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Postharvest conservation of 'Crimson Seedless' grapes as influenced by ethephon and abscisic acid application on field

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Background and Aims

Ethephon (2-chloroethylphosphonic acid) at véraison has been applied to improve colour in red grape cultivars, especially those grown in high temperature regions. However, the use of ethephon can result in faster loss of berry firmness and lower post-harvest conservation. Furthermore, there is a risk of residue in the berries. Hence, it is important to study other techniques to promote the beneficial effects of ethephon. As an alternative, the application of abscisic acid (ABA) during the phase of grape maturation has been studied.

In the São Francisco River Valley, the most important area of table grape production in Brazil, Crimson Seedless is one of the main cultivars. This cultivar demands techniques to give uniform and intensify the colour of the berries. However, the use of plant growth regulators has resulted in non-reproductive responses when the productive cycle is carried out during the second semester of the year, characterised by high temperatures. The aim of this study was to evaluate the effect of different concentrations and time periods of application of ABA, in comparison to ethephon and to the control, on postharvest conservation of 'Crimson Seedless' grapes produced in the São Francisco River Valley.

Experimental Procedure and Results

The study was conducted in a ten-year-old commercial vineyard in Petrolina, Pernambuco State, in São Francisco River Valley, Brazil. The vineyard was grafted on IAC 313 rootstock, trained in an overhead trellis system, with a spacing of 4.0m x 5.0m and drip irrigation. The management included fertilisation, diseases and pest control and other practices, recommended for the region. Pruning for production were carried out on 13 July 2012 and harvest periods began on 21 November 2012.

Treatments consisted of two factors: ethephon (Ethrel® 720, 1 mL.L^{-1}) and ABA (VBC 30101, ProTone®, 100g.L^{-1}) applied pre-harvest and a time of storage. They included: control - no treatment; Ethephon; ABA, 400mg.L^{-1} at 14 days before harvest or 117 days after pruning (DAP); ABA, 200 + 200mg.L^{-1} at véraison or 97 DAP and 117 DAP; ABA, 400mg.L^{-1} at 97 DAP; ABA, 600mg.L^{-1} at 117 DAP; ABA, 300 + 300 mg.L^{-1} at 97 and 117 DAP; ABA, 600mg.L^{-1} at 97 DAP; Ethephon + ABA, 200mg.L^{-1} both of them applied at 97 DAP and Ethephon + ABA, 300mg.L^{-1} at 97 DAP. The treatments where ABA and ethephon were combined, two mixtures were prepared and applied, one for each of the products. The products were applied by manual spraying.

After harvest, bunches in cardboard boxes were stored at 0.5ºC and 85% RH. The storage time evaluated was 0, 20, 27, 30 and 33 days. A randomised block experimental design, in a 10 x 5 factorial arrangement with four replications was used. Each plot had three bunches. The variables analysed were: weight loss; berry shrivelling; coverage and intensity of the red colour, according to a scale of notes where 1= 0%-25%; 2= 26%-60%; 3= 61%-90% and 4= 91%-100%; pulp firmness; skin elasticity; soluble solids and sugars content; and titratable acidity.

The berries were harvested when they attained commercial quality levels of total soluble solids, i.e. a minimum of 18° Brix in this study. The average value of titratable acidity was 0.44% as tartaric acid. During the storage time, weight loss, a light softening and an increase in titratable acidity were observed. Colour of berries was maintained during the study period.

Ethephon and ABA pre-harvest application did not affect soluble solids and sugars content. But they influenced another characteristics related to the quality and postharvest conservation of 'Crimson Seedless' grapes. The weight loss was lower in bunches from treatments with ethephon combined with ABA or with the highest doses of ABA applied at véraison. On the other hand, the weight loss was doubled in the control and the ethephon treated berries. Some shrivelling was observed in berries at two applications of ABA 300mg.L^{-1} treatments.

Pulp firmness was lightly reduced during the storage. The comparison of treatments showed that berries of the control were firmer than berries of ethephon treatments, with or without ABA treatments. In general, skin elasticity had a gradual reduction. However, an abrupt change was observed after 30th days with the ethephon combined with ABA treatments. Finally, the higher coverage and intensity of the red colour was noticed at ethephon combined or not with ABA treatments and with the ABA 600mg.L^{-1} applied in a single dose.

Discussion and Significance of the Study

In conclusion, ethephon combined with ABA application had an effect on reducing the weight loss and promoting colour development of 'Crimson Seedless' grapes. This result can influence positively the quality and postharvest conservation of the grapes. However, other aspects need to be determined, including the data repeatability in other productive cycles, the legal permission to apply ABA in national viticulture and the commercial acceptance of the product.