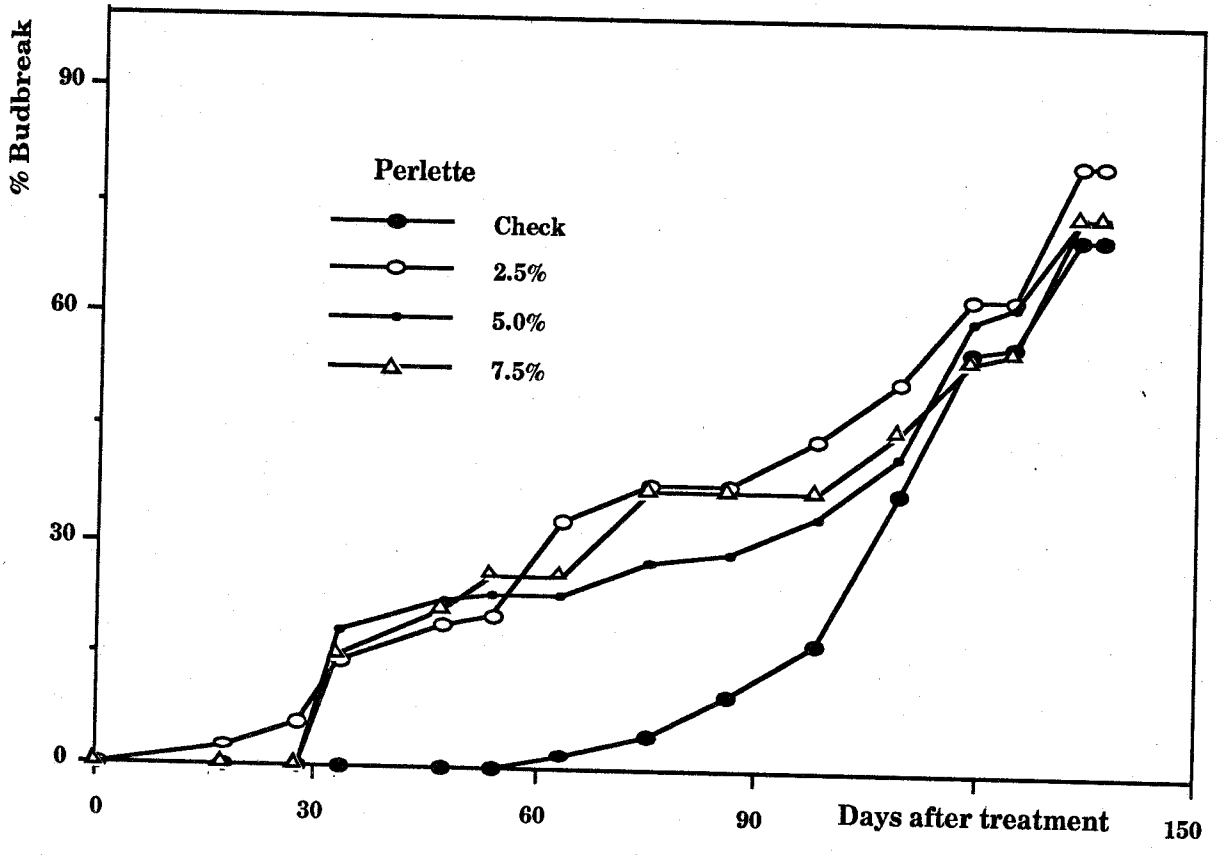
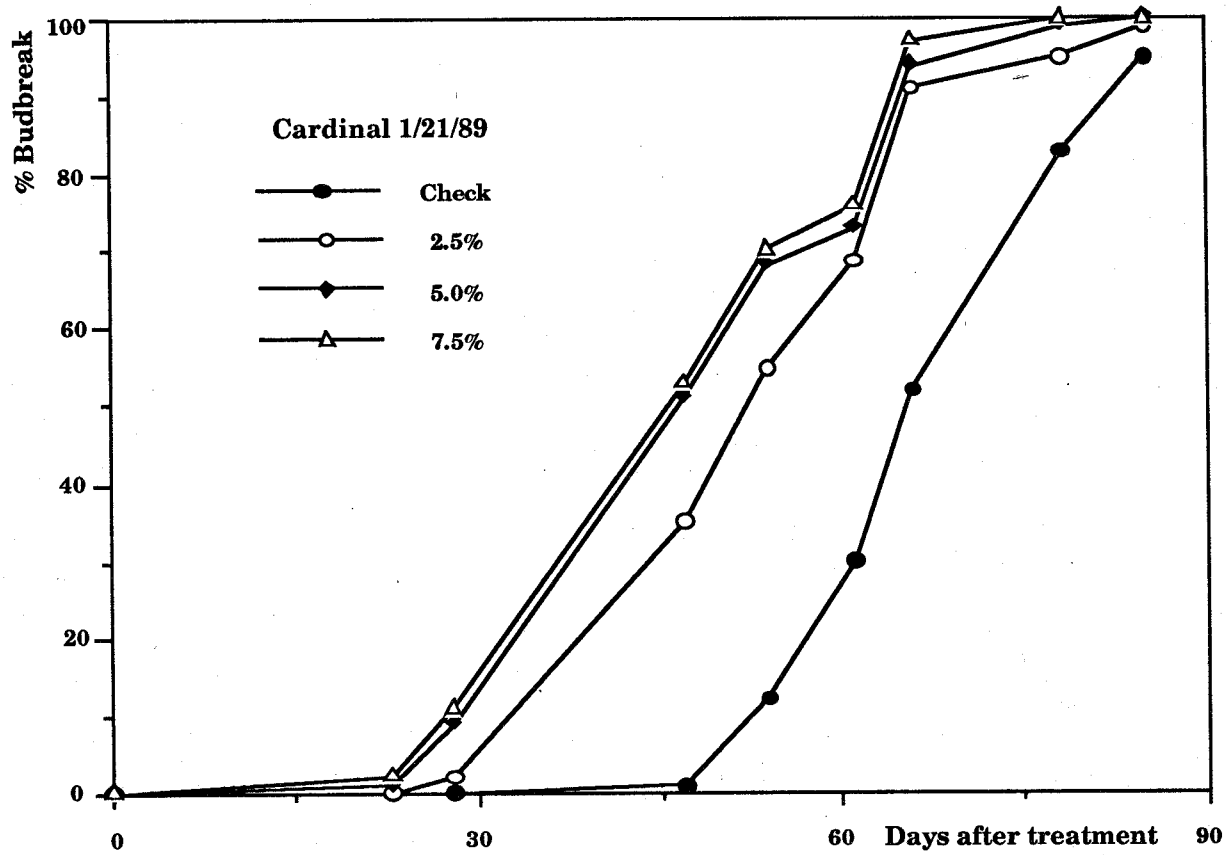


Figure 1. The effect of H_2CN_2 concentrations applied to one node cuttings on the percent budbreak of Cardinal and Perlette



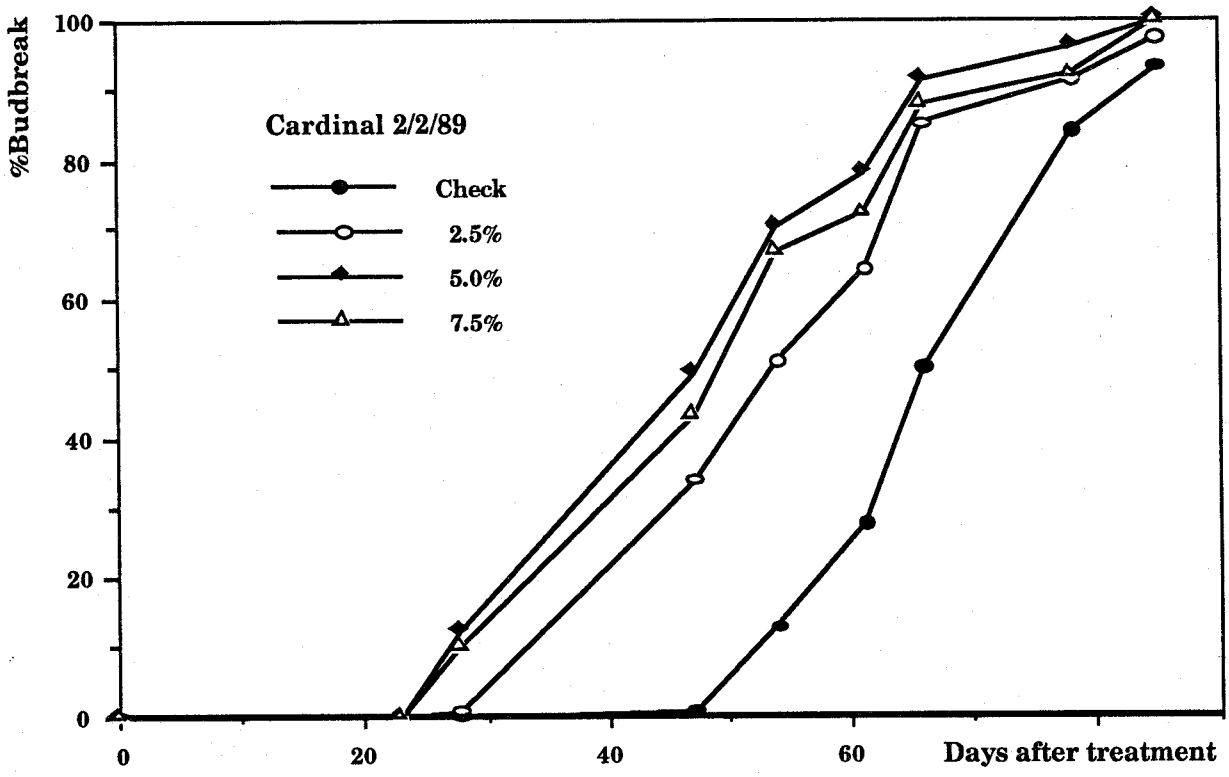
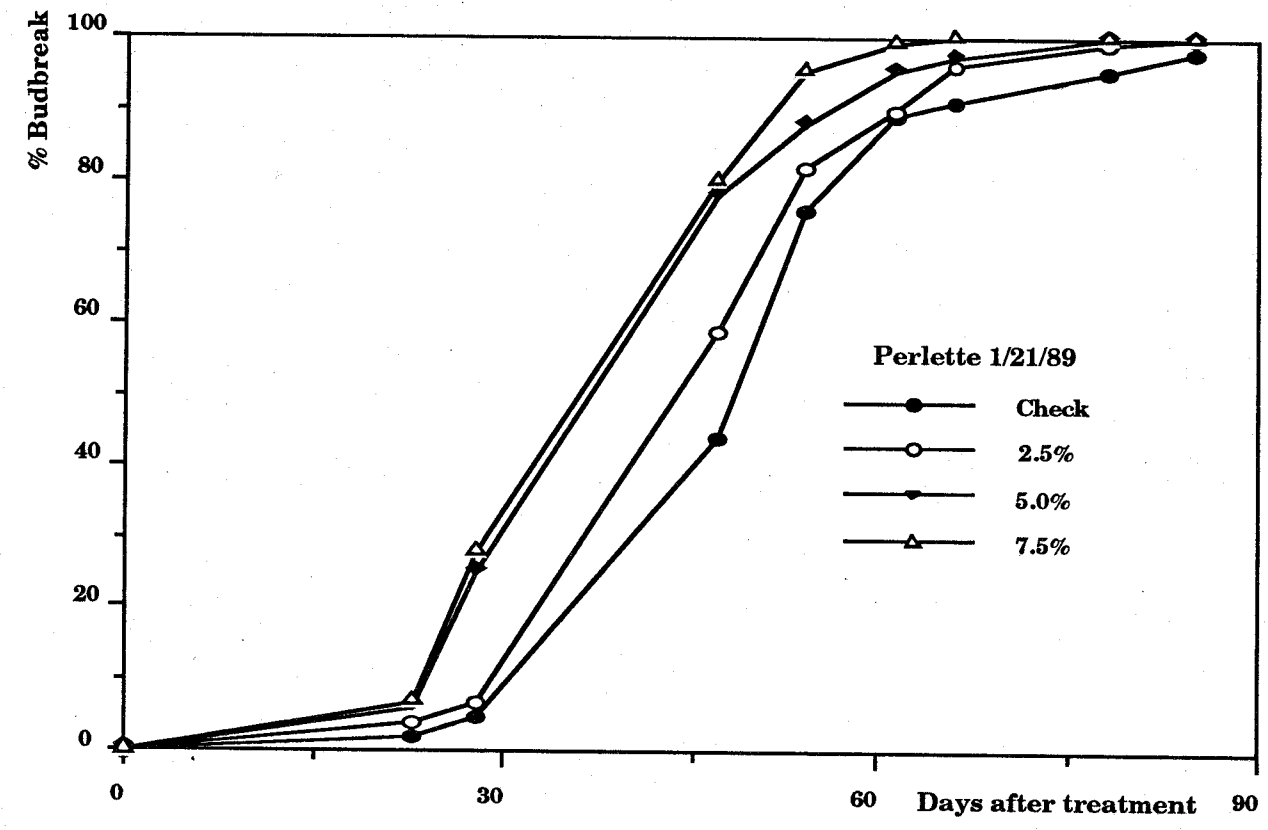


Figure 2a. Effect of H_2CN_2 concentrations applied on two different dates (1/21/89 or 2/2/89) on the percent budbreak of Cardinal grapevines



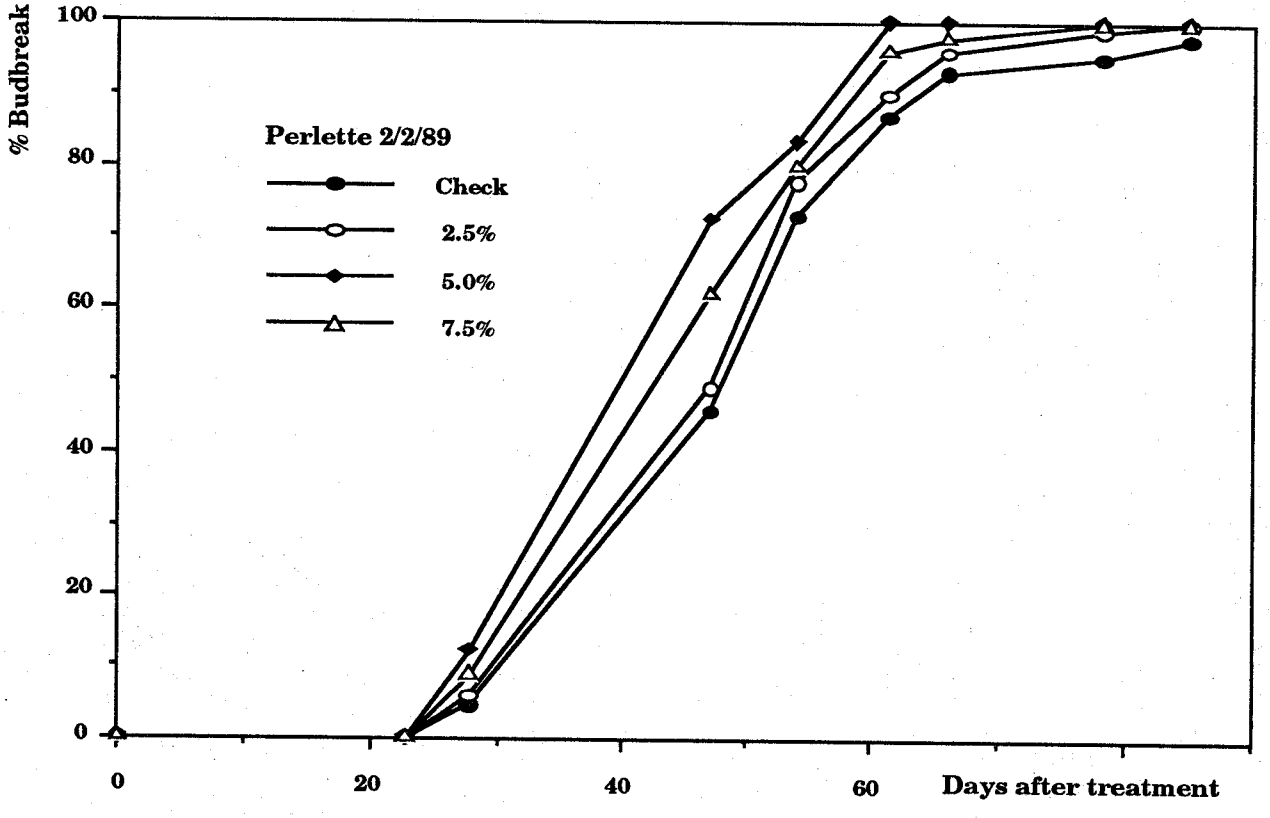
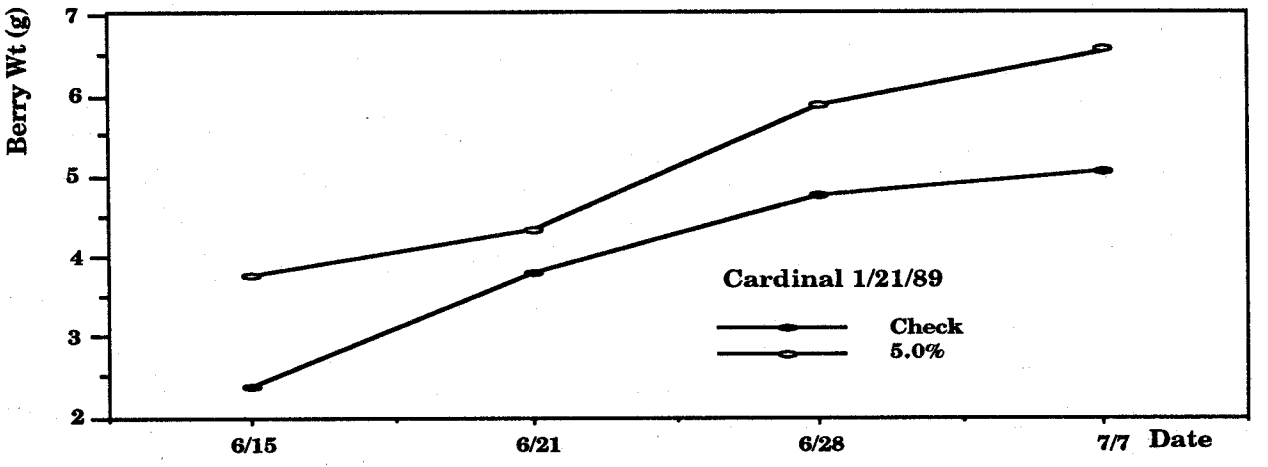
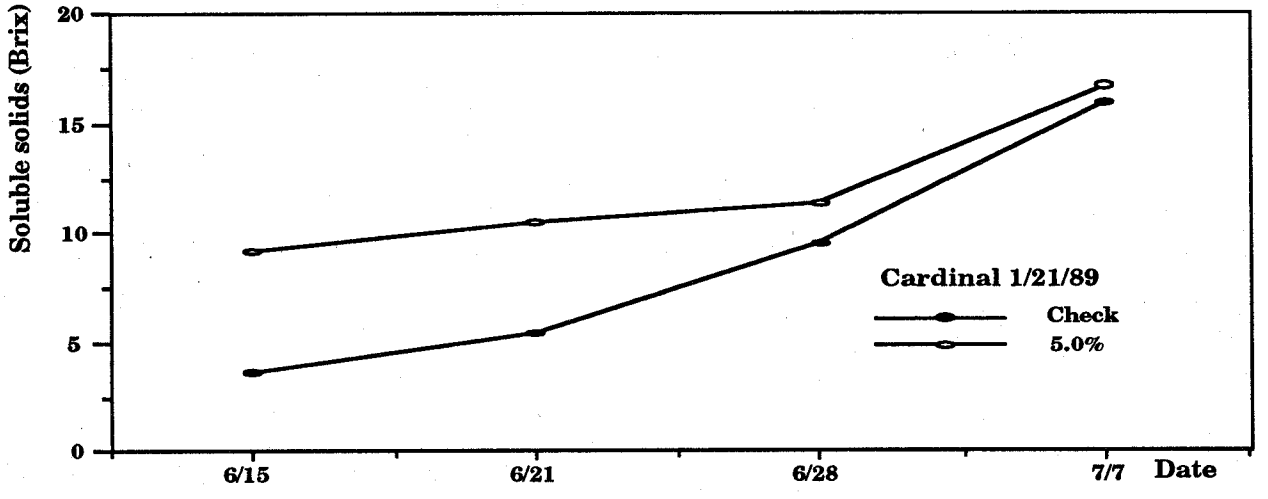


Figure 2b. Effect of H_2CN_2 concentrations applied on two different dates (1/21/89 or 2/2/89) on the percent budbreak of Perlette grapevines

weeks with higher concentrations for both dates of application. For Perlette vines, the enhancement of budbreak was less, ranging from 2 to 3 days with 2.5% H_2CN_2, and from 8 to 13 days with higher concentrations for both application dates.

The development of the fruit for both cultivars indicated that berries from the treated vines matured earlier (Figure 3). Harvest data showed an increase in crop weight for all treated vines, though not always significant (Tables 1 and 2).





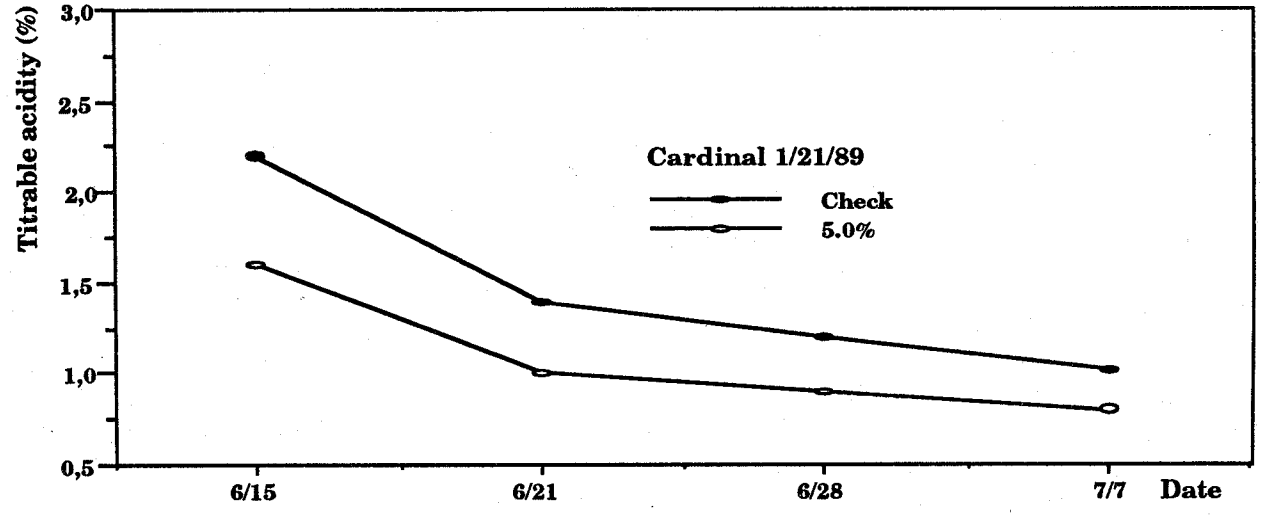


Figure 3a. Effect of H_2CN_2 at 5.0% on berry development and maturation of field-grown Cardinal cultivars

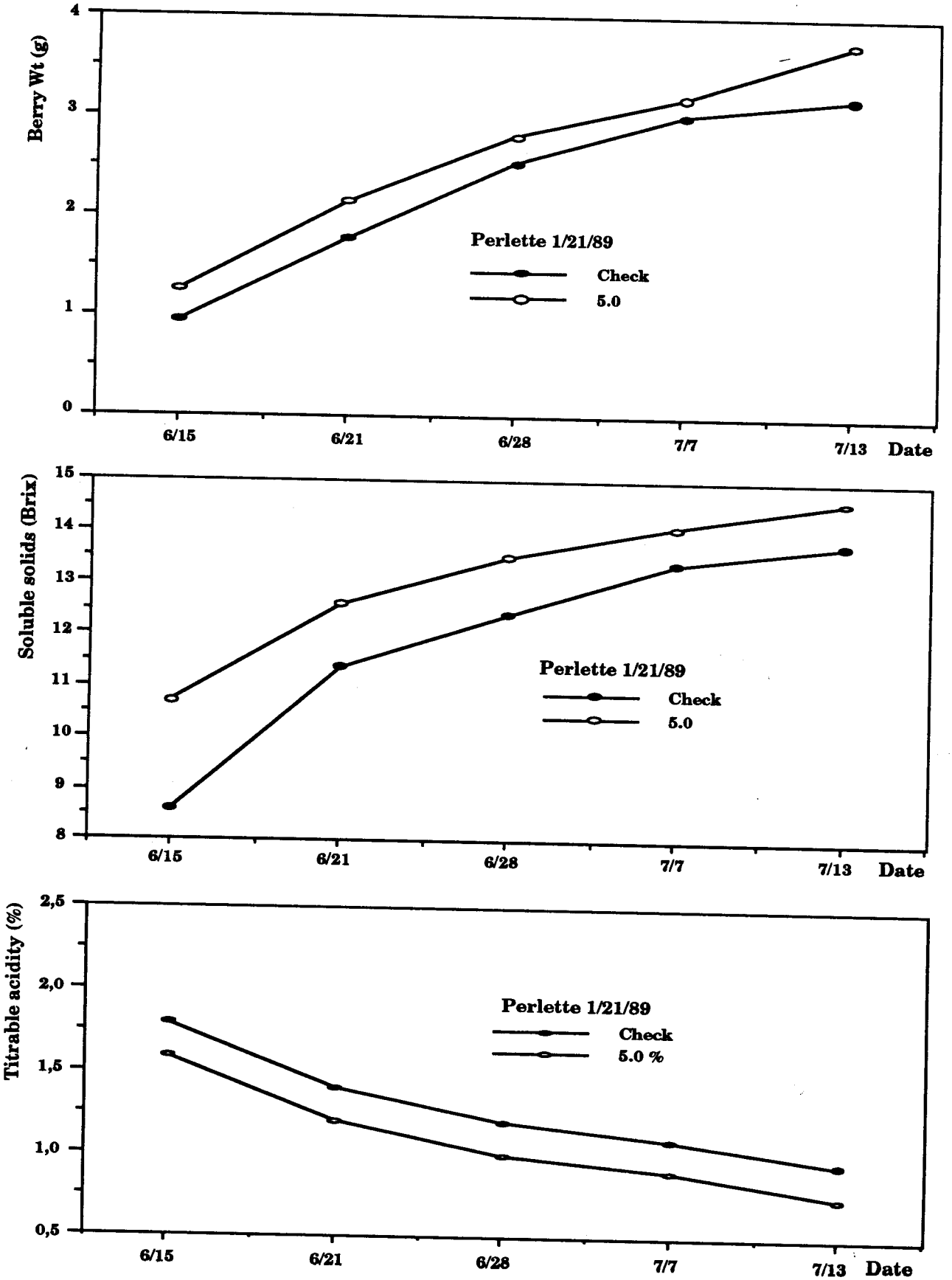


Figure 3b. Effect of H_2CN_2 at 5.0% on berry development and maturation of field-grown Perlette cultivars

Table 1. Effect of different hydrogen cyanamide concentrations applied on two different dates on yield and maturity components of Cardinal grapevines

	Treatments	Bud break (%)	Yield (kg/vine)	Clusters per vine	Cluster wt (g)	Berry wt (g)	°Brix (%)	Titrable acidity (%)
Date 1*	check	95a**	4.7	10	453	5.1a	15.9a	1.10b
	2.5%	99b	6.1	12	527	5.8ab	16.5b	0.90a
	5.0%	100b	6.0	12	506	6.6b	16.7b	0.80a
	7.5%	100b	5.9	11	522	5.7ab	16.3ab	0.75a
Date 2*	check	93a	4.5a	8a	565	5.1a	15.5a	1.01b
	2.5%	97ab	5.2ab	9ab	576	5.5ab	16.6b	0.97ab
	5.0%	100b	5.5b	10ab	543	6.4c	16.8b	0.83a
	7.5%	100b	5.7b	12b	478	6.0bc	16.4b	0.88ab

* Date 1 = 01/21/89 ; Date 2 = 02/02/89

** Means followed by a different letter whithin a column are significantly different at the 5% level using Newman and Keuls test.

Table 2. Effect of different hydrogen cyanamide concentrations applied on two different dates on yield and maturity components of Perlette grapevines

	Treatments	Bud break (%)	Yield (kg/vine)	Clusters per vine	Cluster wt (g)	Berry wt (g)	°Brix (%)	Titrable acidity (%)
Date 1*	check	98	5.0	7	733	3.2a**	13.9a	0.96b
	2.5%	100	6.3	8	796	3.4ab	14.2b	0.87a
	5.0%	100	7.0	9	739	3.8b	14.6b	0.75a
	7.5%	100	6.0	7	852	3.6b	14.5b	0.78a
Date 2*	check	98	4.7a	6a	799	3.3a	13.8a	0.97b
	2.5%	100	6.5ab	7ab	787	3.5a	14.1ab	0.90ab
	5.0%	100	7.7b	9b	822	3.9b	14.4c	0.82a
	7.5%	100	6.2ab	8ab	817	3.8b	14.2bc	0.86a

* Date 1 = 01/21/89 ; Date 2 = 02/02/89

** Means followed by a different letter whithin a column are significantly different at the 5% level using Newman and Keuls test.

The increase was significant for vines sprayed on the second application date for both cultivars, as was the cluster number per vine. Cluster weight did not show any significant differences, however, a slight increase was observed with most H_2CN_2 treatments.

Although berry weight was significantly increased with H_2CN_2 treatments for all rates and dates, berry weight from treated vines with 2.5% H_2CN_2 was not always significantly different from berry weight of the control for both cultivars.

Significant differences were also measured for total soluble solids and titrable acidity. Hydrogen cyanamide treatments resulted in higher total soluble solids and lower acidity.

DISCUSSION

Cuttings made from Cardinal vines were more responsive to H_2CN_2 than were Perlette cuttings, since budbreak enhancement was several weeks with Cardinal, and only a few days to one week with Perlette.

Hydrogen cyanamide at a 2.5% concentration could be considered as the optimal application concentration on one node cuttings since the greatest budbreak enhancement was obtained at this concentration for both cultivars.

Total budbreak also was increased by the 2.5% H_2CN_2 treatment, while the higher concentrations were less effective. The adverse effect observed with higher H_2CN_2 concentrations also was observed on Kyoho one node cuttings (Lin & Wang,1985).

On field-grown, mature vines, H_2CN_2 had a significant effect on the earliness and the amount of budbreak of Cardinal vines, however, Perlette vines responded to a lesser degree. This is not in agreement with other reports indicating that budbreak of Perlette vines was greatly enhanced by H_2CN_2 applications, with 70% more budbreak for treated vines (Shulman *et al.*, 1986). This may have been due to the fact that budbreak was not a problem for Perlette in this vineyard location since total budbreak of the controls was close to 100%.

However, a slight enhancement of budbreak was observed with the 5.0 and 7.5% H_2CN_2 treatments for the first application date indicating that earlier application may be beneficial. Fruit development and maturation were enhanced by H_2CN_2 treatments.

For either application date, berries from treated vines were heavier, with higher soluble solids content and lower acidity than the controls. This finding is in agreement with earlier reports about hastening fruit maturation following an early budbreak for Perlette (Wicks *et al.*,1984), and Cardinal (McCool,1986) after H_2CN_2 treatments.

Harvest data showed that crop per vine was increased by H_2CN_2 treatments for both cultivars, due to more clusters per vine.

This increase of crop per vine due to H_2CN_2 application also was observed in other studies with Perlette (Wicks *et al.*,1984) and other cultivars (Foott,1987).

The use of H_2CN_2 could have an economic benefit for grape growers, in Morocco, by promotion of yield, fruit quality, and ripening for these cultivars.

The application of H_2CN_2 at 5.0% on Perlette and Cardinal would be the optimum concentration to achieve this goal. For nursery purposes, a 2.5% concentration of H_2CN_2 would be the optimal concentration for cuttings of the above two cultivars.

REFERENCES

Fernandez L.E. & Pouget R. (1986) Effet de la cyanamide d'hydrogène sur le débourrement des bourgeons de la vigne en fonction de leur rang sur le sarment et de la vigueur. *Proceedings 3rd International Symposium on The Physiology of the Grapevine* (O.I.V.), Bordeaux, France. pp. 68-74

Foott J.H. (1987) Effect of hydrogen cyanamide on bud emergence in wine grapes. *Calif. Agri.* 41:19

Lin H.S., Chang L.R., Lin J.H., Liaw W.J. & Lin C.H. (1985). The application of cyanamide on termination of dormancy in grapevine bud. (II) Field test. *Proc. Natl. Sci. Counc.* Monthly, ROC 7, 237-242

Lin C.H. & Wang T.Y. (1985) Enhancement of bud sprouting in grape single bud cuttings by cyanamide. *Amer. J. Enol. Vitic.* 36:15-17 (1985)

Mattioda H., Fevre F., Dumartin P. & Payan J.J. (1986) Utilisation du SKW 83010 pour l'amélioration de débourrement de la vigne. *Proceedings 3rd International Symposium on the Physiology of the Grapevine* (O. I. V.), Bordeaux, France. pp. 61-67

Mc Cool C.R. (1986) Cyanamide advances the maturity of table grapes in Central Australia. *Aust. J. Exp. Agric.* 26:505-509

Shulman Y., Nir G., Fanberstein L. & Lavee S. (1986) The effect of cyanamide on the release from dormancy of grapevine buds. *Scientia Hort.* 19: 97-104

Wicks A.S., Johnson J.O., Jensen F.L., Bracho E.A., Neja R. Lider L.A. & Weaver R.J. (1984) Induction of early and more uniform budbreak in *Vitis vinifera* L. cvs. Perlette, Flame Seedless, and Thompson Seedless grapes with hydrogen cyanamide. *Proceedings Bud Dormancy in Grapevines*: Potential and Practical Uses of Hydrogen Cyanamide on Grapevines. Univ. of California, Davis. pp. 48-55

Williams L.E. (1987) The effect of cyanamide on budbreak and vine development of Thompson Seedless grapevines in the San Joaquin Valley of California. *Vitis* 26:107-113