EFFECTS OF SOME PLANT GROWTH REGULATORS ON THE YIELD AND OUALITY OF MUSCAT OF HAMBURG GRAPE VARIETY *

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ÖZET

Bazı Bitki Büyüme Maddelerinin Hamburg Misketi Üzüm Çeşidinin Mahsul Miktarı ve Kalitesine Etkileri

Bu araştırmada DMC (N-Dimethylmorpholinium chlorid) ve Ethrel (2-Chloroethylphosphonic acid)'in farklı dozlardaki uygulamalarının Hamburg Misketi üzüm çeşidinde mahsul miktarı ve kaliteye etkileri araştırılmıştır. Her iki bitki büyüme maddesi 0, 100, 500 ve 1000 ppm dozlarında kullanılmış olup; DMC, tomurcukların sürmesinden 35 ve 45 gün sonra olmak üzere 2 kez, Ethrel ise sadece 35 gün sonra 1 kez püskürtme yöntemi ile uygulanmıştır.

DMC uygulamaları, dozlara bağlı olarak, mahsul miktarını, salkım ağırlığını, salkımdaki tane adedini ve total asit miktarını istatistik olarak arttırmıştır. Buna karşılık 100 tane ağırlıkları, 25 tane hacmi ve toplam kuru madde miktarı ise istatistik olarak azalmıştır. pH değerleri ve tane boyutlarının da aritmetik olarak azaldığı gözlenmiştir.

Ethrel uygulamaları sonucunda ise; mahsul miktarı istatistik olarak (0.01)düzeyde azalırken; diğer özellikler arasında ve kontrola göre uygulamaların herhangi bir etkisinin bulunmadığı saptanmıştır.

SUMMARY

In this experiment the effects of different concentrations of DMC (N-Dimethylmorpholinium chlorid) and Ethrel (2-chloroethylphosphonic acid) applications on yield and quality of Muscat of Hamburg grape variety were investigated. DMC applied twice (35 and 45 days after bud burst) and Ethrel applied once (35 a after bud burst) by spraying method. Applied concentrations were 0, 100, 500 and 1000 ppm for both plant growth regulators.

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DMC applications increased yield per vine, cluster weight, number of berries per cluster and total acids statistically and their increasing-ratio depend on the applied concentrations. Contrarily the 100 berries weight, 25 berries volume and total soluble solid decreased statistically, pH-values and berry size aritmetically.

All ethrel concentrations decreased the yield of vine statistically (0.01 level). For the other characteristics was not found any significant difference between the applications and control.

INTRODUCTION

Almost all of the commercially-grown cultivars of *Vitis vinifera* are of high fertility with few exceptions. Though it depends on the cultivars, a fertile bud may produce up to three inflorescences and cach inflorescence may consist of hundreds of flowers; but 70-80 % of flowers fail to develop into mature fruits (Possingham 1970). Therefore, fruitset is a more important factor in yield determination then inflorescence initiation.

To increase fruit-set amount is a very important factor for fruitfulness, however in viticulture many investigations have done by using several chemical materials and there are still some studies on this subject. The results of investigations show that the plant growth regulators have negative and/or positive effects on fruitset and contrarily there are some investigations showing that they change the quality characteristics of the grapes (Alleweldt 1962, Coombe 1965, 1967, 1970, Dass and Randhawa 1968, Fidan 1969, Tukey and Fleming 1970, Tukey 1970, Barrit 1970, Weaver and Pool 1971 a, b, c, Chundawat et al. 1971, Considine and Coombe 1972, El-Zeftawi and Weste 1972, Naito et al. 1972, 1974, Loreti and Natali 1974, Nelson and Sharples 1974, Ağaoğlu 1975 d, 1976, Bangert and Gotz 1975, Jensen et al. 1975, Laver et al. 1977, Chakrawar and Rane 1977, Ağaoğlu and Çelik 1977, Ağaoğlu et al. 1977).

In this experiment the effects of two different plant growth regulators, DMC and Ethrel, on vine fruitfulness and some grape qualities were investigated. These synthetic materials show many effects depending on the application time, number and concentrations for different varieties and species. DMC (N-Dimenthylmopholinium chlorid), is in the same group like inhibitor materials CCC and Alar. It is observed that, which was first invented by J. Jung and H.Scholz has an inhibitor effect on plants (Jung 1970, Ağaoğlu 1973, 1975 a, b, c). First detailled studies with DMC on vine were done in Turkey by Ağaoğlu (1973, 1975 a and b). Generally, Ağaoğlu (1973) has observed that the different doses of DMC don't have very important effect on the ratios of "Number of Inflorescence/Shoot" and the "Number of Flowers/Shoot"; but it is effective on the ratios of "Differentiation degree/Bud" and the "Number of Inflorescence primordium/Bud" depending on the position of buds on the cane. Also, Ağaoğlu (1975) investigated that the DMC applications on the leaves have negative effect on the increase of shoot lenght. The shoot lenght decreases with the increase of applied doses. The effects of DMC are also very dependent on the variety. The DMC application from the soil increases the cumulative shoot length (not significant) but the increase in number of nodes is very limited (Ağaoğlu 1975 c). No publication was observed on the effects of DMC on the yield

of vines and quality of grapes up to now. Therefore, this study was done in Ankara ecological conditions for Muscat of Hamburg grape variety.

In this experiment Ethrel (2-chloroethylphosphonic acid) was used as a second plant growth regulator. The investigations show that the natural Ethylen content in the berry has an importance in the second and third periods of berry development and during this period it effects a lot on fruit maturity. This is determined by applying Ethylene (Ethrel Ethephone, CEPA) externally to the vine. The application of CEPA at the beginning of the second phase of berry development increases the amount of endogenous ethylene content in berry and consequently the fruit ripen more rapidly (Coombe and Hale 1973).

There are numerous investigations on the application of Ethrel in Vineyards. The aims of these studies were to shorten the maturity period and to increase the quality quantity of yield by ethrel applications (Hali et al. 1970, Weaver and Pool 1971 b, Coombe and Hale 1973, Weaver and Montgomery 1974, Blommaerd et al. 1974, Jensen et al. 1975, Fidan and Çelik 1975, Lavee et al. 1977, Chakrawar and Rane 1977). In most of the experiments the Ethrel is applied late at vegetation period, just before or after veraison period. In this experiment, Ethrel was applied in different doses before blooming and their effects are determined.

MATERIALS and METHODS

Experiments were conducted in the Vineyards of Agricultural Faculty of Ankara University with 6 years old and Goblet type trained Muscat of Hamburg/8 B vines. Planting distances were 3.00 x 1.50 m.

Two growth regulators were tested: DMC (N-Dimethylmorpholinium chlorid-BAS 0660 W) a liquid formulation of 476, 315 g/1 ethephon active ingredient a product of Shell. Ecth formulations did not contain any wetting agent. Sprays were applied by hand with a 2-liters sprayer. DMC and Ethrel were applied of the dosis 0, 100, 500 and 1000 ppm. DMC was applied to the vines at two different times: 1) 35 d after bud burst and 2) 45 d after bud burst. Ethrel was applied on vines only at one date (35 days after bud burst).

Randomized block desing was used in the vineyard trial, with 4 vines per treatment and 3 blocks. Data were subjected to analysis of variance, and significance among treatment means was determined by Tukey's test (Düzgüneş 1963).

The fruits were harvested on the maturity time of Muscat of Hamburg and yield per vine, cluster weight, number of berries per cluster, 100 berries weight, 25 berries volume, size of berries, total soluble solids, total acids (tartaric acid) and pH were determined.

RESULTS

Effects of DMC and Ethrel-applications on yield pervine:

The effects of different concentrations of DMC and Ethrel treatment on yield per vine are given in Fig. 1. It shows that significant differences are aberved for the different treatment. Obtained maximum yield is 5.101 kg. by DMC 500 ppm, then

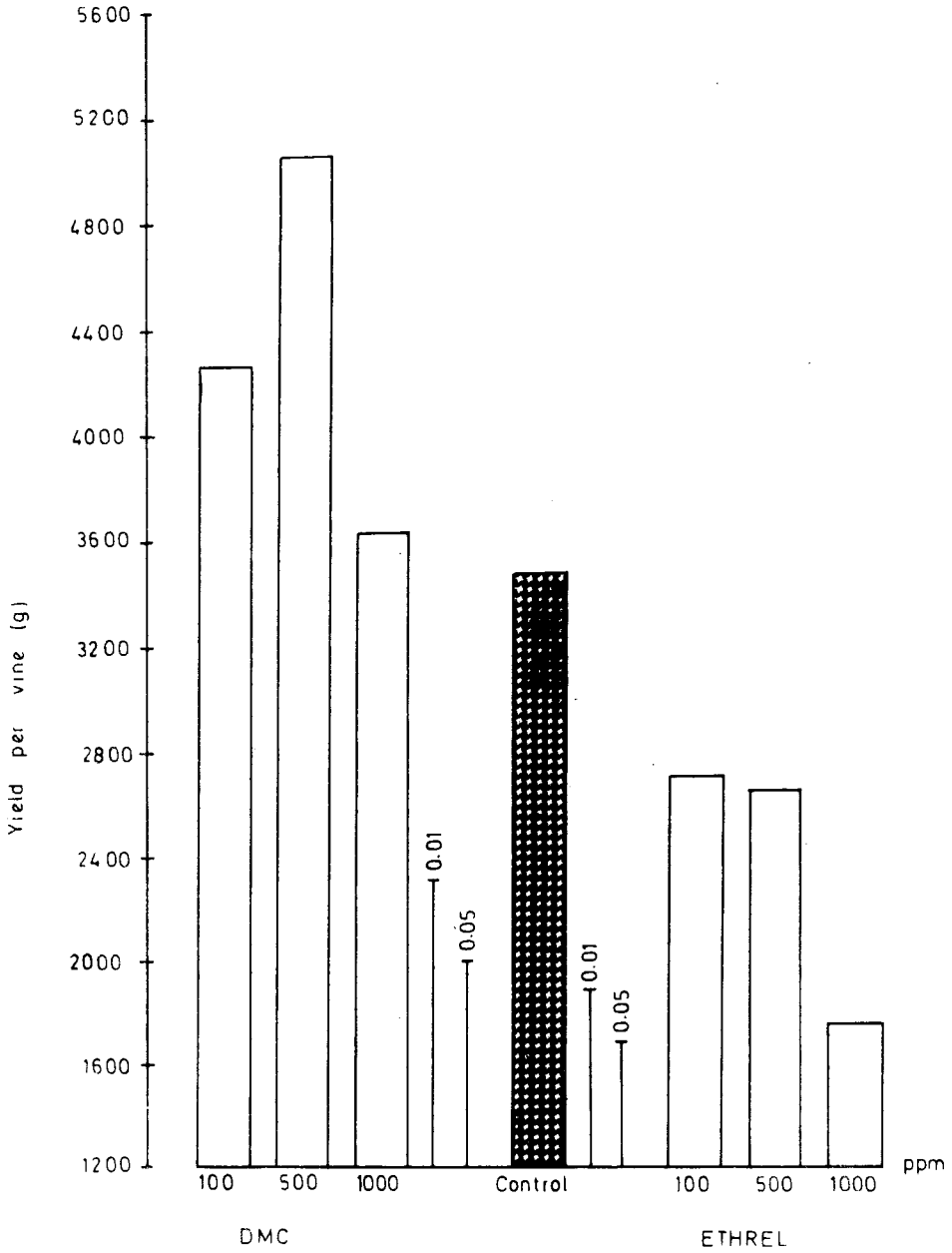

Fig. 1
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the Yield Per Vine

100, 1000 and 0 ppm applications come respectively per vine. Ethrel treated vines gave just the opposite results of DMC. Especially Ethrel treatment of 1000 ppm has a significant reduction in yield. Because the prebloom Ethrel treatment resulted in a higher percent of flower drop.

Effects of DMC and Ethrel-applications on the cluster weight:

Cluster weight has an important role to determine quality properties of grapes and especially for table grapes. However increase in cluster weight is a required factor without reduction at other quality properties. The results of the trials depending on this aim aregiven in Fig. 2. Significant differences are observed in the DMC

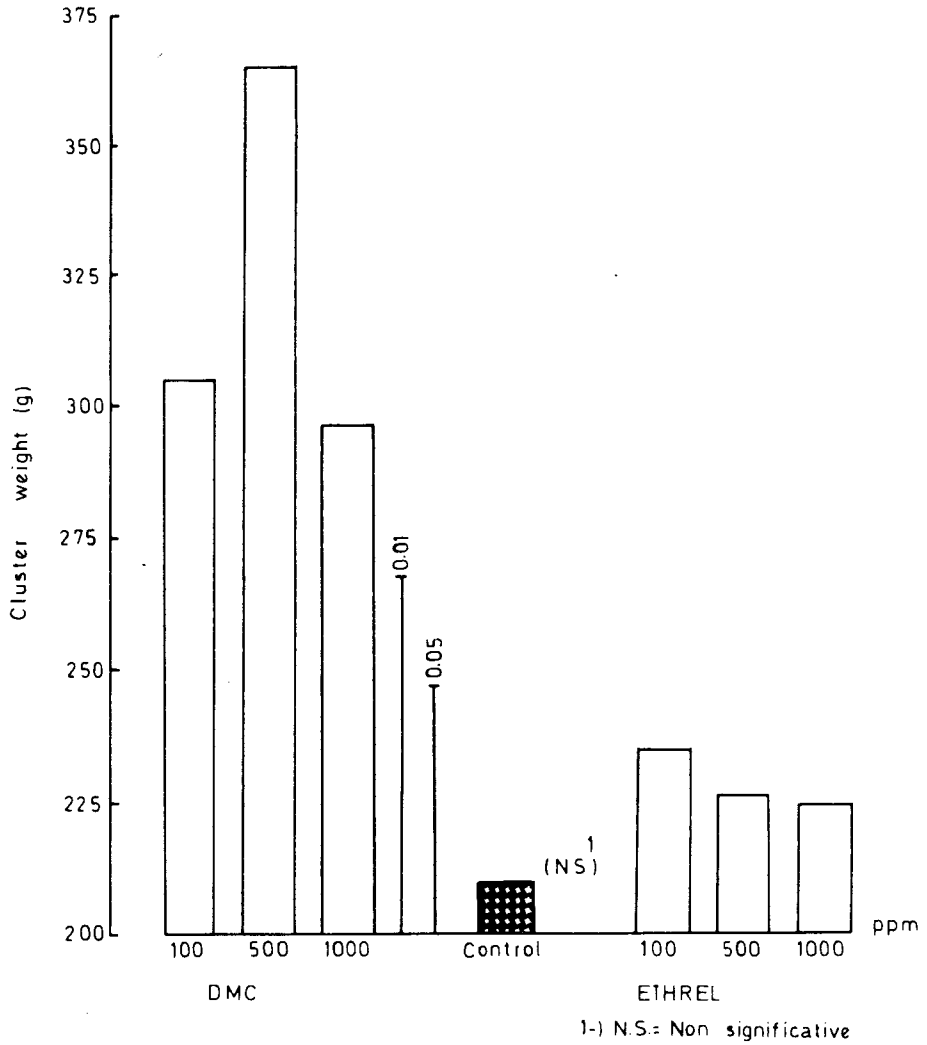

Fig. 2
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the Cluster Weight

treatments. The maximum cluster weight 362,7 g is obtained by the treatment of DMC 500 pp. For 100 ppm, and 0 ppm 308,6 g, 297,3 g; 210 g are obtained respectively. No significant differences were observed by the Ethrel treatments. However, the obtained results have arithmetical differences parallel to DMC treatment.

Effects of DMC and Ethrel-applications on the number of berries per cluster:

All doses of DMC gave statistically more number of berries per cluster than the control (Fig. 3). Maximum number of berries was obtained by IMC 500 ppm (144,5 berries), then 129,6, 129,2 and 88,1 berries came by 1000 ppm, 100 ppm treatments and the control respectively. The difference was not significant for Ethrel treatments.

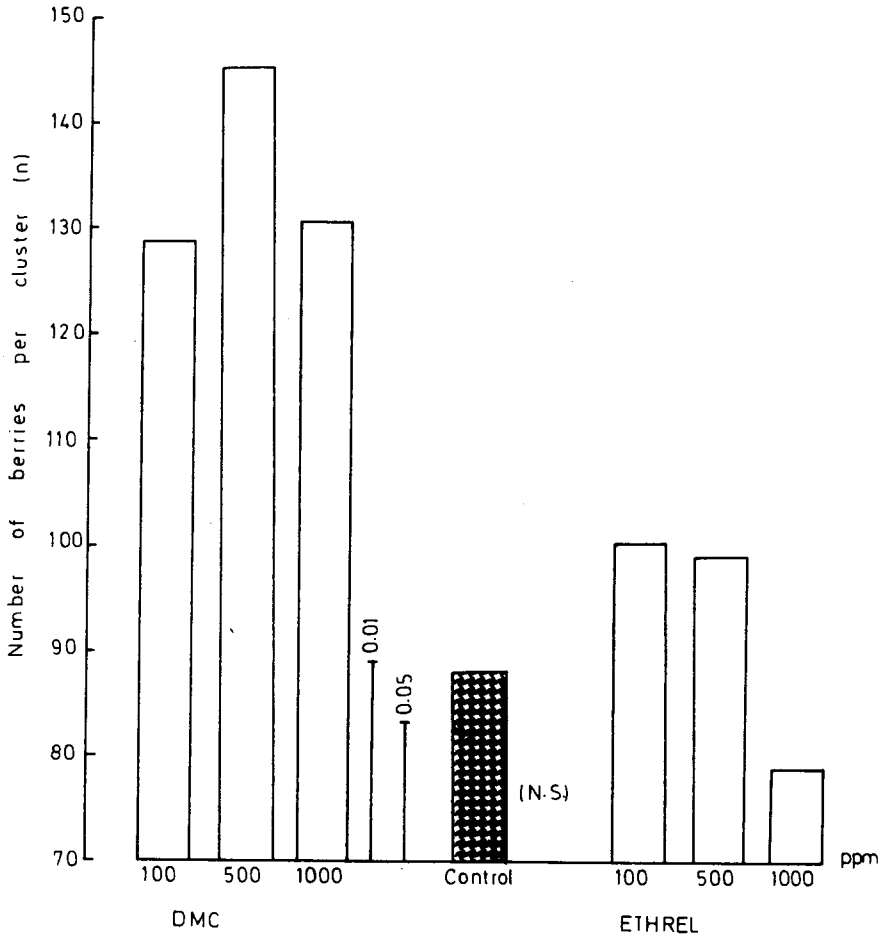

Fig. 3
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the Number of Berries Per Cluster

Effects of DMC and Ethrel-applications on the 100 berries weight:

The effects of different DMC and Ethrel doses on 100 berries weight for Muscat of Hamburg are given in Fig. 4.

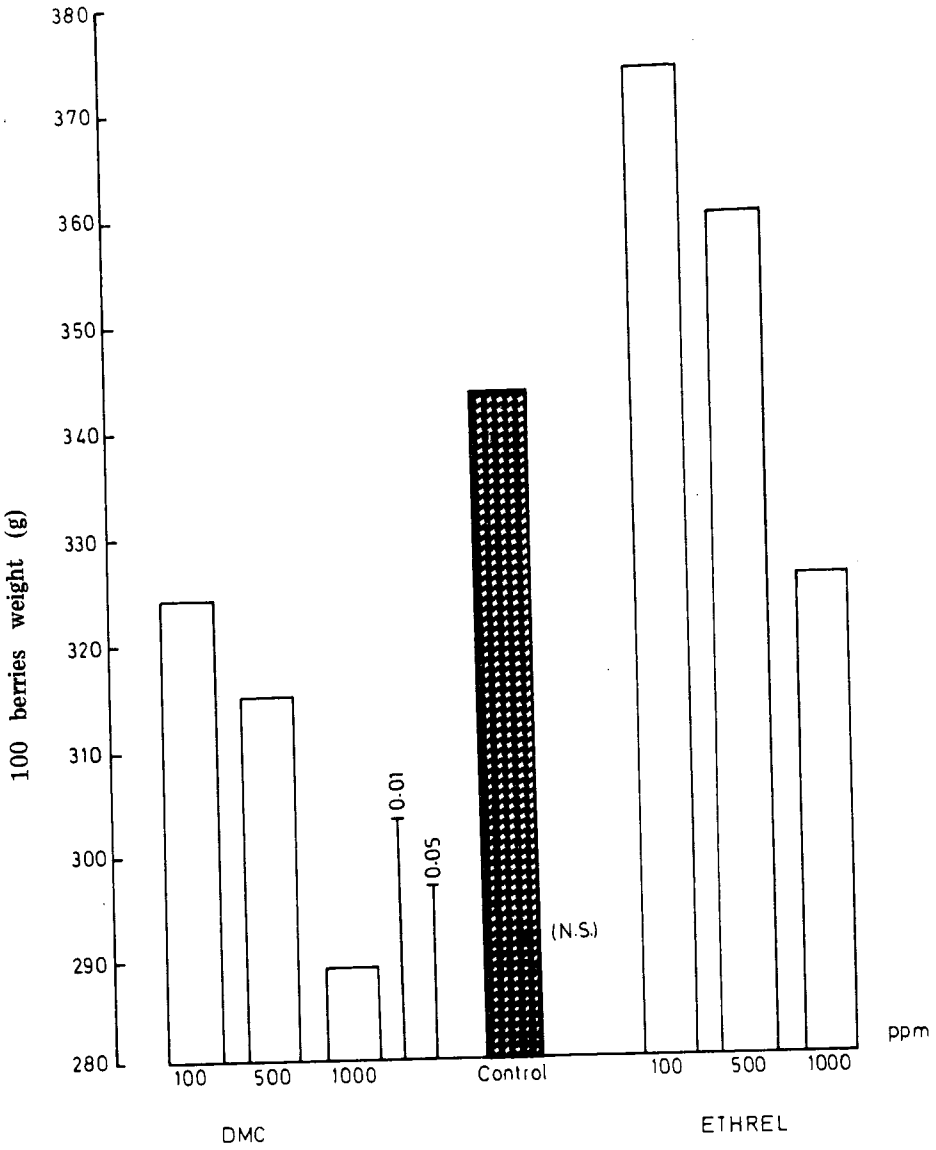

Fig. 4
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the 100 berries weight.

All concentrations of DMC treatment resulted in significant decrease in 100 berries weight. 100 berries weight for control was 343.4 g and it was 324.5 g, 315.7 g and 289.5 g for 100 ppm, 500 ppm and 1000 ppm respectively. DMC 1000 ppm treatment resulted in a significant decrease than the other two concentrations.

Results for Ethrel treatments are not significant. Differences are arithmetical and the maximum 100 berries weight 374.1 g obtained for Ethrel 100 ppm application. Then 359.6 g, 343,4 g, 327,7 g for 500 ppm, control, 1000 ppm respectively.

Effects of DMC and Ethrel-applications on the 25 berries volume:

Only DMC 1000 ppm treatment had lower volume of 1 % level among the other treatments for 25 berries volume. The differences for the others are not important (Fig. 5).

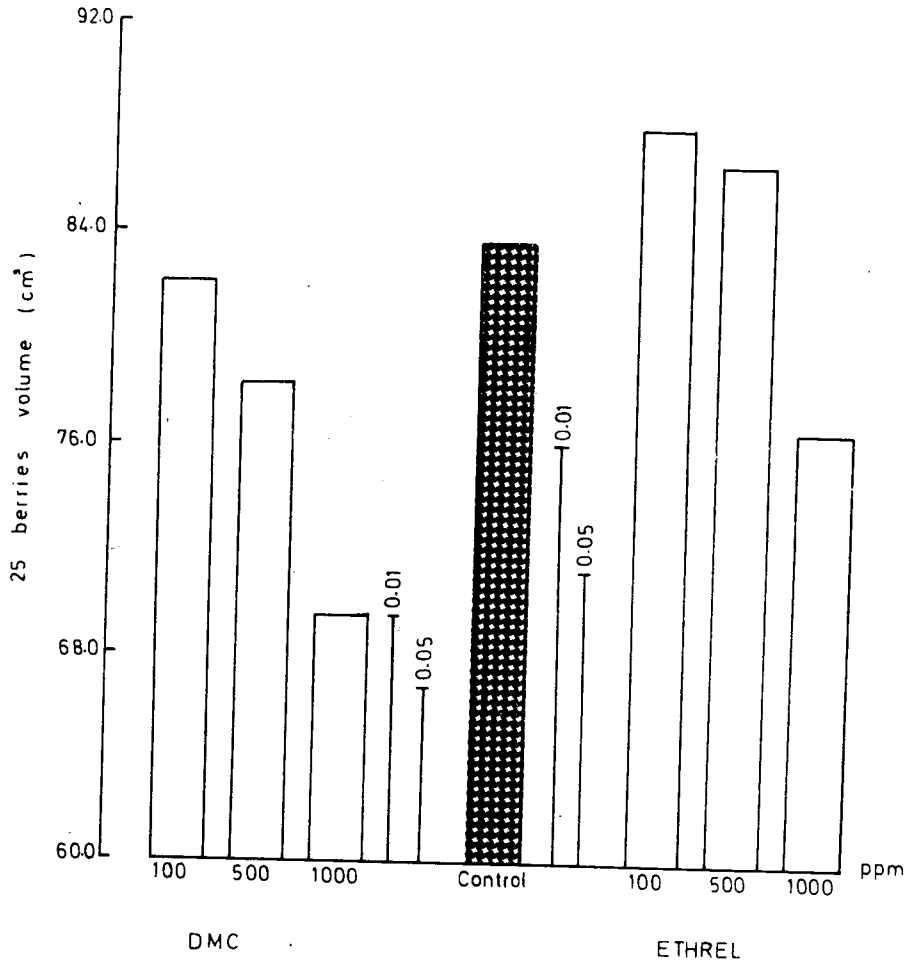

Fig. 5
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the 25 berries volume

For Ethrel treatments, difference at a level of 5 % for 100 and 1000 ppm was observed. Like DMC the differences for the others are not important (Fig. 5).

Effects of DMC and Ethrel-applications on the size of berry:

Effects of DMC and Ethrel treatments were not significant for berry size (Fig. 6 and 7). Maximum berry size for DMC treated vine are resulted by the Control and for the Ethrel treatments by the 100 ppm. The smallest size was observed by the 1000 ppm of both hormones.

Effects of DMC and Ethrel-applications on the Total soluble solids, total acidity and pH:

The results of analysis for the grapes harvested on the same day are given in Fig. 8, 9 and 10.

Fig. 8 and 9 show that there are significant differences (1 %) in total soluble solids and in total acidity amounts observed by DMC treatments. Maximum total soluble solid was obtained by the Control (20.5 % Brix) and minimum amount was observed by DMC 500 ppm (17.7 % Brix). The results obtained for total acidity are just the opposite of TSS.

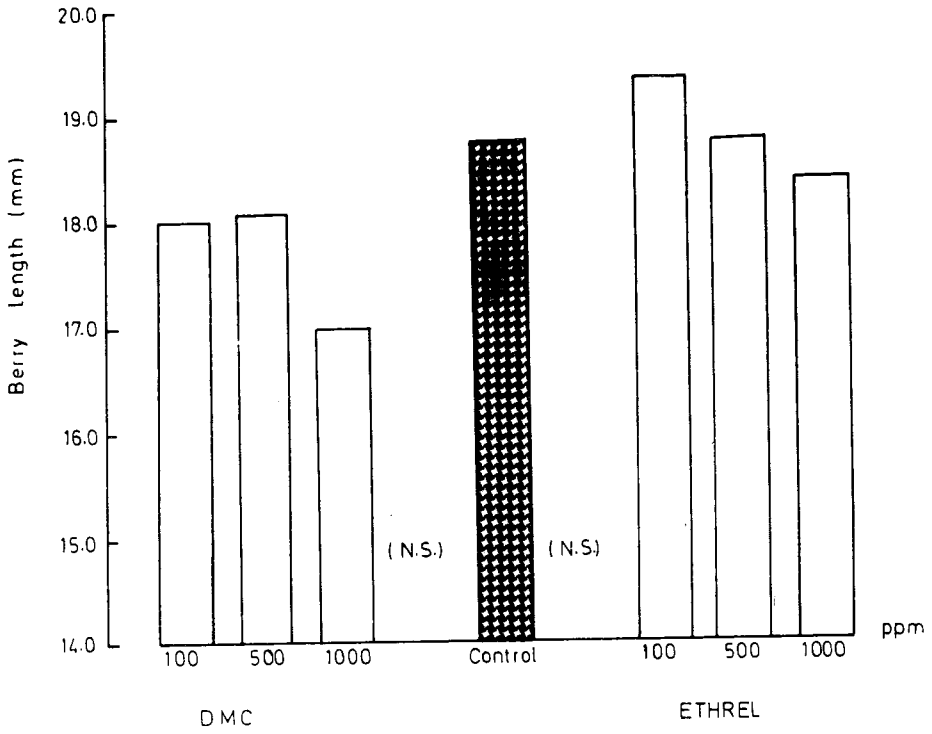

Fig. 6
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the berry length.

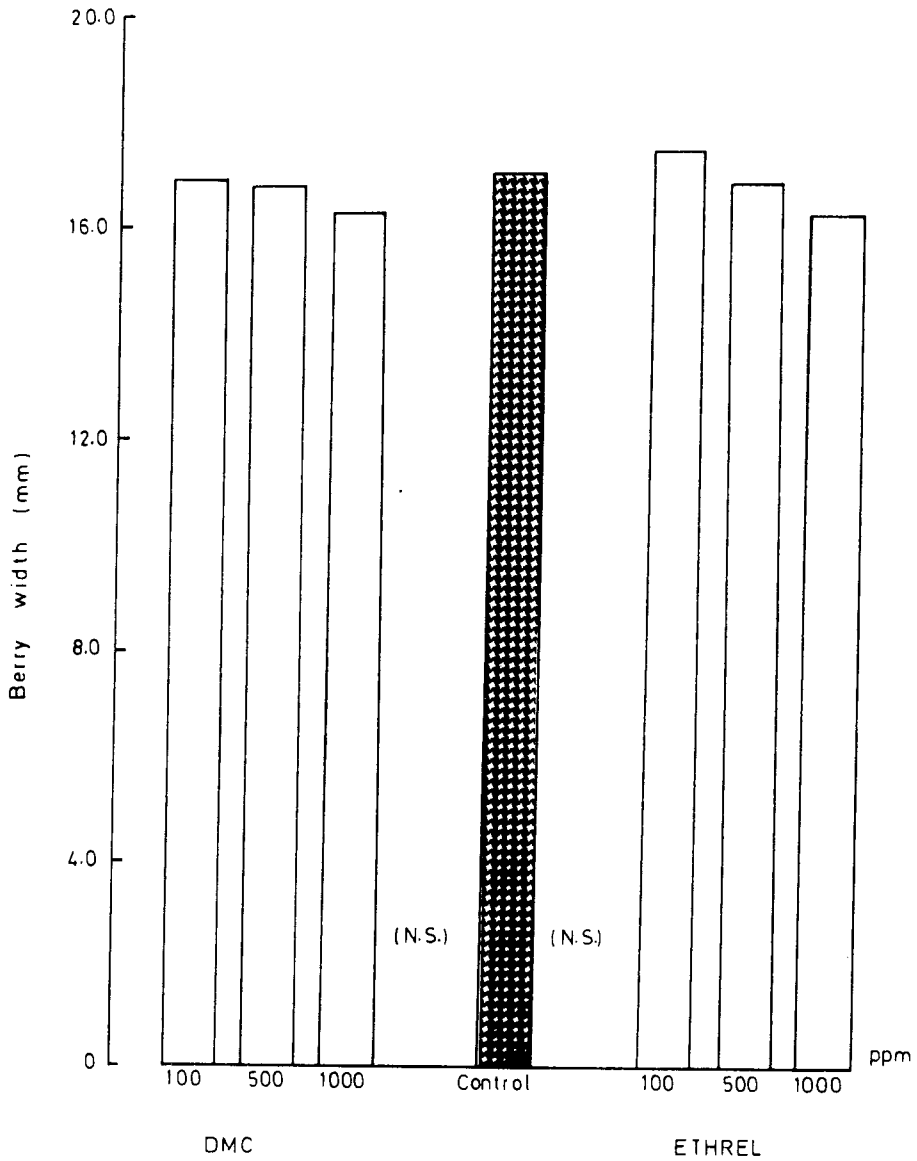

Fig. 7
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the Berry Width.

Ethrel applications gave non-significant results both for TSS and total acidity. The differences were arithmetical (Fig. 8 and 9).

DMC and Ethrel treatments had no significant effects on the pH value of the juice too (Fig. 10).

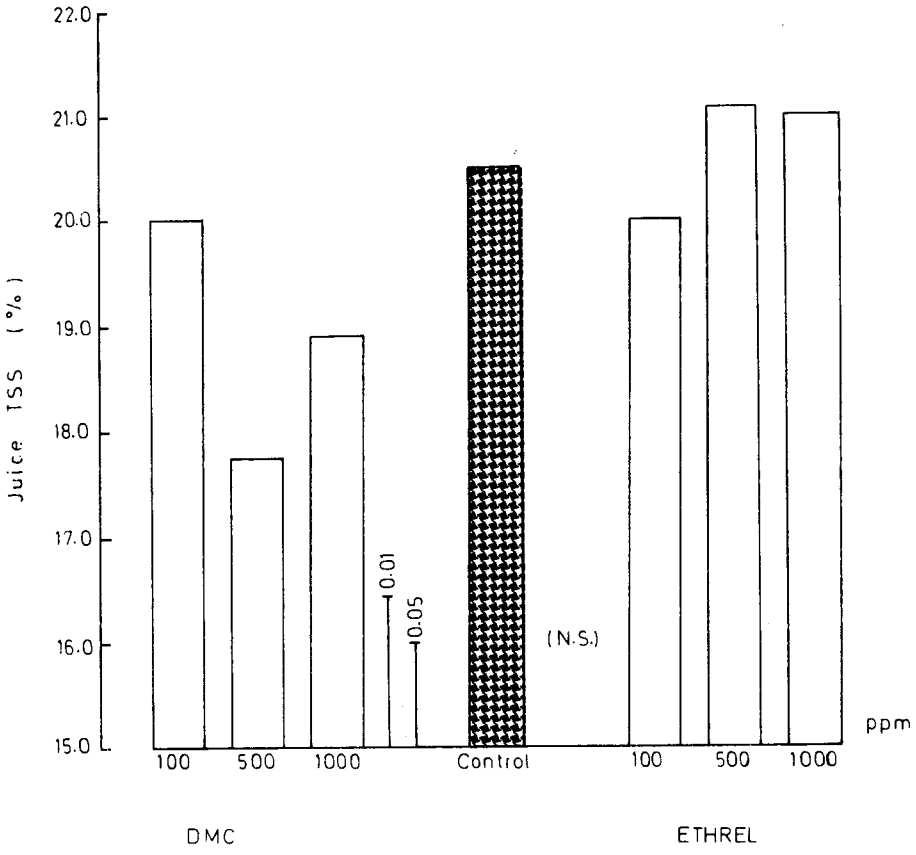

Fig. 8
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the Total Soluble Solids.

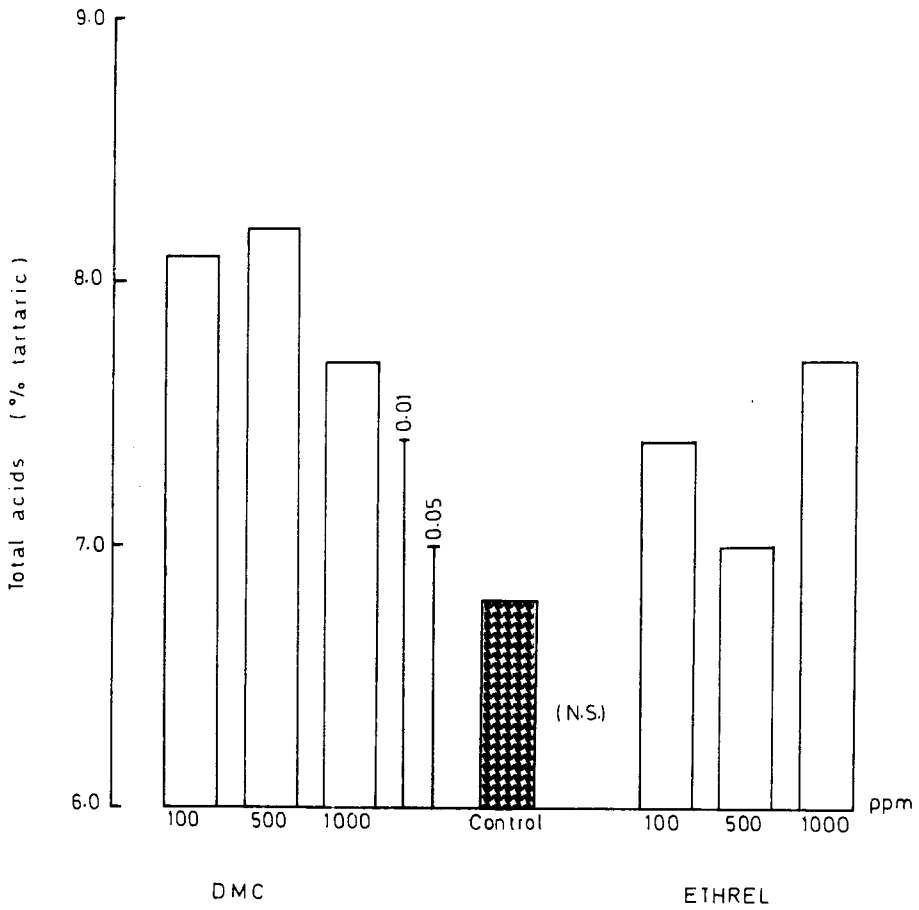

Fig. 9
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the Total Acidity.

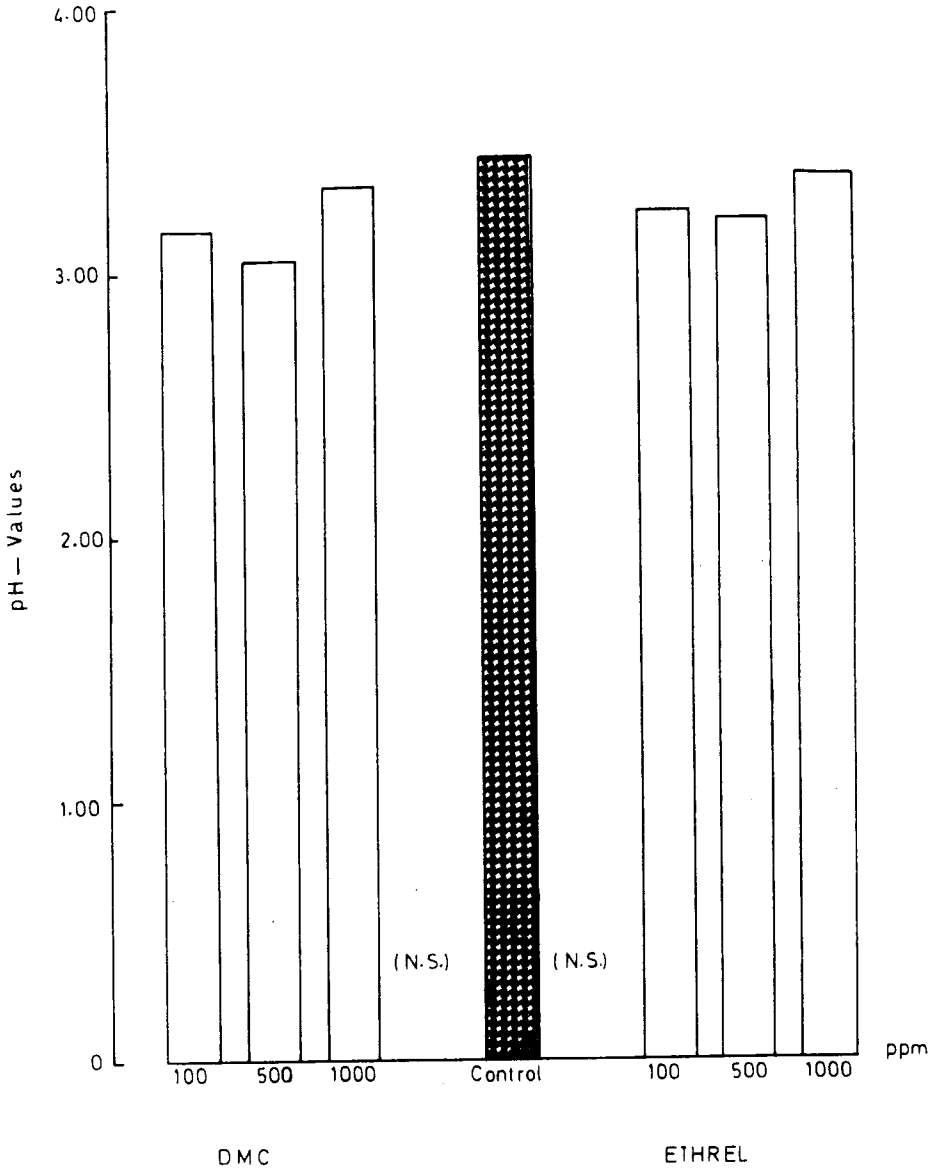

Fig. 10
Frequency Distribution Histograms Showing the Effects of Concentrations of DMC and Ethrel on the pH- Values.

DISCUSSION

The promotive effects of growth regulators on berry-set of grapes when applied as shoot apraying before anthesis have reported by many workers (Coombe 1967, Weaver and Wool 1971 a, b, c, Naito et al. 1972, 1974, Nelson and Sharples 1974, Lilov et al. 1974, Weaver and Montgomery 1974, Ağaoğlu 1975 d, Jensen et al. 1975, Lavee et al. 1977). The investigations also show that the treatment type of the plant growth regulators effect on the fruit-set (Naito et al. 1974). But the mechanism of promoting set of grapes by the applications of growth retardants was discussed in relation to their effects on shoot growth. Since we applied only one treatment system we will not discuss it here. Though it depends on the concentrations of the DMC treatments significantly increase the yield per vine, cluster weight, number of berries per cluster, total acids (% tartaric). Contratily, 100 berries weight 25 berries volume, juice total soluble solid significantly, berry size and pH-values decreased arithmetically. DMC has shown the growth retardant characteristics like CCC, SADH and Alar. The results we obtained confirms with the results obtained from the other growth retardants (Coombe 1965, 1970, Naito et al. 1972, 1974, Ağaoğlu 1975 d, 1976).

It is generally supported that fertilization is one of the most important factors limiting fruit-set. Skeen (1969), Coombe (1970), Naito et al. (1972 and 1974) have suggested, however, that the application of CCC does not effect the polination and fertilication of grapes. Ağaoğlu et al. (1977) obtained from the incestigation done by CCC and growth retandants on Muscat of Hamburg and Müşküle grape varieties that the pollen germination rate is very low relative to the control. These results that the CCC and DMC treatments reduce the pollen germination rate, Therefore the effects of these two growth retardants to increase the fruit-set are not related with the pollen germination rate. Therefore, the ideas of Loreti and Natali (1974) become important which mention that the use of these plant growth regulators increases the fruit-set effect in on the greater corbohydrate availability for ovary or flower cluster growth.

The effects of Ethrel on the quantity and the quality of yield are found very limited relative to DMC. Pre-bloom Ethrel opplication of 100, 500 and 1000 ppm to Muscat of Hamburg resulted in a significant decrease (1 % level) in quantity of yield. Decrease in yield quantity was increased with high concentration. This result confirms with the resul result of Weaver and Pool (1971 d). Cluster weight, number of berries per cluster, 100 berries weight, 25 berries volume, berry size, total soluble solids, total acid and pH-values were not significantly different from the control for Ethrel treated Muscat of Hamburg. But Ethrel 1000 ppm generally resulted bad quality properties of berries and flower drop. This was also verified by Lavee et al. (1977).

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