RESOURCE ALLOCATION IN KIWIFRUIT (*Actinidia chinensis*)

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ABSTRACT

Kiwifruit growers in New Zealand receive financial incentives to produce high yields of fruit with high individual dry matter concentrations (DMCs). Several vine management techniques are available to growers to enable them to direct more resources into production of fruit rather than into other sinks such as root growth and shoot extension. The long term consequences of these management techniques are not well understood. The overall objective of the work described in this thesis was to investigate how manipulating whole vine source-sink relationships affects fruit quality, long-term vine health and productivity in 'Hort16A' kiwifruit vines.

A compensatory reduction in flower numbers occurred as a result of whole vine carbohydrate depletion (famine treatment) and producing high crop loads of high DMC fruit with reduced leaf area (minimal pruning, standard nitrogen). Keeping crop loads low did not result in increased productivity, instead additional resources were allocated to root growth (feast treatment). Isolating the canopy from the roots by extended trunk girdling was the technique that enabled high flower numbers to be maintained across seasons.

Increasing individual fruit DMC generally enabled fruit to be harvested earlier than fruit with lower DMC. This was because flesh colour change, the main harvest criterion, occurred earlier in fruit from treatments where DMC was increased. Fruit softening behaviour was less affected by changes in DMC than flesh colour change, meaning that low DMC fruit could be softer at commercial harvest that more mature high DM fruit. The implications of this finding for storage performance were discussed.

Vines showed few of the common responses to carbohydrate depletion. There was no evidence of increased individual leaf area, reduced specific leaf weight, upregulated leaf photosynthesis or increased shoot growth. Uptake and allocation of some mineral nutrients within the vines was affected, but few visible signs of leaf nutrient deficiencies were seen. The results suggest that vines respond to carbon depletion primarily be altering resource allocation between flowering and root growth, rather than by altering its ability to capture carbon.

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LIST OF ABBREVIATIONS AND TERMS USED

A	Net photosynthesis
BB	Bud break
C_i	Internal leaf CO_2 concentration
CP	Conventional pruning
CPPU	N-(2-chloro-4-pyridyl)-N´-phenylurea
DAMB	Days after mid-bloom
DMC	Dry matter concentration
DW	Dry weight
ETG	Extended trunk girdling
FBB	Floral bud break
F/FS	King flowers per floral shoot
FW	Fresh weight
GA	Gibberellic acid
g_s	Stomatal conductance
ha	hectare
IAA	indole-3-acetic acid
KF/Bud	King flowers per winter bud
LA	Leaf area
LAI	Leaf area index
LSD	Least significant difference (between two means)
LTB	Low temperature breakdown
MP	Minimal pruning
N	Newton
NCER	Net CO_2 exchange rate
NPA	1-N-naphthylphthalamic acid
NSC	Non-structural carbohydrates
PGRs	Plant growth regulators
SE	Standard error (of the mean)
SSC	Soluble solids concentration
SLW	Specific leaf weight
VBB	Vegetative bud break
Year 1	Spring 2007 to winter 2008 where spring = Sept. to Dec., winter = May to Aug.
Year 2	Spring 2008 to winter 2009
Year 3	Spring 2009 to winter 2010