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Ethylene pre-harvest application in 'Cabernet Sauvignon' produced in the region of "Dom Pedrito" – RS

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Abstract. Thus this work was to evaluate the use of ethylene application in pre-harvest grapes of Cabernet Sauvignon cultivar. Applying ethylene by spraying with ethylene solution in different periods with the following treatments; (T1) without application of ethylene; (T2) 10 ppm of ethylene in the fruit only on the day of collection; (T3) two applications of 10 ppm ethylene (one day before harvest and once on the day of harvest) and; (T4) three applications of 10 ppm ethylene (two days prior to harvest, one day prior to harvest and the other on the day of harvest). For each treatment were made four replications in the field, with 07 plants each. The physicochemical analyses in must and wine as pH, total soluble solids (TSS), expressed acidity malic acid, expressed as acid into lactic acid, total acid and ethanol were made by infrared spectrometry Fourier transform (FTIR). There were significant differences between treatments in physical and chemical composition of must and wine. These preliminary results suggest that ethylene pre-harvest application modify somehow the malic acid content, modifying the total acidity and pH of the must and wine in Cabernet Sauvignon, promoting a slight modification in the TSS and thus in ethanol.

1. Introduction

Ethylene has many know effects on plant growth and development. Much of our knowledge of ethylene activity comes from exposing plant tissues or organs with ethylene in enclosed containers. With the development of ethephon (2-chloroethylphosphonic acid) ethylene application is greatly simplified. Ethephon is applied as an aqueous spray and is absorbed into plant tissues. There it decomposes to release ethylene gas, chloride, and phosphate ions [1].

Ethylene is extensively used in agriculture to ensure adequate ripening fruit since it triggers a series of reactions which alter the colouring of the fruit, causing the softening of the fleshy part and increase the amount of sugars. The use of ethylene in post-harvest processes are widely spread around the world, being scarce the researches of the use in direct applications in the fruit field.

On the other hand, anthocyanins provide many of the red-purple colours of fruit and vegetables and flowers. Anthocyanins are water-soluble phenolic glucosides that can be found in the cell vacuoles of fruit and vegetables such as beetroot, but are often in the epidermal layers, as with grape. They produce strong colours, which often mask carotenoids and chlorophyll [2].

The objective of this study was to evaluate the use of ethylene application in pre-harvest grapes of Cabernet Sauvignon cultivar.

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2. Materials and methods

Thus this work was to evaluate the use of ethylene application in pre-harvest grapes of Cabernet Sauvignon cultivar. The test was conducted in a commercial vineyard located in the city of "Dom Pedrito", Rio Grande do Sul (RS), during the season 2015/16, in 'Cabernet Sauvignon', Clone R6, grafted on 'SO4', 16 years old installed.

The work consisted of applying ethylene by spraying with ethylene solution in different periods with the following treatments (T1) without application of ethylene; (T2) application of 10 ppm of ethylene in the fruit only on the day of collection; (T3) two applications of 10 ppm ethylene (one day before harvest and once on the day of harvest) and; (T4) three applications of 10 ppm ethylene (two days prior to harvest, one day prior to harvest and the other on the day of harvest). For each treatment were made four replications in the field, with 07 plants each.

Each of the experimental units were vinified in the experimental winery of Federal University of Pampa (UNIPAMPA) – "Dom Pedrito" Campus, and packed in bottles of 20 liters following the standard protocol to produce red wine and then the wines were stored in 5-liter bottles where they currently are.

The physicochemical analyses in must and wine as pH, total soluble solids (TSS), expressed acidity malic acid, expressed as acid into lactic acid, total acid and ethanol were made by infrared spectrometry Fourier transform (FTIR).

The data were submitted to analysis of variance (ANOVA), and when significant, the averages were compared by Tukey test at 5% probability [3–5].

Table 1. Total Soluble Solids (TSS), pH, total acidity, tartaric acid and, malic acid; in must and wine of the 'Cabernet Sauvignon' with different treatments.

Treatments	Must				
	TSS (°Brix)	pH	Total Acidity ($g L^{-1}$)	Tartaric Acid ($g L^{-1}$)	Malic Acid ($g L^{-1}$)
T1*	20.73 a	3.55 a	2.20 b	6.75 a	2.45 b**
T2	20.45 a	3.49 b	2.25 b	6.95 a	2.48 b
T3	20.80 a	3.55 a	2.58 a	6.50 a	3.08 a
T4	19.95 a	3.52 ab	2.53 a	6.23 b	2.98 a
	Wine				
	Ethanol		pH	Total Acidity ($g L^{-1}$)	
T1	11.22 a		3.42 b	9.58 a	
T2	10.95 ab		3.43 b	9.48 a	
T3	11.12 ab		3.51 a	9.23 a	
T4	10.56 b		3.47 ab	9.18 a	

* T1 = without application of ethylene; T2 = 10 ppm of ethylene in the fruit only on the day of collection; T3 = two applications of 10 ppm ethylene (one day before harvest and once on the day of harvest) and; T4 = three applications of 10 ppm ethylene (two days prior to harvest, one day prior to harvest and the other on the day of harvest). ** Means followed by the same small letter in the column did not differ significantly between them by Tukey test at 5% probability.

3. Results and discussion

There were significant differences between treatments in physical and chemical composition of must and wine. Being the grape must, malic acid and total acidity parameters, the ethylene treatment without pre-harvest application (T1) and an ethylene pre-harvest application (T2), were the lowest values. Moreover, the must with the treatment of ethylene with two pre-harvest application (T3) and three applications (T4) showed the highest malic acid and total acid values (Table 1).

As for the rates in TSS must and pH, no significant differences between treatments were found. In wine the treatments showed significant differences for the variable ethanol: T1 had the high value and the lowest value T4. For the variable response in the wine, the pH of the T1 and T2 presented the lowest values and the treatment T3, presented the greater value (Table 1).

For total acidity the treatments also differ, and the T1 and T2 showed the highest values and the treatment T3 is smaller (Table 1).

The classification of grapes as non-climacteric fruit was mainly due to a set of data showing only weak changes in endogenous ethylene levels around veraison, a development stage at which grape berries start to lose their acidity and to redden, in the case of red cultivars, among other biochemical changes [6].

Ethylene seems also implicated in the regulation of berry acidity. Indeed, ethephon treatment induces an acidity decrease in grape juice [7]. These authors observed the acidity drop in musts and wines of "Carignane" grapes over two seasons, and this was linked to the concentration decrease of both tartaric and malic acids [8].

The use of ethylene-releasing compounds to enhance grape colour is one of the main practices in the vineyard [9].

4. Conclusion

These preliminary results suggest that ethylene pre-harvest application modify somehow the malic acid content, modifying the total acidity and pH of the must and wine in 'Cabernet Sauvignon', promoting a slight modification in the TSS and thus in ethanol.

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