

## Effect of chilling stress on three commercial kiwifruit cultivars (Hayward, Golden, and Red)

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### Introduction

Kiwifruit is more resistant to temperature changes and frost than citrus trees, but the flowers of kiwifruit are more sensitive to chilling. Autumn frost delays plant flower initiation in spring. Whenever frost occurs after flowering, it will prevent fruit-set (Sheikhi, 2015). In areas where the winter temperature is less than -12° C, the kiwifruit vines are damaged. However, the buds, flowers and fruits of kiwifruit are damaged at -1.5° C (Mohammadi and Abdi SaneKohi, 2013). In the current research, chilling stress (freezing) was evaluated in three commercial kiwifruit cultivars (Hayward, Golden, and Red) with the aim of determining the cold resistance of kiwifruit buds in different growth stages and also determining the maximum chilling tolerance in the cultivars.

### Materials & Methods

To evaluate the chilling tolerance of three commercial kiwifruit cultivars (Hayward, Golden, and Red) this study was carried out as three factor experiment using a randomized block design with three replications from January to April 2019. The first factor was kiwifruit cultivars that included three cultivars of Hayward, Golden, and Red; the second factor was three levels of chilling [including b1) 4 °C, b2) -6 °C and b3) -16 °C] and the third factor was three phenological stages of kiwifruit cultivars including: dormancy of buds, swelling of buds and fruit-set stages. According to the Levitt (1980) method, 3 g of the samples were separated. The samples were sprayed with distilled water at different stages and transferred to a thermo gradient freezer. The evaluated traits included Na, K, Ca, Mg, electrolyte leakage, and proline.

### Results & discussion

The results revealed that the highest Ca, Mg, electrolyte leakage index, and proline content were in the fruit-set stage and there was no significant meaning in dormant buds and the swelling bud stage. According to the results of the interaction of "cultivar × chilling", the highest amount of potassium belonged to "Hayward × -16°C" and the lowest amount of potassium was related to "Golden × -16°C". The highest amount of Ca belonged to "Hayward × -6 °C", "Golden × -16°C" and "Red × -6 °C" and the lowest amount of Ca was related to "Red × +4 °C" and "Red × -16 °C". Based on the mean comparison of trilateral effect of "cultivar × chilling × phenological stage", the highest amount of Ca was obtained under "Hayward × +4°C × fertilized fruits" and the lowest amount of Ca was related to "Red × -16°C × bud dormancy". According to the results, the highest amounts of Ca and proline content were obtained at -6 °C. The results also showed that the highest proline content and the lowest electrolyte leakage were related to the Golden cultivar. Based on the results of analysis of variance, the simple effect of three phenological stages was statistically significant ( $p < 1\%$ ) on the amount of Mg, but the effect of other experimental factors and their interaction was not significant on Mg amount. The results of the mean comparison showed that the highest amount of Mg belonged to the fertilized fruits and the lowest amount was related to the dormant and swelled buds. Frost resistance in plants is mainly related to their nutritional status (Nagy *et al.*, 2008). On the other hand, it has been determined that potassium is the main element released in the damaged cells (Mirmohammadi Meybodi and Turkish Esfahani, 2014). It can be concluded that the severity of damage to kiwifruit tissues in the fruit set stage is more than their damage in the bud swelling stage.

**Conclusion:**

The results of this research showed that the amount of calcium, magnesium, electrolyte leakage and proline of the samples was the highest in the fertilized fruits and there was no significant difference between dormancy stage and swelling of buds. Recognition of the resistant phenological stages to chilling stress can help to prevent chilling damage. Also, the results showed that the highest amount of calcium and proline was obtained at -6°C. According to the results of this experiment, the highest amount of proline and the lowest amount of electrolyte leakage were related to the Golden variety. Since increasing the electrolyte leakage shows the sensitivity to cold stress, it can be concluded that the Golden cultivar is more resistant to chilling than the other experimental cultivars.

**Keywords:** *Electrolyte leakage, Fruit-set, Phenological, Proline.*

**Declaration of conflict of interest:**

The authors declare that there is no conflict of interest.