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Sweetness of Buttercup Squash

Possible Climatic, Maturity and Storage Influences

Interim Report to the New Zealand Buttercup Squash Council

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Summary

Total sugar levels (sweetness) were higher in Pukekohe squash than in squash from either Hawkes Bay or Lincoln. Total sugar levels at all sites remained relatively constant during on-vine maturation. However, the sugar composition changed with time; sucrose rather than glucose and fructose was the predominant sugar in fully mature fruit. Sugar levels increased up to 2-fold in all fruit following a 3 week postharvest storage period. We conclude that postharvest effects have a greater influence on total sugar levels than does on-vine maturity. It may be possible to maximise sugar levels by postharvest management.

Starch levels are currently being measured; the results of which will give some indication of the role of this carbohydrate in sugar and sweetness levels.

Flesh colour, as assessed by total carotenoids, increased with both on-vine maturity and postharvest storage. If flesh colour is an important quality attribute then it should be possible to maximise this.

Background

The New Zealand squash industry exports mainly to Japan. Quality attributes (taste and colour) are important parameters for marketing squash in Japan, and it is important that these factors match consumer expectations. Currently there is a suggestion that fruit from New Zealand is below the desirable level of sweetness.

Sweetness arises from the level of sugars (sucrose, glucose and fructose) in the flesh, and because the sweetness factor of these individual sugars is not the same (glucose is only half as sweet as sucrose, and fructose is 1.2 times as sweet as sucrose), sweetness will be determined by not only the total level of sugars, but also by the sugar proportions of the different sugars. In other crops, sweetness can be influenced by other factors such as climatic conditions, and conversion of starch reserves into sugars.

Method

In the 1992/93 season fruit samples were obtained from Pukekohe, Hawkes Bay and Lincoln to investigate any possible climatic (sunshine hours, mean maximum temperatures) influences. This experiment has been coordinated with a project of Winna Harvey, Crop & Food Research, Lincoln. We obtained from Winna, freeze-

dried squash samples, taken at 10-day intervals, from fruit 30 days after flowering (daf) up to 70 daf. Samples were also obtained from similarly harvested fruit but which had been stored for 3 weeks.

Sugars have been measured and starch analyses are in progress.

Carotenoids have also been measured because it was very apparent that the colour of the squash powders varied considerably. Carotenoids give squash flesh its colour and are also precursors of vitamin A. So from both visual appeal and nutritional standpoints, the carotenoid content is important.

Results

Sugars

Total sugar (sucrose + glucose + fructose) levels were higher in Pukekohe fruit than in either Hawkes Bay or Lincoln fruit at all sampling times. Levels in Hawkes Bay and Lincoln fruit were similar. These results suggest some climatic influence but this conclusion is guarded because of the poor growing conditions that prevailed throughout the country.

Total sugar levels at all sites tended to be constant with increasing on-vine maturation but the sugar composition changed markedly.

Glucose and fructose levels decreased as fruit were left on the vine, whereas sucrose increased, suggesting that glucose and fructose were converted into sucrose. In early harvested fruit (30 daf) glucose and fructose levels were higher than sucrose levels; at 40 daf they were about equal; in late harvested fruit sucrose predominated.

Over and above this on-vine maturity effect, there was a postharvest effect. Irrespective of harvest date, the levels of all sugars increased after 3 weeks' storage. In Hawkes Bay and Lincoln fruit this increase was about 2-fold, amounting to 16-20% of fruit dry matter. In fruit from Pukekohe, the postharvest increase was less but total sugars still accounted for 20-24% of dry matter. These results suggest that a carbohydrate reserve (possibly starch) was being mobilised into sugars. Generally, the pattern of more glucose or fructose than sucrose in early fruit and more sucrose than glucose or fructose in late fruit seen in on-vine fruit was maintained in stored fruit.

These results indicate that interconversions of sugars (and possibly starch) are complex during both on-vine and off-vine maturation. However, these results do suggest that postharvest conditions could be managed to maximise sugar levels, and that harvest date has a profound effect on sugar composition.

Carotenoids

Carotenoids increased with increasing on-vine maturity at all sites. For example, 70 daf fruit from Lincoln had 3 times the level of 30 daf fruit. Pukekohe fruit had higher carotenoid levels than similar age fruit from Hawkes Bay and Lincoln,

indicating a climatic/maturity effect on carotenoid synthesis.

Fruit from all sites and from all harvest times had increased carotenoid levels following the 3 weeks' storage period. The highest levels were found in Pukekohe 60 daf+3 wk fruit, followed by Lincoln 70 daf+3 wk fruit. Clearly, carotenoid synthesis continues after harvest and there is potential to maximise flesh colour by both harvesting and postharvest storage strategies.

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