DMG_11/2017_J007223

Dr Grant Thorp

grant.thorp@plantandfood.com.au

Plant & Food RESEARCH
AUSTRALIA

Transforming almond orchards – tree architecture and advanced production systems

Plant & Food Research Australia Pty Ltd, 7 Bevan St., Albert Park,
VIC 3206, Melbourne, Australia

www.plantandfood.co.nz

THE NEW ZEALAND INSTITUTE FOR PLANT & FOOD RESEARCH LIMITED

The Almond Board of California and the Almond Board of Australia are supporting a programme of collaborative research to increase production and profits from existing and future almond orchards.

The research is focused on tree architecture and the development of production systems that involve no or minimal additional cost to the grower; reduce the time taken to reach break-even point on the orchard investment and that increase productive yield per hectare and grower profits.

Light management

Research in Australia on light management in high density orchards (planted at 10 x 20 ft) demonstrated that reflective ground covers and selective limb removal pruning can increase light transmission and nut bearing in the lower canopy zones of 'Nonpareil' trees (Table 1, Figure 1).

- However, the additional fruit produced in the lower canopy zones of these trees were slow to mature and were not ready for harvest until 2 to 3 weeks after the main crop (Figure 2). There was also no change to the total yield on these trees (Table 2).
- The "grower" solution has been to start a program of mechanical pruning/trimming to allow more light into the lower canopy and thus stimulate growth of new fruiting wood (Figure 3)
- The "long-term" solution is to produce pyramid-shaped trees (wider at their base than at their tops) with narrow canopies. This shape is the most efficient at capturing light and converting that light into high value crops. New pruning systems are required to achieve this tree shape.

Table 1: Effect of reflective ground covers and selective limb removal pruning on kernel moisture content and yield at commercial harvest in the lower canopy zone (0 to 9 ft) of 8th leaf 'Nonpareil' almond trees on Nemaguard rootstock in Australia. Trees were planted at 10 x 20 ft spacing.

Treatment	Kernel moisture (%)	Kernel weight (lb/tree)[a]	Kernel weight (lb/acre)[a]
Control	16.3	0.73	156
Pruned + Reflective covers	8.7	1.79	389
Significance[b]	**	***	***

[a] Adjusted to 5% moisture content
[b] Significance: ** = P<0.01, *** = P<0.001

Table 2: Effect of reflective ground covers and selective limb removal pruning on total kernel yield of 'Nonpareil' almond trees on Nemaguard rootstock in Australia. Trees were planted in 2009 at 10 x 20 ft spacing.

	Kernel weight (lb/acre)[a]		
Treatment	2015 6th leaf	2016 7th leaf	2017 8th leaf
Control	2247	4840	3716
Pruned + Reflective covers	2679	4926	3975
Significance[b]	NS	NS	NS

[a] Adjusted to 5% moisture content
[b] Significance: NS = not significant (P=0.05)

Figure 1: Reflective ground covers were installed beneath 'Nonpareil' almond trees planted at 10 x 20 ft spacing to increase the amount of light and fruit yield in the lower canopy zones.

Figure 2: Fruit in the lower canopy (right) were not ready for harvest when fruit from the upper canopy (left) were harvested, the lower canopy fruit were ready 2-3 weeks later.

Figure 3: Mechanical pruning in winter, starting in Year 6 after planting, is used as a "grower" solution to reduce shading in 'Nonpareil' almond trees planted at 10 x 20 ft spacing.

Acknowledgements

Thanks to: Ben Brown, John Kennedy, Daryl Winters and Andrew Hobbs for their advice; CMV Farms, Lacton Farm, Select Harvests, OLAM International and Rural Funds Management Ltd for their support; Ian Moss from Mossmont Nursery in Australia, and Tom Burchell from Burchell Nursery in California.

This project has been funded by the Almond Board of California and by Hort Innovation using the almond research and development levy and contributions from the Australian Government.

New pruning systems

Research in Australia has demonstrated that "palmette" style pruning of young 'Nonpareil' trees will produce a narrow tree canopy suitable for blocks with closer row spacing (Figure 4).

- Trees were planted in 2012 at 10 x 20 ft on Nemaguard rootstock. Tree yields were similar on the pruned and unpruned pruned trees (Table 3)
- This "palmette" style of pruning would be suitable for planting trees at 10 x 16.5 ft, which would increase potential yields by 21%
- New trials have been planted in Australia at these closer spacings and with a wider range of varieties to evaluate this option. Similar projects will be planted in California in the 2017/18 winter.

Figure 4: A single round of "palmette" style pruning was applied to 'Nonpareil' almond trees (foreground) in winter at Year 2 from planting to produce trees with a narrow canopy, suitable for high density blocks. The objective was to prevent any "big wood" from growing out into the rows and blocking machinery access.

Table 3: Total kernel yield from 'Nonpareil' almond trees on Nemaguard rootstock. Trees were planted in 2012 at 10 x 20 ft spacing and treatment trees were pruned in winter 2014 to produce a narrow 'palmette' style canopy.

	Kernel weight (lb/acre)[a]		
Treatment	2015 3rd leaf	2016 4th leaf	2017 5th leaf
Control	424	3371	3284
Pruned	467	2766	2766
Significance[b]	NS	NS	NS

[a] Adjusted to 5% moisture content
[b] Significance: NS = not significant (P=0.05)

Central leader trees for high density orchards

Our research in Australia and California also aims to identify varieties and management systems that with no or minimal pruning will produce central leader trees with a slender pyramid shape suitable for planting in high density orchards.

These projects start with trees taken directly from the nursery with no pruning, apart from removal of side shoots below 2 ft on the trunk to provide a clear trunk for shaking.

Key results/observations in 2017 from Australian trials planted in 2016 include:

- 'Nonpareil' and 'Price' trees maintained a central leader with strong scaffold branching (Figure 5)
- Although 'Monterey' trees produced numerous side shoots, few of these were strong enough to be scaffold branches able to support the weight of a developing crop
- Heavy flowering on 'Carmel' trees restricted the growth of the central leader and promoted the dominance of side branches

New trials to be planted in California in winter 2017/18 will compare a wider range of tree types and how these respond to a range of pruning methods designed to produce a narrow, slender pyramid tree shape.

Figure 5: 'Nonpareil' and 'Price' trees planted in Australia in July (winter) 2016 as "unpruned" trees direct from the nursery and trained with a central leader (left), compared with traditional "pruned" trees (right) that were headed back to 3 ft and grown as multi-axis trees. Images were taken in October (spring) 2017.

Research Team

- **PFR Australia:** Grant Thorp, Andrew Granger, David Traeger, Belinda Jenkins, Ann Smith
- **PFR New Zealand:** Stuart Tustin, Jill Stanley, Carlo van den Dijssel, Steve Green, Edouard Périé, Andrew Barnett, Michael Blattmann, Vincent Mangin
- **California:** Gurreet Brar (CSU Fresno), Bruce Lampinen (UC Davis), John Slaughter and Kaylan Roberts (Burchell Nursery)

Hort Innovation Strategic levy investment | ALMOND FUND | australian almonds ALMOND BOARD OF AUSTRALIA | california almonds Almond Board of California