The Influence of Calcium Foliar Application on Enhancing Fruit Quality Attributes in Pink Lady® Apples

1. Introduction

The Australian apple industry is one of the most important fruit industries in Australia. Fruit quality is based on several parameters including color, flavor, firmness, hardness, crispiness, etc. Calcium plays a crucial role in fruit quality and numerous studies have found that the foliar application of Calcium improved the fruit quality in apples. In this study, Pink Lady® Ruby apple trees were treated with Dual Force Calcium and Transit Calcium at two different rates. Four foliar applications of treatments were done during the growing season and the effects of Dual Force Calcium and Transit Calcium on improving fruit quality in apples were assessed.

2. Project aim

To evaluate the effects of foliar application of Dual Force Calcium and Transit Calcium on improving fruit quality characteristics in Pink Lady Apples.

2.1. Project objectives

To assess the yield quality parameters of treated and control plants:

a) Evaluation of fruit weight and diameter
b) Evaluation of fruit firmness and Brix
c) Analysis of the Calcium levels in fruits
d) Analysis of the nutritional status of leaves and tips

3. Material and Methods

Site Selection and Trial Design

The trial was conducted in Invergodon, Shepperton, Victoria. There were five treatments and four replicates in this trial. Four foliar applications of Dual Force Calcium and Transit Calcium was done by using a knapsack sprayer. Two different rates of each product were used in this trial. Table 1 shows the treatments and application rates. One half of the tree was sprayed with each product while the other half remained as untreated. Control and treated sides of the trees were marked clearly. Therefore, each treatment had specific control trees to the treatment. Fruits, leaves, and tip samples were collected from the control and treated side of the trees. Laboratory analysis was done by sending the fruit, leaf, and tip samples to an independent laboratory in Australia called Analytical Laboratories & Technical Services Australia (ALTSA). Statistical data analysis was done by using GraphPad Prism software.

Table 1: Treatments and application rates of each Calcium product.

Treatment	Rate (L/ha)
Grower's Practice- Calcium Chloride	25kg/ha
Dual Force Calcium + Grower's Practice	2kg/ha
Double Rate Dual Force Calcium + Grower's Practice	4kg/ha
Transit Calcium + Grower's Practice	2L/ha
Double Rate Transit Calcium + Grower's Practice	4L/ha

4. Observations

Fruit Weight and Diameter

During the commercial harvesting time, apples were collected randomly from each treatment. Individual fruit weight was recorded and then average fruit weight was calculated.

Fruit diameter was recorded by using Vernier Calliper. Individual fruit diameter was recorded and then average fruit diameter was calculated.

Fruit Firmness and Brix

Apple samples were picked randomly from each treatment during the commercial harvesting time. The firmness of individual fruit was recorded by using a penetrometer and average firmness was calculated.

Brix levels of the apples were measured by using the Refractometer and average Brix values were calculated.

Nutritional Analysis of Fruits

Apple samples were randomly collected from each treatment during the commercial harvesting time to check the nutritional status of fruits. Samples were then analyzed by sending them to an independent laboratory in Australia called Analytical Laboratories & Technical Services Australia (ALTSA).

Nutritional Analysis of Leaves and Tips

After the commercial harvesting time, leaf and tip samples were collected from each treatment to assess the nutritional status of tissues. Samples were analyzed by sending them to an independent laboratory in Australia called Analytical Laboratories & Technical Services Australia (ALTSA)

5. Results

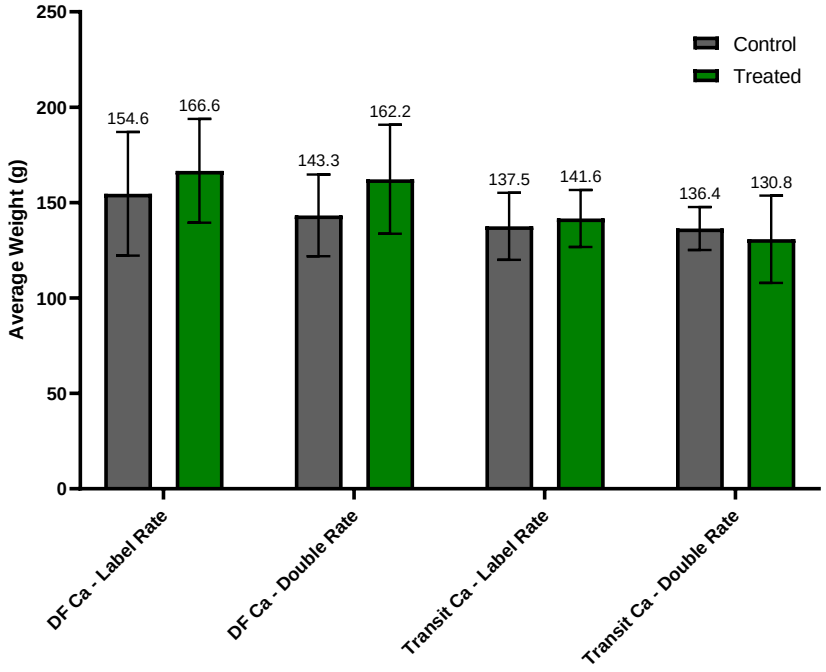

Figure 2: Average weight of apples collected from control and treated trees at commercial harvesting time.

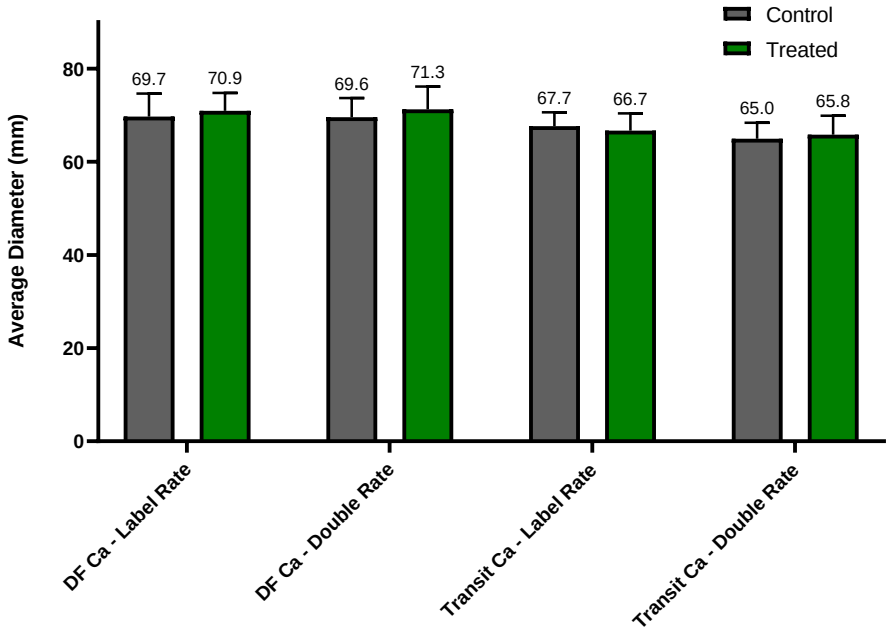

Figure 3: Average diameter of apples collected from control and treated trees at commercial harvesting time.

After treatment application, the average weight of apples treated with Dual Force Calcium label rate, Dual Force Calcium double rate, and Transit Calcium label rate was increased by 8%, 13%, and 3% respectively. However, there was no increment was observed in Transit Calcium double rate (Figure 2). The average fruit diameter was measured by using Vernier Calliper. It was observed that both of Dual Force Calcium label rate and Dual Force Calcium double rate increased the fruit diameter by 2% and Transit Calcium double rate by 1%. But

there was no increment was observed in apples treated with the Transit Calcium label rate (Figure 3).

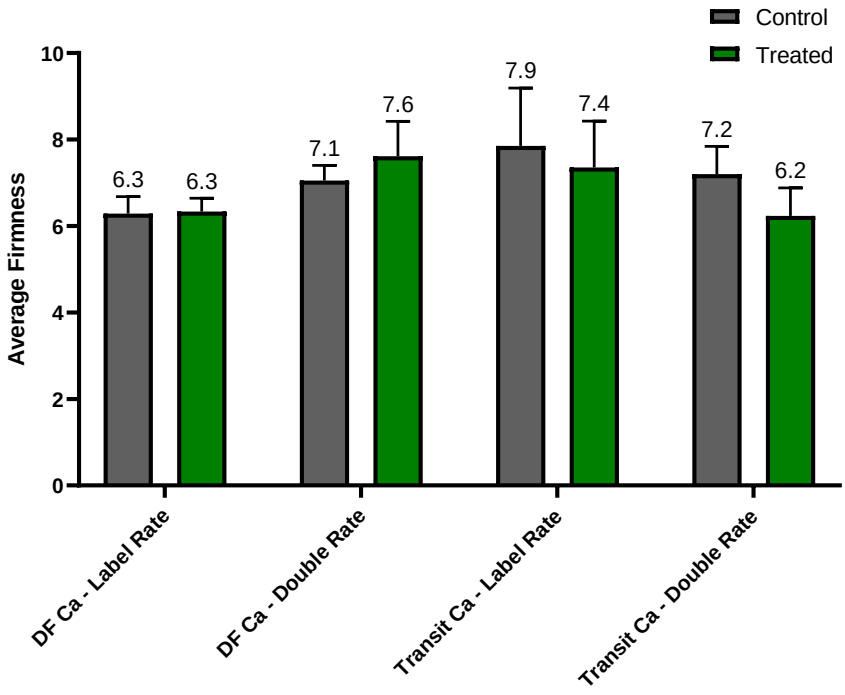

Figure 4: Average firmness of apples collected from control and treated trees at commercial harvesting time.

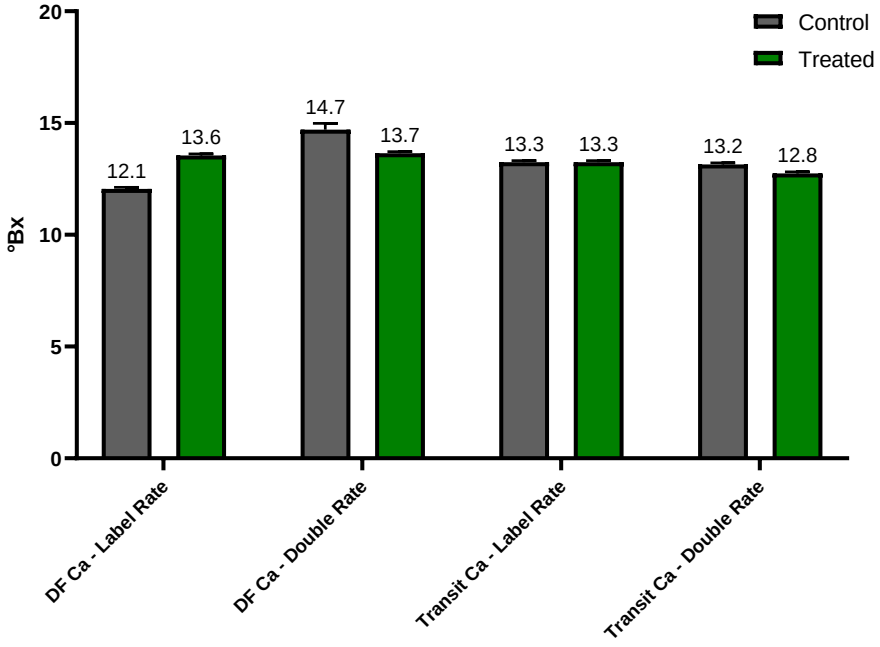

Figure 5: Average Brix Values of fruits collected from control and treated trees at commercial harvesting time.

Fruit firmness was measured by using a penetrometer. Results showed that the application of Dual Force double rate increased the average firmness by 7%. However, there was no improvement in firmness was observed in other treatments (Figure 4). Brix levels of the apples were checked by using a refractometer. According to the results, Dual Force Calcium

label rate increased the average Brix levels in apples by 12%, however, there was no Brix increment was observed in all other treatments (Figure 5).

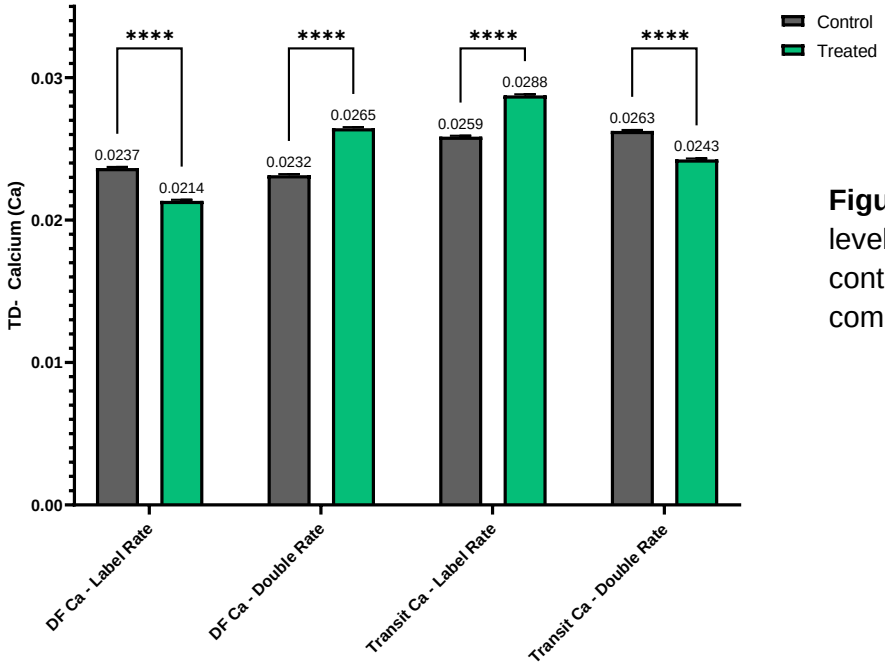

Figure 6: Comparison of Calcium levels in apples collected from control and treated trees at commercial harvesting time.

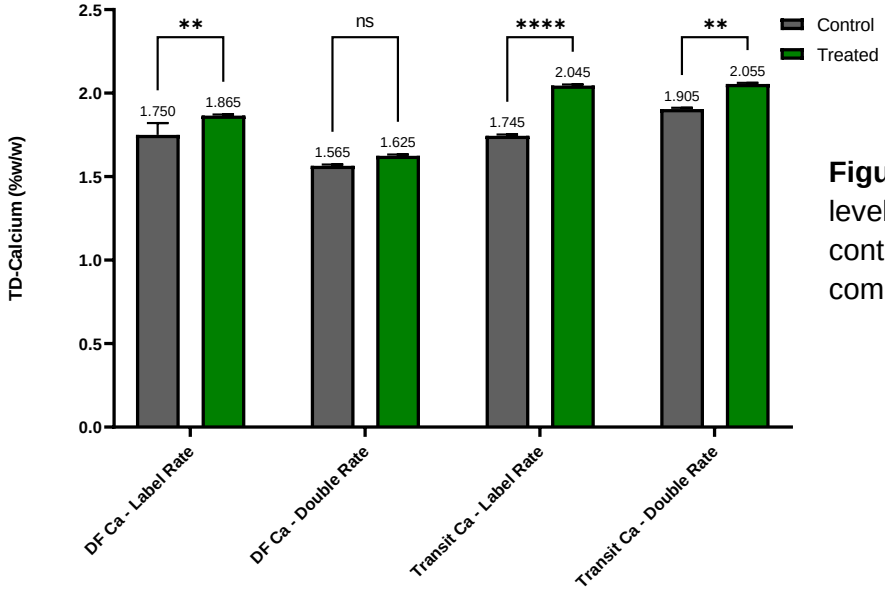

Figure 7: Comparison of Calcium levels in leaves collected from control and treated trees after commercial harvesting time.

Fruits were tested to assess the impact of treatments on improving Calcium levels in fruits. According o the results, Dual Force Calcium double rate and Transit Calcium label rate significantly increased the Calcium levels in fruits by 14% and 11% respectively. However, there was no increase in fruit Calcium levels observed in the other two treatments (Figure 6).

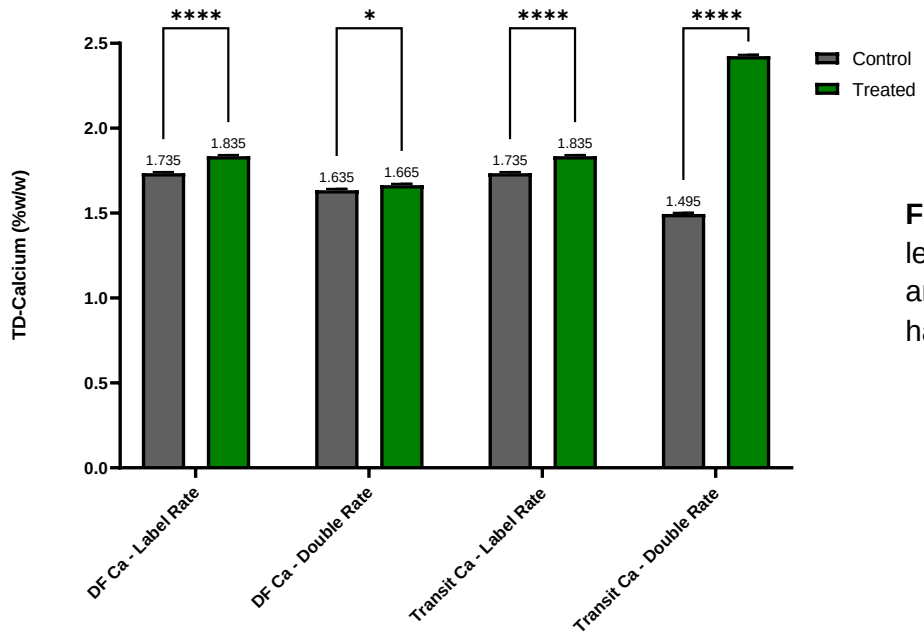

Figure 8: Comparison of Calcium levels in tips collected from control and treated trees after commercial harvesting time.

Similar to the fruit Calcium levels, leaves, and tips were tested to assess the impact of foliar application of different Calcium products on improving Calcium levels in plant tissues. Results revealed that all of the treatments significantly increased the Calcium levels in treated leaves by 6% in Dual Force Calcium label rate, 4% in Dual Force Calcium double rate, 17% in the Transit Calcium label rate, and 8% in Transit Calcium double rate. Furthermore, it was observed that both Transit Calcium treatments had the highest level of Calcium compared to the other two treatments and control (Figure 7). Plant tip analysis results showed that all four treatments significantly increased the Calcium levels in tips compared to the controls (Figure 8).

8. Conclusion

The foliar application of both label rate and double rate of Dual Force Calcium increased the average fruit weight and diameter in Pink Lady® Ruby apples. Dual Force double rate increased the fruit firmness more than any other treatment where Dual Force label rate increased the average Brix levels in apples. In addition, Dual Force Calcium double rate and Transit Calcium label rate significantly increased the Calcium levels in fruits. Furthermore, all four Calcium treatments significantly improved the Calcium levels in plant tissues including leaves and tips. Therefore, it can be concluded that the foliar application of Dual Force Calcium at the label rate and double rate is beneficial in improving fruit weight, diameter, Brix levels, and Calcium levels in fruits and plant tissues and thereby fruit quality in Pink Lady® Ruby apples.