

Pre-harvest Treatment with Growth Regulators Improves Quality of 'Thompson Seedless' Grapes (*Vitis vinifera* L.) During Cold Storage

KARIM H. AL-JUBOORY,¹ F. JUMMA'A, A. SHABAN² AND R. M. SKIRVIN³

Abstract

The use of pre-harvest treatments, Indole-acetic acid (IAA), Chloromequat (CCC), Gibberellic acid (GA₃), and 2-Chloroethyl-phosphonic acid (ethephon) on 'Thompson Seedless' grapes to improve quality during cold storage was studied. The treatments had no significant effect on total soluble solids (TSS), but titratable acidity (TA) was reduced by CCC and ethephon.

Berries sprayed with CCC had the lowest percent shatter and the longest storage life (84 days); those sprayed with ethephon had the highest percent decay and the shortest life (63 days). Berries treated with GA₃ showed significantly less weight loss than the other treatments. Overall, the CCC and IAA treatments gave the best keeping quality.

Introduction

Grapes are an important fruit in Iraq. The total number of vines in Iraq was about 30,486,000 in 1980, producing approximately 423,820,000 kilograms (5). Many factors reduce quality of stored grapes, some of these are decay, weight loss, and berry shatter. Research has shown that growth regulators can modify fruit quality in 'Thompson Seedless' grape (14). Dhillon et al. (6) and Ibrahim (8) found that grapes treated with 500-4000 ppm CCC had increased TSS, TA, and total sugar content within the storage period. Pandey and Roa (10) and Randhawa et al. (11) found berry shatter and weight loss reduced following CCC treatment with no effect on TSS. In another study, clusters were treated with 2000-4000 ppm CCC and then stored at 0-3°C for up to 50

days (9, 11). Berry weight loss and rot were lowest in clusters treated with 4000 ppm CCC. Total sugar content was found to be highest in grapes treated with 500 to 1000 ppm CCC after fruit set (7).

Al-Dujaili (1987) reported that the application of GA₃ at 75 ppm to 'Thompson Seedless' at full bloom did not affect TSS, total sugar content or TA. Application of 75-100 ppm GA₃ two weeks after fruit set, reduced berry shatter in 'Thompson Seedless' (12). Their findings agreed with (4) who noted that 10-50 ppm IAA and 100 ppm GA₃ reduced shatter in 'Bolgarg' grape.

Recently, Vergas et al. (14) reported that application of 0-1500 ppm ethephon at veraison improved fruit color and advanced ripening. After storage at 5°C for 40 days, withering of the rachis was noted, and this increased with ethephon concentration. (10) found 100-200 ppm ethephon applied three weeks before harvest increased berry shatter and weight loss.

The objectives of this study were to examine the response of 'Thompson Seedless' grapes to different pre-harvest growth regulator applications and to determine the optimal storage life for high quality grape production.

Materials and Methods

The research was conducted in 1985 at the Zaafarana Experiment Station

¹Lecturer, Department of Horticulture, College of Agriculture, University of Baghdad, Iraq.

²Lecturer and Technician, Respectively, Technology Institute, Kufa, Iraq.

³Professor, Department of Horticulture, University of Illinois, Urbana, Illinois 61801.

in Iraq. Growth regulator treatments (GA₃, CCC, IAA, and ethephon) were applied to uniform 15-year-old 'Thompson Seedless' vines. Treatments were follows as: 1) 500 ppm CCC applied one week before full bloom; 2) 25 ppm GA₃ applied one week after fruit set; 3) 20 ppm IAA applied 10 days after fruit set; 4) 100 ppm ethephon applied 8 weeks after fruit set; and 5) control. Application times were chosen on the basis of preliminary studies. Each treatment was replicated six times. A completely randomized design was used for the experiment. Least significant difference (LSD) was used to separate the treatment means at 5% confidence level (13).

Vines were harvested at fruit maturity. Fruit samples from each treatment were placed in fiberboard boxes and stored at 3°C with a relative humidity of 90-95%. Samples were taken from storage at 7-day intervals and the following tests performed.

1) *Percent shatter*: Clusters were lifted from cartons and lightly shaken. Berries which had separated before or after shaking were counted and their percentage of the original number was determined.

2) *Percent decay*: Spoiled berries were counted and their percentage of the original number was estimated. Sampling continued until 50% of the berries had been discarded.

3) *Weight loss*: This was calculated as follows:

$$\frac{\text{Average loss in berry weight} = \frac{\text{Average berry weight at sampling period} - \text{Average berry weight at harvest}}{\text{Average berry weight at harvest}} \times 100$$

4) *Total Soluble Solids*: Juice from 10 sampled berries was measured using a hand refractometer.

5) *Titrate Acidity*: Ten ml of juice from sampled berries was titrated with 0.1 N NaOH using phenolphthaline as an indicator. Results were expressed as percent tartaric acid (3).

Results and Discussion

Percent shattered berries increased continuously throughout the storage period (Figure IA), reaching a maximum at the end of the 84 day storage period. Ethephon increased shatter significantly, by 63 days all berries had abscised. All the other treatments reduced shatter below the ethephon. Berries treated with CCC had significantly less shatter than the other growth

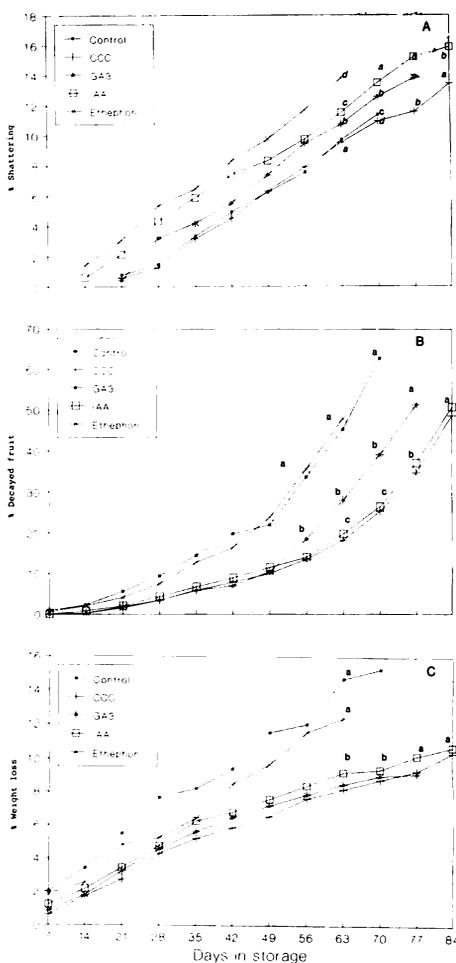


Figure 1. The effect of growth regulators and their time of application on percentage shatter, decay, and weight loss of 'Thompson Seedless' fruit stored at 3°C.

regulator treatments. These results are in general agreement with the findings of (10) on 'Pusa' seedless grape treated with 500 ppm CCC and 100 ppm ethephon.

Percent decay increased gradually for both treated and untreated fruits during storage (Figure 1B). Berries treated with GA₃, CCC, and IAA had significantly less decay than control and ethephon-treated fruits. It is clear that CCC and IAA treatments extended storage life (84 days), while ethephon treatment shortened storage life (70 days).

Data presented in Figure 1C show treatment effects on fruit weight loss which occurred during cold storage. Control and ethephon treated berries lost more weight than the other treatments. These results are in agreement with Rizk et al. (12).

TA decreased during storage for all treatments (Figure 2B). A significant decrease in TA occurred with CCC and ethephon treatments, while GA₃ and IAA had no significant effect. These results coincide with the findings of (7) on 'Banati' grape treated with 500-1000 ppm CCC. Organic acids change faster than most other compounds in fruits. They are high during fruit development and decrease as ripening occurs. In grapes the concentration of acids is reduced by 80% during ripening (1). Organic acids are used in respiration to produce the energy compounds. Some are used directly in the Krebs cycle while others are converted to a Krebs cycle intermediate. Organic acids may be used to form compounds for cell building or be converted to an insoluble state when they are united with other compounds or nutrients.

Data presented in Figure 2A show treatment effects on TSS. An increase in TSS during cold storage was observed, but was not significant.

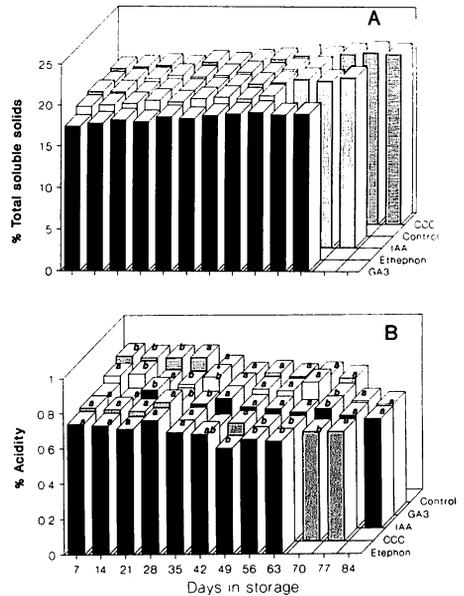


Figure 2. The effect of growth regulators and their time of application on total soluble solids of titratable acidity of 'Thompson Seedless' fruit stored at 3°C.

Summary

In summary, 'Thompson Seedless' grapes treated pre-harvest with either CCC or IAA stored better at 3°C than GA₃ or ethephon treated grape. Etnephon significantly increased shattering, decay, and weight loss.

References

1. Al-Ani, A. M. 1985. Postharvest Physiology of Horticultural Crops. Univ. of Mousal Press, Iraq VI pp. 575.
2. Al-Dujaili, J. A., M. A. Al-Kafaji and K. H. Al-Juboory. 1987. The effect of localized GA₃ application on the yield and quality of 'Thompson Seedless' grape (*Vitis vinifera* L.). Iraqi J. Agric. Sci. "Zanko" 5:51-57.
3. Association of Official Analytical Chemists (A.O.A.C.). 1970. Official methods of analysis. 11th Ed. Washington DC, USA, pp. 545.
4. Bozhinova-Boneva I. and L. Masheva. 1975. Effect of exogenous treatment of grape vine with basic phytohormones. Hort. Abst. 46:3.
5. Central Statistical Organization, Baghdad, Iraq. 1980.
6. Dhillon, B. S., M. S. Ladaniya, J. S. Bhullar and J. S. Randhawa. 1985. Effect of plant regulators on the storage of Anab-e-shahi grapes. Indian J. Hort. 42:18-24.

7. El-Latief, F. L. A. 1976. Effect of pre-harvest sprays of some growth retardants on the quality of Banati grapes during cold storage. *Acta. Agro.* 25:156-161.
8. Ibrahim, F. A. 1974. The influence of growth retardant sprays on the quality of Banati grapes during cold storage. *Hort. Abst.* 45:8300.
9. Ladaniya, M. S. and J. S. Bhullar. 1985. Effect of plant regulators on the storage behaviour of perlette grapes. *J. Res. Punjab Agr. Univ.* 22:467-473.
10. Pandey, R. M. and M. M. Rao. 1975. Changes in berry weight, organic acids and sugars during ripening and storage of Pusa seedless grapes treated with Ethrel and growth retardants. *J. Food Sci. Tech. India* 12:9-12.
11. Randhawa, J. S., B. S. Dhillon and S. S. Mann. 1976. 12 effects of pre-harvest application of CCC and Kinetin on the cold storage life of perlette grapes. *J. Res. India* 13:267-272.
12. Rizk, S. S. S., S. B. Ioma and Y. M. Isshak. 1974. Quality of gibberellic acid treated grapes as influenced by storage condition during transit. *Agric. Res. Rev.* 52:61-75.
13. Snedecor, C. W. 1956. *Statistical Methods.* Iowa State College Press, Ames, Iowa, pp. 534.
14. Vergas, G., J. C. Colmenares and M. S. Gonzales. 1987. Effect of ethephon on some maturity in 'Tucupita' grapes. *Hort. Abst.* 58:155.

Fruit Varieties Journal 44(3):127-130 1990

The Munson Grapes — A Rich Germplasm Legacy¹

JULIE M. TARARA² AND EDWARD W. HELLMAN³

Abstract

An historical review is presented of the contributions of T.V. Munson to viticulture and the improvement of cultivated grapes. Munson developed more than 300 grape cultivars with the principal goal of combining the pest resistance and climatic adaptability of various native American grape species with the superior fruit quality of commercial cultivars. Several Munson cultivars achieved commercial importance in the early 1900's and a few are still grown today, most notably the rootstock 'Dog Ridge.' Munson's legacy is the genetic diversity within his cultivars; a valuable genetic resource for grape breeders.

Thomas Volney Munson (1843-1913), pioneer in American viticulture, made important contributions in three areas: classification, breeding, and cultural practices. His belief in the importance of genetic diversity to commercial viticulture fueled nearly four decades of work, which included the development of over 300 grape cultivars. Munson centered his research at his Denison,

Texas vineyards. His viticultural pursuits, however, led him through 40 states to collect specimens of both wild *Vitis* species and cultivated varieties. He distinguished himself as a botanical authority in 1885, when he presented a preliminary reorganization and expansion of *Vitis* classification to the American Horticultural Society. By 1890, the United States Department of Agriculture published a completed version: "Classification and Generic Synopsis of the Wild Grapes of North America" (16). In 1909, Munson published a classic viticulture text, *Foundations of American Grape Culture*, a treatment of classification, cultivar descriptions, and cultural practices (18).

Beyond these efforts, Munson also joined in the search for solutions to the phylloxera devastation of French vineyards. He suggested the adoption of

¹Contribution no. 89-510-J from the Kansas Agricultural Experiment Station.

²Student and ³Assistant Professor, Department of Horticulture, Kansas State University, Manhattan, KS 66506.