The effects of canopy architecture and crop load on non-structural carbohydrate in young stone fruit trees: preliminary results

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INTRODUCTION

Understanding the effects of canopy architecture and crop load on non-structural carbohydrate (NSC) in stonefruit trees is fundamental to boost early bearing and ensure consistent fruit size and quality. NSC, like sucrose or starch, is an important energy store in plants as well as an indicator of potential plant productivity. NSC is critical as a source of reserves for the growth/development and play an important role in tree carbohydrate dynamics, under conditions of excessive sink demand (high crop load) and when carbon acquisition is reduced by biotic and/or abiotic stress (e.g. nutrient, drought stress). There is limited knowledge on the effects of crop load on NSC accumulation in peach as influenced by canopy architecture.

Picture 1: 3-years-old peach 'August Flame' trained as Vertical Axis

Picture 2: 3-years-old nectarine 'Autumn Bright' trained as Tatura Trellis

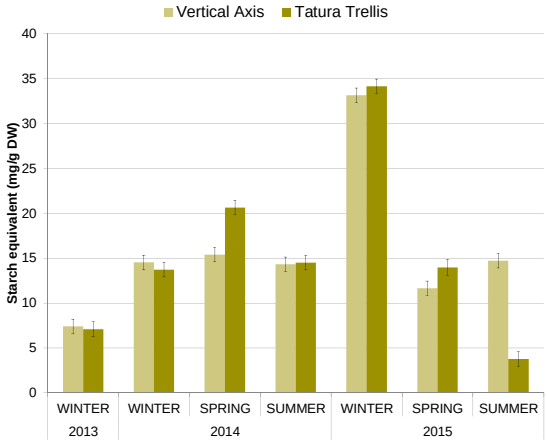

Figure 1: Starch equivalent for peach 'August Flame' trained as Tatura Trellis and Vertical Axis from planting (2013) to summer 2015

AIM & METHODS

Our field experiment (Tatura, Victoria, Australia) aimed to understand NSC content in wood of stonefruit trees as affected by canopy architecture and crop load (high, medium and low fruiting level) in young (3-year-old) peach and nectarine trees (1m x 4.5m; north-south; micro-irrigated). NSC content in wood was measured periodically from planting of young peach and nectarine trees trained as Tatura Trellis or as Vertical Axis with two main branches (Pics 1 and 2). Wood was collected in spring (after shack fall), summer and winter. NSC was obtained by starch enzymatic digestion on powdered wood and subsequent colorimetric quantification by spectrophotometer.

Preparation of samples for starch analysis was carried out on 25 mg fine ground wood using a method based on Hendrix (2003), and Lee et al (2013). Hydrolysis of starch to glucose was based on methods by Hendrix (2003) and Richardson (2013). The determination of starch was carried out using a method based after Gomez et al. (2007) by colorimetric quantification on a Varioskan microplate spectrophotometer.

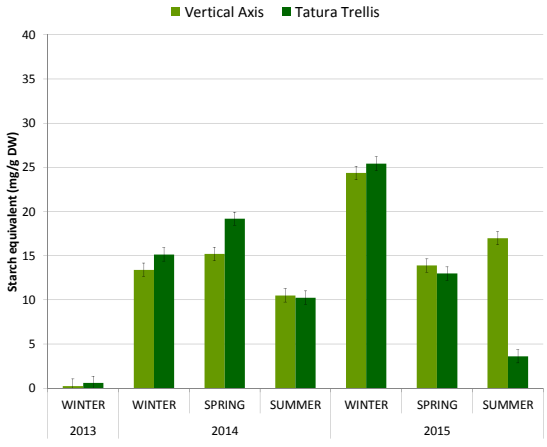

Figure 1: Starch equivalent for nectarine 'Autumn Bright' trained as Tatura Trellis and Vertical leader from planting to summer 2015

RESULTS

Application of different crop load levels was successful in affecting fruit size and total soluble solids content (Table 1). Tatura trellis seemed to have slightly higher soluble solids content when compared with vertical axis canopy training independently of species. No differences were noticed for the summer pruning wood fresh weight or either of the shoot length measurements (Table 1).

Crop load did not seem to affect wood starch content. If differences were found, Tatura trellis seemed to have slightly higher starch content apart from summer 2015 (first productive year) where the difference was probably caused by different timing of wood collection.

Table 1: Effect of fruit crop load on fruit size, soluble solids, summer pruning and shoot length measured in summer and end of the growing season for both nectarine 'Autumn Bright' and peach 'August Flame' trained as Tatura Trellis and Vertical Axis, season 2015/16.

Crop load Fruit/cm²	Fruit weight (g)	Total soluble solids (°Brix)	Summer pruning FW (g)	Shoot length at summer pruning (cm)	Shoot length end of season (cm)
Peach, August Flame, Vertical Axis					
9.3	94 b	16.0	534 b	26.3 b	31.7
3.2	138 a	16.5	860 a	41.4 a	39.6
2.4	138 a	16.8	968 a	29.4 b	33.9
$LSD_{0.05}$	12.9	0.88	238	13.7	19.7
Fprob	< 0.001	0.47	0.004	0.078	0.638
Peach, August Flame, Tatura Trellis					
6.2	125 b	16.3 b	565	49.1	62.1
3.7	145 a	17.6 a	649	49.0	58.6
1.8	151 a	18.2 a	693	52.3	59.7
$LSD_{0.05}$	17.8	0.84	136	17.2	25.6
Fprob	0.003	0.18	0.155	0.894	0.998
Nectarine, Autumn Bright, Vertical Axis					
8.1	128 c	13.4 c	503	37.4	39.8
6.3	146 b	14.7 b	619	38.6	43.1
3.4	167 a	15.9 a	505	35.0	34.7
$LSD_{0.05}$	17.1	1.29	246.5	15.1	18.6
Fprob	< 0.001	0.003	0.527	0.852	0.574
Nectarine, Autumn Bright, Tatura Trellis					
8.2	136 b	14.7 b	596	48.7	50.8
6.7	143 b	16.0 a	539	37.9	40.7
3.3	158 a	17.3 a	556	39.2	41.7
$LSD_{0.05}$	14.1	1.29	105.4	12.3	13.2
Fprob	0.01	0.004	0.508	0.174	0.271

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