Effects of above-canopy photovoltaic arrays on crop yield and fruit quality in a pear orchard

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Aim of the study

Determine the effect of photovoltaic arrays on fruit yield and quality of 'ANP-0118' blush pears.

Experiment

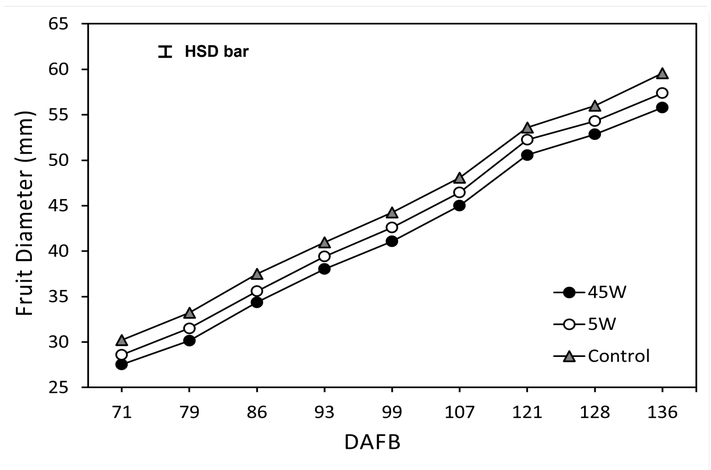
Treatments

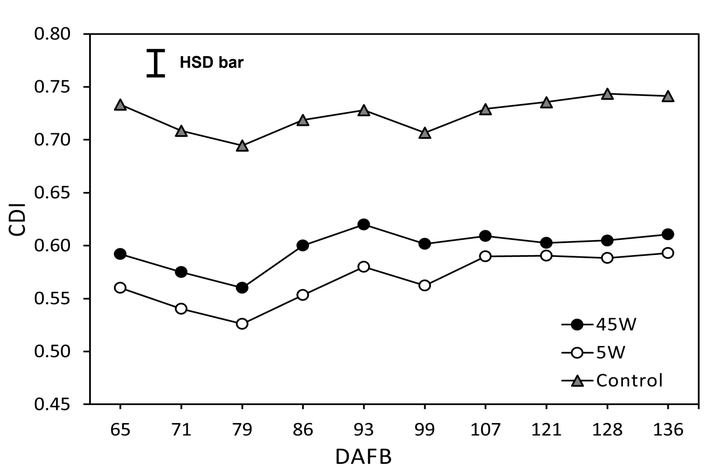
Experiment conducted in 2021–22 at the Tatura SmartFarm, Goulburn Valley, Victoria, Australia.	Cultivar and rootstock: 'ANP-0118' (Lanya^{TM}) on BP1.
Open Tatura trellis, four-leader system.	Row and tree spacings were 4.5 and 1 m, respectively

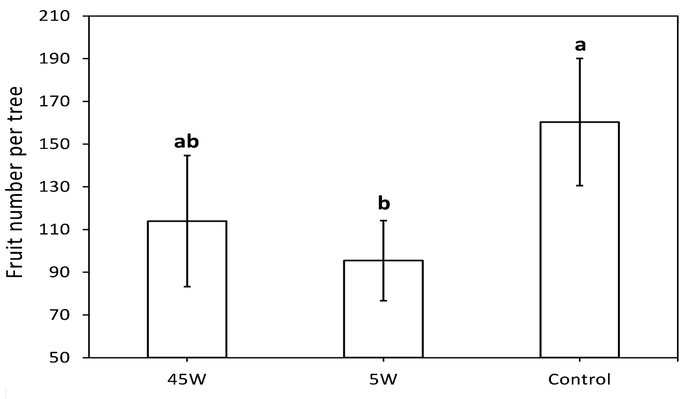
Measurements

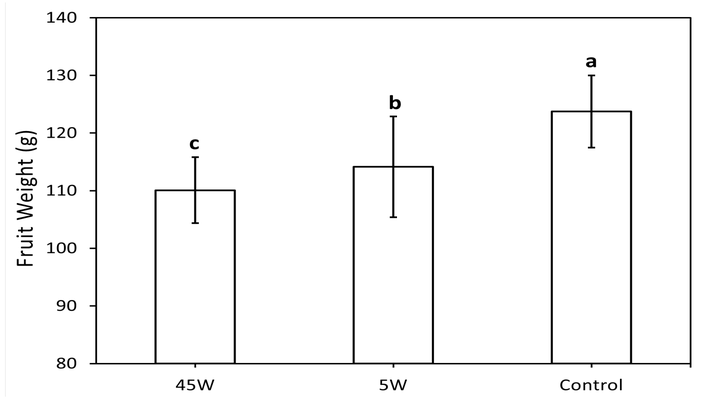
- Fruit diameter (n = 324) measured at 71, 79, 86, 93, 99, 107, 121, 128 and 136 days after full bloom (DAFB) using a digital calliper.
- Colour development index (CDI, 0 (pure green) to 1 (pure red)) calculated from hue angle (h°) measured at 65, 71, 79, 86, 93, 99, 107, 121, 128, 136 DAFB using a contact tristimulus colourimeter.
- Sunburn was assessed using a 1–4 scale — i.e., mild bleach (1), moderate bleach (2), slight browning (3), severe browning (4).
- In-line commercial grader was used to measure fruit number per tree, fruit weight, blush coverage (%) and green (%) present on fruit skin at harvest.
- Soluble solids concentration (SSC) and flesh firmness (FF) measured with a digital refractometer and a penetrometer on fruit at harvest (n = 324).

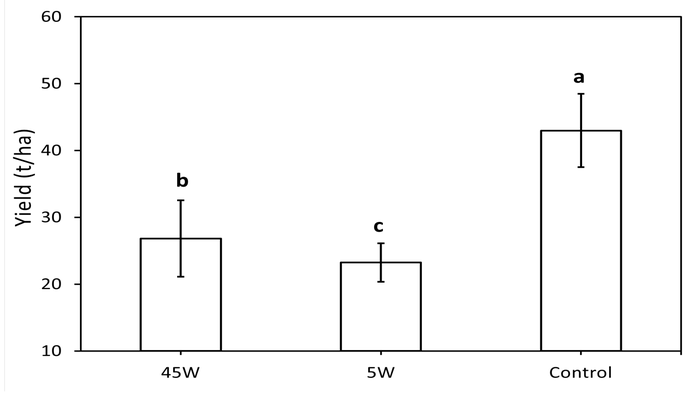
Results











- Fruit diameter in control trees was significantly higher ($p < 0.05$) than in 45W and 5W trees from the beginning to the end of the experiment (growth rates were similar between treatments).
- CDI of control fruit consistently remained higher than both 45W and 5W treatments.
- Fruit number was 25% higher in Control trees compared to 5W trees. No significant difference between control and 45W trees, and 45W and 5W treatments.
- Fruit weight at harvest (total population) were in line with fruit diameter measurements on fruit samples.
- At harvest, control fruit had 13 and 12% higher SSC than 45W and 5W, respectively.
- No significant effect of treatments on FF.
- Blush coverage was 22 and 23% lower in 45W and 5W, respectively, compared to control fruit.
- Sunburn damage was negligible in 45W and 5W trees, and low in control fruit (< 5%).

Crop parameter	Control		45W		5W	
	Mean	St. dev.	Mean	St. dev.	Mean	St. dev.
SSC[a]	13.5 a	0.4	11.9 b	0.4	11.9 b	0.2
FF (kg cm^{-2})	5.2	0.2	5.0	0.2	5.0	0.1
Green (%)	61.9 a	4.1	87.6 b	3.4	89.3 c	3.0
Blush coverage (%)	32.1 a	3.6	10.6 b	2.9	8.9 c	3.5
Sunburn (%)	3.4 a	-	0.2 b	-	0.3 b	-

Shade caused by above-canopy photovoltaic arrays adversely affected fruit size, yield, SSC, CDI and blush coverage but significantly reduced sunburn in 'ANP-0118' pears. The 45W configuration outperformed the 5W in terms of total yield and blush coverage.

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Accessibility

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