Preharvest Practices Affecting Postharvest Quality of 'Hayward' Kiwifruit

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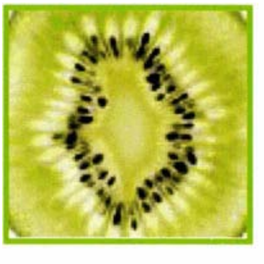

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Abstract

Repeat purchase of kiwifruit is primarily driven by consumer judgement of internal fruit quality attributes, including those affected by dry matter concentration (DMC) and mineral composition in fruit. This research investigated mechanisms affecting carbohydrate, mineral and water accumulation in 'Hayward' kiwifruit (*Actinidia deliciosa*), and related these to specific management practices. Canopy manipulation through pruning and treatments such as artificial pollination, defoliation, girdling, thinning and application of the auxin transport inhibitor TIBA, may affect fruit DMC and mineral composition.

Leaf photosynthesis and fruit dry matter concentrations (DMC) started to decline as leaf area index values increased above 3-4. In addition to reducing competition for carbohydrates between vegetative and reproductive growth, leader pruning probably increased DMCs of fruit in the leader zone by improving light interception. Photosynthesis was not affected by crop loads between 20-60 fruit m^{-2}, but was consistently higher on non-terminating (long) shoots than on terminating (short) shoots, as were fruit DMCs. Differences in photosynthetic rate of leaves on these two shoot types were attributed to differences in shoot exposure to the sun, and also to the greater demand for carbohydrate within long shoots.

Leaves subtending fruit may increase Ca, and to a lesser extent Mg, flow into fruit, however their accumulation was not affected by leaves outside the fruiting shoot. Xylem sap Ca and Mg concentrations were higher in shoots with a high rather than a low leaf: fruit (L:F) ratio and this may, at least partially, relate to the increase in shoot transpiration that occurs as shoot L:F ratios increase. Within vine variation in fruit Ca concentrations may reflect variations in xylem sap flow rates and Ca concentrations of xylem sap reaching fruit.

Calcium translocation may occur independently of ion movement in the transpiration stream. Timing and extent of vascular differentiation in flower and fruitlet pedicels, possibly regulated by auxin, may influence fruit Ca accumulation. It is likely that early differentiation of vascular tissue in flower and fruitlet pedicels influenced cell division and subsequent (carbohydrate) sink strength of fruit by determining availability of carbohydrate for partitioning into cell walls.

While growers have the potential to induce minor changes in fruit DMC, further increases will depend on the separation of carbohydrate and water accumulation. Further research is required to elucidate the mechanisms regulating phloem transport and unloading of sucrose in kiwifruit.

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CONTENTS

List of Figures

Chapter 1:

Chapter 2:

Chapter 3:

Chapter 4:

Chapter 5:

Chapter 6:

Chapter 7:

Chapter 8:

Chapter 9:

Chapter 10:

List of Tables

Chapter 1:

Chapter 3:

Chapter 4:

Chapter 5:

Chapter 6:

Chapter 7:

Chapter 8:

Chapter 9:

Chapter 10:

List of Abbreviations

ABA	abscisic acid
ANOVA	analysis of variance
AuG	autumn girdling
a_w	water activity
BER	blossom end rot
CME	chloroflurenolmethylester
CP	conventionally-pruned
CPPU	N1-(2-chloro-4-pyridyl)-N3-phenylurea
CSA	cross-sectional area
DAFB	days after full bloom
DM	dry matter
DMC	dry matter concentration
DPFB	days prior to full bloom
DW	dry weight
FB	full bloom
FW	fresh weight
FZ	fruiting zone
GLA	gap light analyser
GLM	general linear model
Gs	stomatal conductance
HP	high crop load, pruned (vines)
HUP	high crop load, unpruned (vines)
IAA	indole-3-acetic acid
K_h	hydraulic conductivity
LAI	leaf area index
L:F	leaf: fruit (ratio)
LP	leader-pruned
LSD	least significant difference
LTB	low temperature breakdown
LUP	low crop load, unpruned (vines)
LwP	low crop load, pruned (vines)
LZ	leader zone
NAA	napthalene acetic acid
NPA	1-N-napthylphthalamic acid
NPQ	non-photochemical quenching

PAR	photosynthetically active radiation
PC	personal computer
PGR	plant growth regulator
PIX	1,1-dimethyl-piperidinium
Pn	Net photosynthesis
RH	relative humidity
rSSC	ripe soluble solids concentration
SA	surface area
SB	short-base (proximal cane end)
SE	short-end (distal cane end)
SLW	specific leaf weight
SmD	summer defoliation
SpD	spring defoliation
SpG	spring girdling
SSC	soluble solids content
TIBA	2,3,5-triiodobenzoic acid
VMC	ventromedian carpellary (vascular bundle)
VPD	vapour pressure deficit
WAFB	weeks after full bloom