STUDIES ON THE COMPOSITION OF PULP AND SKIN OF RIPENING GRAPE BERRIES

by

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to JUDITH

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SUMMARY

Changes occurring in the content of some organic acids, monovalent cations, total anthocyanins and total phenols in the pulp and skin of ripening 'Shiraz' grapes were studied. During berry ripening, amounts of malate in the pulp declined, sometimes to 1/5 of the value at veraison, while in the skin malate levels doubled during the same period. Levels of potassium increased significantly in both pulp and skin and during the period from veraison to ripeness the potassium content of whole berries increased 3 to 4 fold. The total amount of tartrate per berry remained relatively constant during berry ripening; however differential extraction of berry pulp with 80% ethanol showed that the free acid form (H_2T) of tartrate was progressively converted to salt forms (HT^-, $T^=$). Malate existed entirely as the free acid (H_2M) at all stages of berry ripening.

Effects of canopy structure and vine water status on the amounts of the above components in the pulp and skin of ripening 'Shiraz' grapes were investigated. Ripe fruit from shaded canopy environments had higher potassium, malate and pH values in the berry pulp and decreased levels of total anthocyanins in the berry skin. Shaded conditions induced high potassium in berries at veraison and this correlated positively with potassium levels in ripe berries. The interrelationship between improved vine water status and berry composition appeared dependent on the extent to which the applied treatment modified the canopy structure.

Compartmentation and properties of cell membranes in relation to the above compounds in berry cells during ripening were investigated using efflux techniques. As ripening progressed, the speed with which tartrate, malate and potassium leached out of pulp tissue increased, indicating an increased membrane permeability with berry ripening. Malate leached out faster than the other compounds. It is postulated that malate was contained in cells separate to those storing tartrate and potassium.

Potassium, total anthocyanins and total phenols were the major components extracted from the skins of 'Shiraz' and 'Cabernet Sauvignon' grapes during vinification. Higher amounts of extractable potassium were associated with initially natural low pH and low potassium levels in the juice. The rise in pH associated with the fermentation of black grapes was greatest when natural juice pH was low.

When grape berries are crushed varying percentages of compounds originally in the pulp are found dissolved in the resultant juice - 100% of malate, 66% of potassium and 55% of tartrate. Thus grape juice or must samples represent solutions in which varying amounts of H_2T, HT^-, $T^=$, H_2M, K^+ and Na^+ have been dissolved. Higher juice pH values would be associated with higher amounts of dissolved HT^- and $T^=$ which corresponds also to higher potassium concentration in the juice. Increased potassium uptake in the berry pulp during berry ripening indirectly lowered the titratable acidity and raised the pH of the juice extracted from the ripe berry, suggesting that viticultural practices should aim at limiting the uptake of this cation during berry ripening.

STATEMENT

I hereby declare that the thesis here presented is my own work, that it contains no material previously published, except where due reference is made in the text, and that no part of it has been submitted for any other degree.

I consent to this thesis being made available for photocopying and loan if accepted for the award of M. Ag. Sc.

Patrick G. Iland

PREFACE

This thesis explores aspects of red wine grape composition and aims at improving knowledge at the interface of viticulture and oenology.

I am very grateful to my supervisor, Dr. Bryan Coombe, who through his scientific thought and persistence to detail has taught me the reality and rewards of scientific research.

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My family have supported me throughout this period and this thesis indicates their patience and understanding in contributing to my final goal.

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