Effect of Foliar Application of Chelated Calcium by Trees on the Strength and Durability of Red Delicious Apple Harvest

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Abstract In order to investigate the effect of foliar application of chelated calcium on Red Delicious apple trees, a randomized complete block design with four repetitions was conducted in the city Abadeh, Fars Province, southern Iran. In this experiment, different concentrations (zero, 2.5, 5.0, and 7.5 mg/l) of calcium chelate were sprayed on the apple trees. After spraying the trees, mature fruits were harvested and kept in the cold house for 3 months. After this period, traits such as TSS percentage, fruit weight, fruit firmness and decay of tissue were assessed at the horticultural laboratory of Jahrom Azad University. The results showed that the percentage of fruit decay in the control treatment was more than the other treatments. The foliar application of calcium chelate on apple trees considerably reduced fruit decay during storage. The highest fruit firmness was related to apples that were sprayed with chelated calcium at concentrations of 0.5 and 7.5 mg/l. Moreover, the fruits sprayed with the control treatment had the highest percentage of weight loss. Spraying fruit trees with chelated calcium led to less weight loss during storage. The highest TSS percentage was related to apples treated with 7.5 mg/l chelated calcium.
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Introduction

Increased production and excess supply of fruits during the harvest season along with the low fruit prices has led to fruit processing as well as its storage in cold houses. Although fruit storage has succeeded to reduce fruit respiration and prevented weight reduction and physiological disease contraction by decreasing the temperature, fruits still experience decay during storage. To reduce waste and decay as well as maintain the best quality, management is essential. Recent studies have shown that spraying diluted chelated calcium on apples near harvest season reduces the risk of bitter pit disease during storage (Scott et al, 1985).

We aimed to assess the effect of the foliar application of chelated calcium on the strength and durability of stored Red Delicious apple trees.

Materials and Methods

In order to investigate the effect of foliar application of chelated calcium on Red Delicious apple trees, a randomized complete block design with four repetitions was conducted in the city Abadeh, Fars Province, southern Iran. In this experiment, different concentrations (zero, 2.5, 5.0, and 7.5 mg/l) of calcium chelate were sprayed on the apple trees.

The study was done in one of the young gardens of Imam Khomeini Relief Committee, Abadeh that cultivating East Malling-Merton 106 apple rootstocks. The trees were five years old and the garden comprised Red Delicious apples. The initial stage of foliar application was done in September 2012. Other stages of foliar application were done every other week. Each tree was sprayed with 1 liter of solution in all stages.

After foliar application, mature fruits were separately harvested from each tree and collected. The fruits were labeled based on the type of treatment, repetitions, and solution concentrations and transferred to the horticultural laboratory of Jahrom Azad University. After measuring fruit traits, they were transferred to the cold storage house and stored at ±1 ^{c} and 85-90% humidity. The fruits were taken out of storage three months later and their traits were measured once again. The measured characteristics included fruit firmness, TSS percentage, weight reduction percentage, and percentage of fruit decay.

Data were analyzed using SAS software. Duncan test was used for comparing different treatments. $P<0.05$ was considered as significant.

Results and Discussion

We found that the amount of decay was higher in the apples treated with the control treatment. The foliar application of chelated calcium on apples reduced their amount of decay during storage. The lowest percentage of decay was related to apples treated with 7.5 mg/l of chelated calcium (figure 1). Consistently, Shear (1995) found that fruit decay was

related to calcium deficiency. Moreover, Hewajulige et al (2003) further found that increased calcium concentrations reduced decay in peaches.

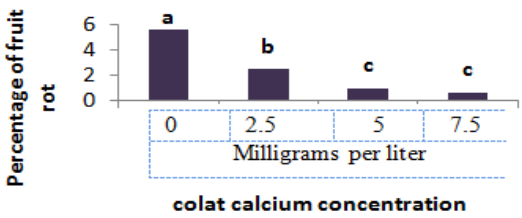

Figure 1: Effect of different concentrations of chelated calcium on amount of fruit decay

apples. The highest firmness was related to apples treated with 5 and 7.5 mg/l of chelated calcium. 2.5 mg/l treatments of chelated calcium reduced firmness during storage and these apples had the lowest firmness (figure 2).

When the surface cell walls are saturated, calcium probably turns into solution in the intercellular space of surface cells and gradually moves towards cell walls with less calcium. Ultimately, calcium's bond with cell walls leads to more firmness leading to higher market preference. Calcium, as an intermolecular connector, stabilized compounds of the medial septum and maintains cell walls.

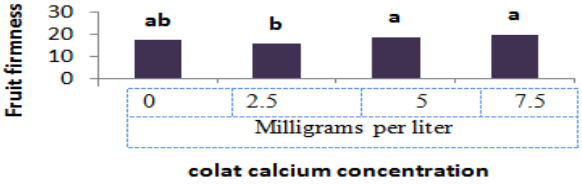

Figure 2: Effect of different concentrations of chelated calcium on fruit firmness

We found that fruits treated with the control treatment experienced the highest amount of weight loss.Chelated calcium led to lower weight loss during storage. Therefore, the lowest amount of weight loss was related to fruits treated with 7.5 mg/l chelated calcium (figure 3).

Calcium chloride covers fruit surfaces and leads to lower water loss and maintains water in fruits and as a result fruit weight. Weight reduction during dehydration is due to changes that occur in water vapor pressure resistance during respiration from the fruit's surface.

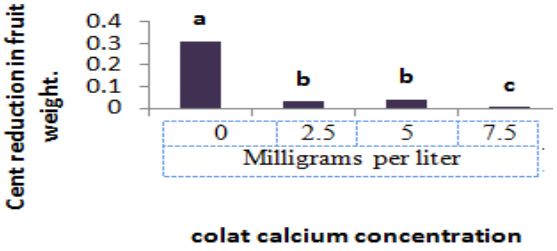

Figure 3: Effect of different concentrations of chelated calcium on amount of weight loss

The highest percentage of TSS was related to fruits treated with 7.5 mg/l chelated calcium. The application of other treatments led to reduced amounts of TSS; so that, the lowest TSS amount was related to a concentration of 2.5 mg/l chelated

calcium (figure 4). The amount of TSS slightly increases with fruit ripeness. Therefore, foliar application of chelated calcium delays starch hydrolysis and its transformation into glucose.

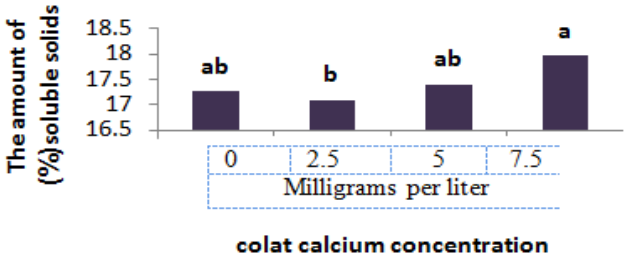

Figure 4: Effect of different concentrations of chelated calcium on amount of TSS

References

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