Transit K® improves Colour and °Brix development in 'Crimson Seedless' grapes by single application at veraison.

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At a glance

Lack of adequate colour development in 'Crimson Seedless' table grapes, which affects the marketability and value of the grapes, is a main concern for table grape growers. This study was conducted to test the effect of Transit K® foliar application on colour development, and ripeness parameters (total soluble solids, total acidity, pH) in 'Crimson Seedless' grapes.

Results from this study showed that Transit K® treatment of 'Crimson Seedless' increased the free anthocyanins by 18.75%%, total phenolics by 16.1% and total tannins by 32.8% in the berries. In addition, the sweetness (total soluble solids) was significantly increased (7.8%) by Transit K® treatment while no concurrent effect on the total acids or pH of berries was found.

1. INTRODUCTION

'Crimson Seedless' is a high value, red table grape (*Vitis vinifera*) cultivar. Failure to develop adequate red colour in maturity, is a common issue associated with this variety, especially in hot climates. Most bunches usually show variability in colour between berries, which affects the marketability and value of the grapes (Lurie, et al., 2009). Colour development in grapes is associated with the accumulation of anthocyanins (Spayd, Tarara, Mee, & Ferguson , 2002) and the colour of grape berries is determined by the quantity and composition of anthocyanins in the skin (Lurie, et al., 2009). In grapes, the accumulation of anthocyanins begins at veraison (the onset of maturation), and is influenced by various environmental, physiological and chemical factors such as temperature, light, and vine nutrition (Lurie, et al., 2009). A small number of studies have suggested that potassium can influence the colour development in grapes (Delgado, Martín, Alamo-Sanza, & González, 2004). Transit K® is a potassium (K) formulation containing 10% K and 26% amino acids (potassium in the Transit K® is 100% amino acid chelated). This study was therefore conducted to test the effect of Transit K® foliar application on colour development, and ripeness parameters (total soluble solids, total acidity, pH) in 'Crimson Seedless' grapes.

2. OBJECTIVE

The specific objectives of this research are:

1. To study the effect of Transit K® foliar application on the accumulation of anthocyanins, phenolics and tannins in 'Crimson Seedless' grapes.
2. To assess the impacts of Transit K® foliar application on the ripeness and quality parameters of Crimson Seedless grapes.
3. To examine the effect of Transit K® on berry potassium levels

3. MATERIALS AND METHOD

3.1. Site Selection and Trial Design

This trial was conducted in Robinvale, Victoria (34°38′S 142°45′E). The Crimson Seedless block of the vineyard, at the start of veraison, was treated with Transit K® (containing 10% amino acid chelated potassium) at a dilution rate of 15 kg/ 3000L water. Biologically active organic molecules (patented product) at the rate of 300 mL/3000 L water was also added to the spray solution. Five rows (20 vines in each row) were kept untreated and taken as the control. Five rows from the Transit K® applied area (20 vines in each row) were taken as treated. Each row was considered as a replicate. At harvest, evaluations were carried out to assess colour development and berry ripeness parameters.

3.2. Evaluation Method

Laboratory analysis

For the assessment of ripeness parameters, 150 berries were randomly collected from 20 vines in each replicate row. The berries were crushed and the juice was analysed in a FOSS OenoFoss analyser (DK-3400 Hilleroed, Denmark) for: pH, Total acidity, Tartaric acid, Malic acid, Total soluble solids, and °Brix values.

100 berries were randomly collected from 20 vines in each replicate row, and the berries were frozen for colour and other phenolics analysis at the Australian Wine Research Institute (AWRI) in South Australia. Measurements of free anthocyanins, total phenolics and total tannins were done by spectroscopic analysis (UV-Vis Cary 60, Agilent Technologies, CA) at the AWRI.

For the potassium analysis, 100 berries were randomly collected from 20 vines in each replicate row and homogenised by using a lab blender.K levels (whole berry) were measured by ICP-OES (Dual Chelate Fertilizer Pty Ltd Lab, Robinvale, VIC).

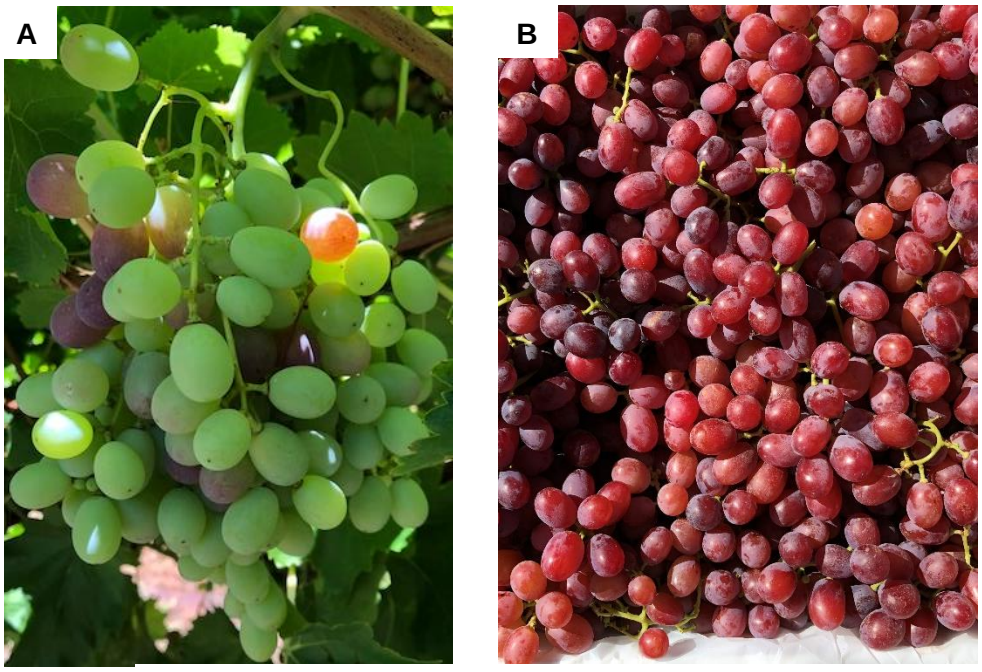

Figure 1. ‘Crimson Seedless’ table grapes at veraison (A) and at harvest (B)

3.3. Statistical Analysis

Prism 7 (Graph Pad Software) was used for the statistical analysis. *t*-test was performed to determine the significant difference between the control versus treated, *P* values <0.1 were considered to be significant.

4. RESULTS

4.1. Total phenolics, Free Anthocyanins and Total Tannins

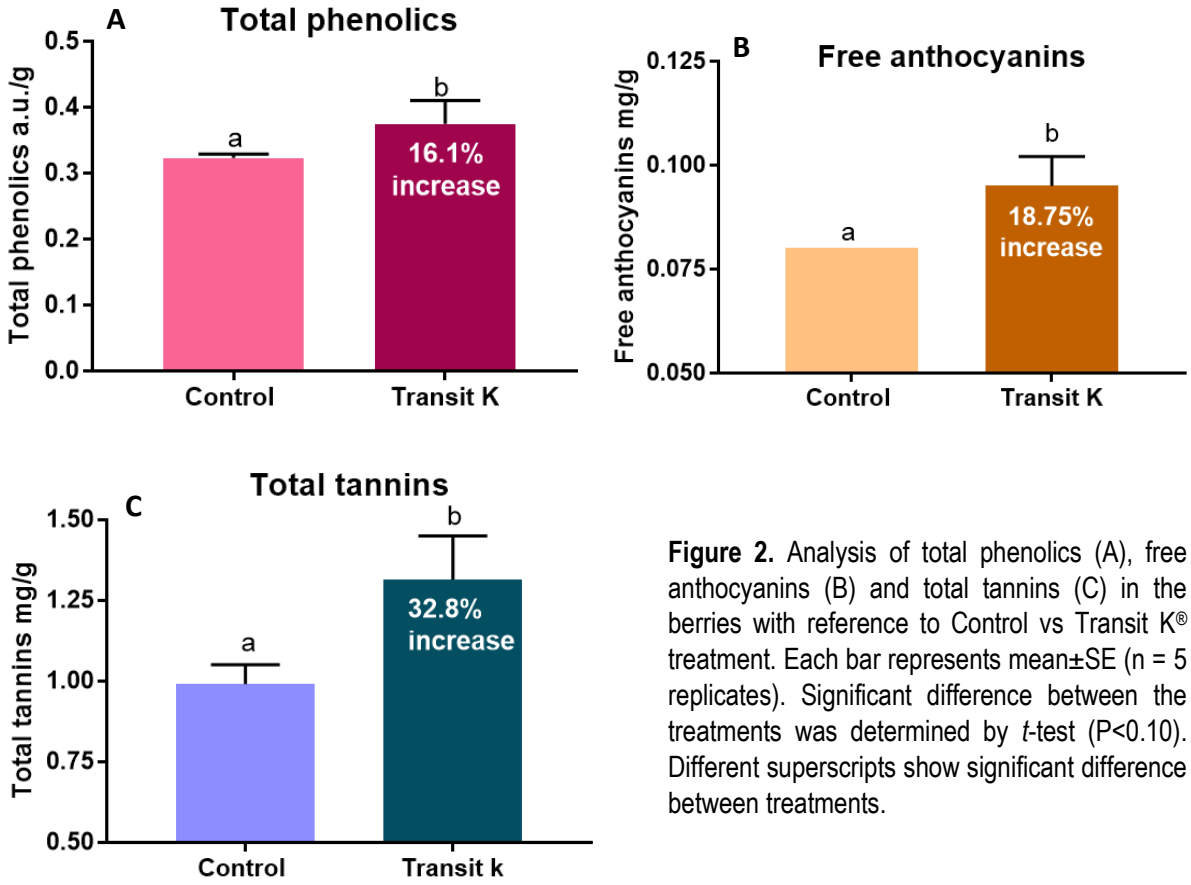

Figure 2. Analysis of total phenolics (A), free anthocyanins (B) and total tannins (C) in the berries with reference to Control vs Transit K® treatment. Each bar represents mean±SE (n = 5 replicates). Significant difference between the treatments was determined by *t*-test (P<0.10). Different superscripts show significant difference between treatments.

The transit K® treated berries showed significantly higher levels of total phenolics, free anthocyanins and total tannins compared to the control berries (Figure 2 A, B, C). Total phenolics is a measure of all coloured and non-coloured phenolic molecules present in grape skin, flesh and seed. The content of phenolics in mature grape berries will ultimately influence the sensory attributes and quality of grape berries. Free anthocyanins are the highly coloured compounds responsible for the colour of red grapes. Tannins are a family of natural organic compounds that are found in wine grape skins, seeds/pips. Tannins have excellent antioxidant properties and are have natural preservative ability, which protects the grapes from deterioration. Tannins have also been reported to have many health benefits for humans (Conde, et al., 2006).

4.1. Potassium levels in the berries

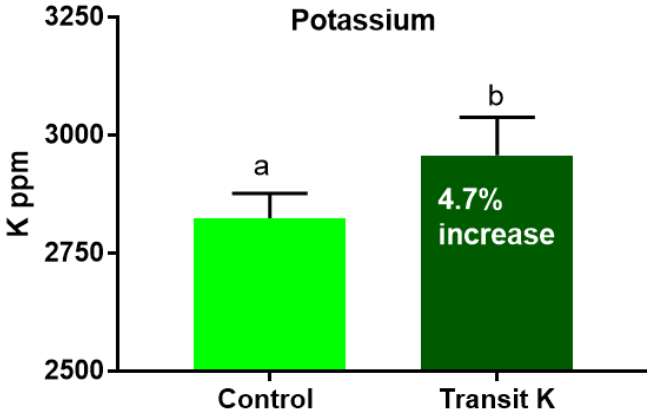

Figure 3. Potassium levels in the berries with reference to Control vs Transit K® treatment. Each bar represents mean±SE (n = 5 replicates). Significant difference between the treatments was determined by t-test (P<0.10). Different superscripts show significant difference between treatments.

Berries from Transit K treated vines showed significantly high levels of potassium compared to the control (Figure 3).

4.3. Berry ripeness parameters: Total soluble solids (°Brix), pH and Total acids

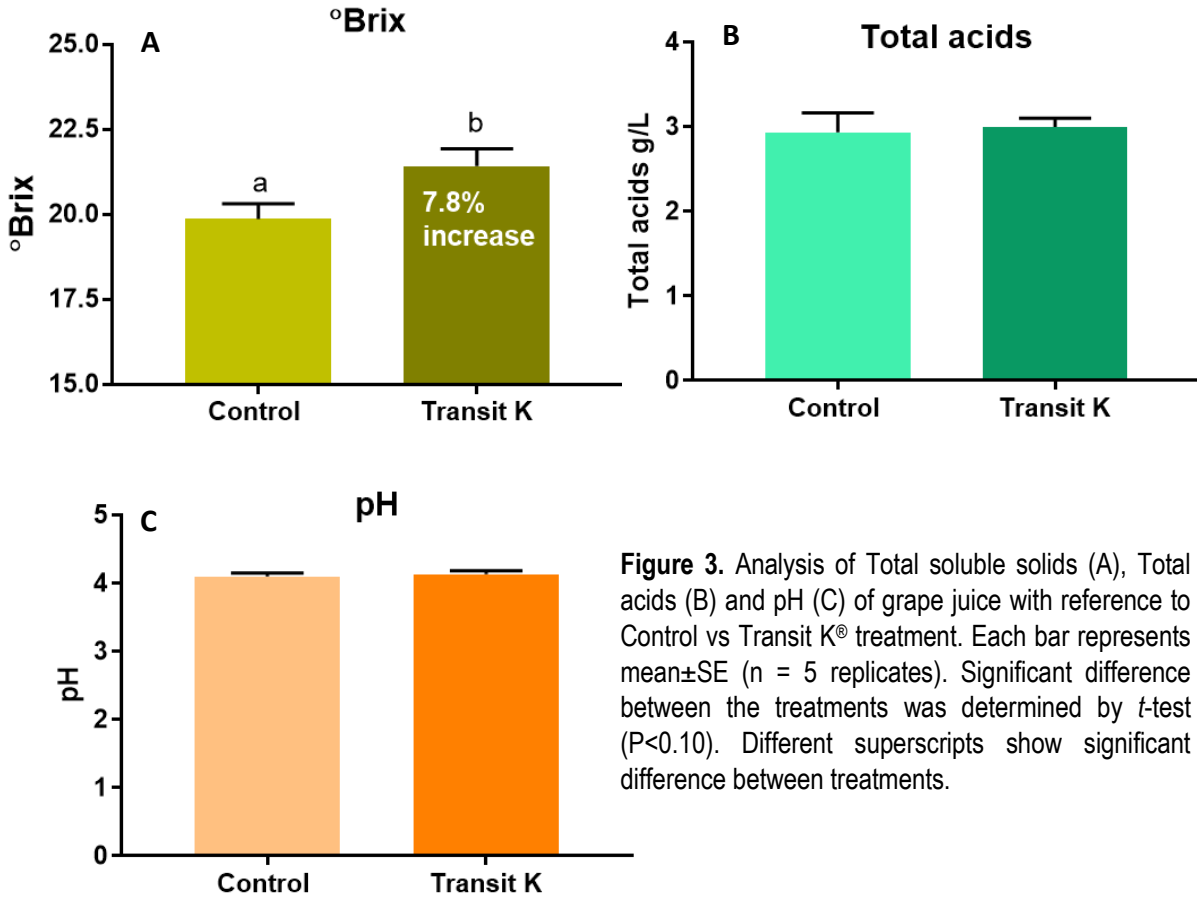

Figure 3. Analysis of Total soluble solids (A), Total acids (B) and pH (C) of grape juice with reference to Control vs Transit K® treatment. Each bar represents mean±SE (n = 5 replicates). Significant difference between the treatments was determined by *t*-test (P<0.10). Different superscripts show significant difference between treatments.

Compared to the control, the Transit K® treated grapes showed significantly higher levels of total soluble solids (sugar content) while no changes in the total acids or pH (Figure 3 A, B, C) were found. For table grapes (*Vitis vinifera L.*), growers mainly use TSS (sweetness) as an indicator of ripeness. Most of the commercial varieties are considered mature when TSS ranges from 15 to 18% (Muñoz-Robredo, Robledo, Manriquez, Molina, & Defilippi, 2011).

Table 1. Analysis of grape quality and ripeness parameters with reference to Control versus Transit K® treatments.

Parameters	Treatments		Average % increase	*P* value	Statistical Significance
	Control	Transit K®			
Total phenolics (AU/g)	0.3233 ± 0.0033	0.375 ± 0.025	**16.1%**	0.070	Yes
Free anthocyanins (mg/g)	0.08 ± 0	0.095 ± 0.005	**18.75%**	0.027	Yes
Total tannins (mg/g)	0.99 ± 0.03464	1.315 ± 0.095	**32.8%**	0.030	Yes
°Brix	19.86 ± 0.2615	21.42 ± 0.36	**7.8%**	0.036	Yes
Berry potassium (ppm)	2823 ± 26.29	2957 ± 40.37	**4.7%**	0.033	Yes
pH	4.1 ± 0.0305	4.13 ± 0.029	-	0.477	No
Total acids (g/L)	2.933 ± 0.133	3 ± 0.057	-	0.670	No

The values given are mean ± standard error, n=5. P values <0.1 were considered to be significant.

5. CONCLUSION

Transit K® treatment of 'Crimson Seedless' had a significant effect on promoting colour development and quality attributes such as free anthocyanins, total phenolics and total tannins in the berries. In addition, the sweetness (total soluble solids) was significantly increased by Transit K® treatment while no concurrent effect on the total acids or pH of berries was found. Potassium levels were significantly higher in the Transit K® treated grape berries. This study showed that grape quality and flavour attributes of Crimson Seedless table grapes can be improved by Transit K® application at veraison.

6. REFERENCES

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