TEMPERATURE EFFECTS ON KIWIFRUIT MATURATION

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ABSTRACT

The effect of temperature on rate of kiwifruit maturation was studied using container-grown vines placed in controlled environments and field-grown vines from four orchards (Kerikeri, Te Puke, Palmerston North and Riwaka) at the geographical extremes of the kiwifruit growing regions. Soluble solids concentration (SSC) and partitioning of carbohydrate between starch and total sugar concentrations were studied at different stages of maturation in both the controlled environment and field work. Flesh firmness, dry matter concentration and fruit growth changes during fruit maturation were also measured. The effect of carbohydrate status on fruit maturation was determined by manipulating it using girdling of field-grown vines. A model relating changes in SSC to temperature was derived using data collected from controlled environment treatments. This model was applied to field-grown vines using meteorological data from kiwifruit growing regions.

Use of controlled environments quantified changes in kiwifruit during maturation. Increase in SSC and total sugar concentration, and decrease in starch concentration were faster at cooler than warmer mean temperatures, irrespective of minimum temperature *per se* or magnitude of the difference between maximum and minimum temperature. A temperature perturbation altered the partitioning of carbohydrate compared to treatments where a perturbation did not occur. In some years fruit were not responsive to any temperature treatments; these fruit had not reached the stage of development at which they were able to respond to temperature. Differences in rate of fruit maturation were found among orchard sites. Some of these differences, such as decrease in starch concentration and increase in total sugar and SSC could be attributed to the effect of temperature.

Girdling kiwifruit laterals altered carbohydrate concentration and affected rate of fruit maturation. Carbohydrate concentration was higher in fruit from the 5:1 than 1:1 leaf:fruit ratio treatment. Fruit in the 5:1 treatment matured similarly to fruit from ungirdled vines, compared to delayed maturation in fruit from the 1:1

treatment. Carbohydrate concentration in this treatment may be insufficient to support fruit maturation.

The model developed to predict the rate of change in SSC during kiwifruit maturation was made up of two components; a state-dependent physiological response function and a temperature-dependent rate function. The base + exponential model was chosen to represent the state-dependent physiological response function, based on SSC being separated into two components; basal SSC and maturation SSC. The temperature-dependent rate function from container-grown vines placed in controlled environments was successfully transported to fit SSC in field-grown vines at different orchard locations. The model was developed using continuous temperature records but was later modified to use daily maximum and minimum temperatures allowing greater practical application. The partial rate coefficient accounted for most of the physiological differences between years, orchards and experiments; it required fitting at each orchard location. Transportability of the partial rate coefficient was demonstrated between years for two orchard locations. The model, therefore, has great potential for prediction of harvest date of kiwifruit in different regions and seasons.

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