Transforming almond orchards – tree architecture and advanced production systems

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Dr Grant Thorp is a Senior Scientist with Plant & Food Research Australia, based in Melbourne. He completed his PhD studies at The University of Adelaide researching avocado tree architecture. He has worked with the apple, avocado, kiwifruit and persimmon industries in New Zealand and overseas examining the role of plant architecture, canopy management and rootstocks in determining tree productivity and fruit quality.

Grant currently leads programmes in Australia researching the development of “small tree” high density growing systems for almonds and macadamia.

Transforming almond orchards

- The Australian almond industry has under gone rapid growth
- Growers have adopted Californian growing systems and varieties
- Yields per hectare are now similar to those obtained in California

Question was:

“What new growing systems can we develop to lift those yields even further?”

Designing new almond orchards

New orchard systems must:

- Involve no or minimal additional cost to the grower
- Reduce the time taken to produce the first commercial crop
- Reduce the time to reach break-even point on

Critical knowledge gaps

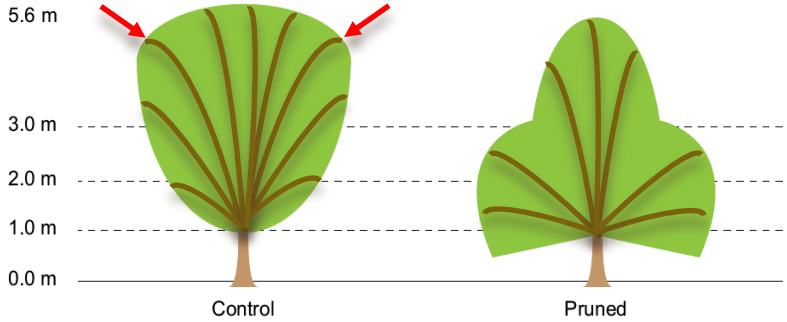
- **Physiological responses:** what are the constraints of current growing systems that limit productivity (eg carbon partitioning, light distribution)
- **Tree architecture:** working with the natural growth habit of almond cultivars varieties to increase production efficiencies
- **New cultivars and rootstocks:** what are the best combinations to increase productivity and profit

1. Summary of results 2014-16

2. New growing systems

Key results 2014/16

“Selective limb removal” pruning – removing the shoulder branches of cropping trees – created more open, spreading tree canopies compared with unpruned trees, with increased light transmission and nut bearing in the lower canopy zones



Key results 2014/16

“Palmette” style pruning of young almond trees produced trees with a narrow canopy, suitable for blocks with closer row spacing

Nonpareil trees, planted 2012 and pruned in winter 2014

Narrow “palmette” style pruning

Pruned

No pruning

Planted 2012 and pruned in 2014

Images taken 2016

Key results 2014/16

Trunk girdling 'Nonpareil' trees increased return bloom by 30%, but **girdles did not heal** and with subsequent kernel abortion meant no increase in actual yields

Trunk girdles applied to 'Carmel' and 'Monterey' healed within 4 weeks, so girdling offers an opportunity to increase yields of these polleniser cultivars

Nonpareil ☒

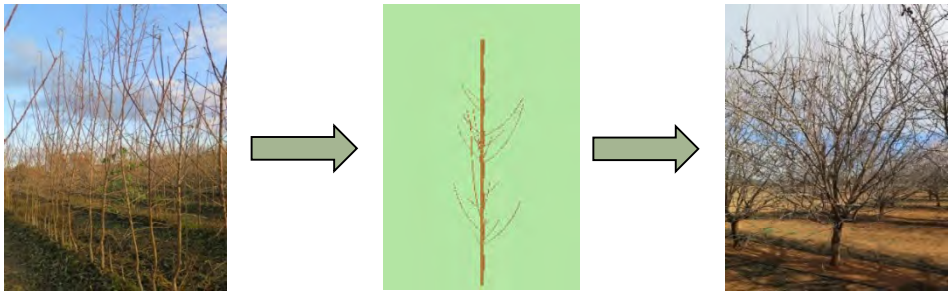
Carmel ☑

Monterey ☑

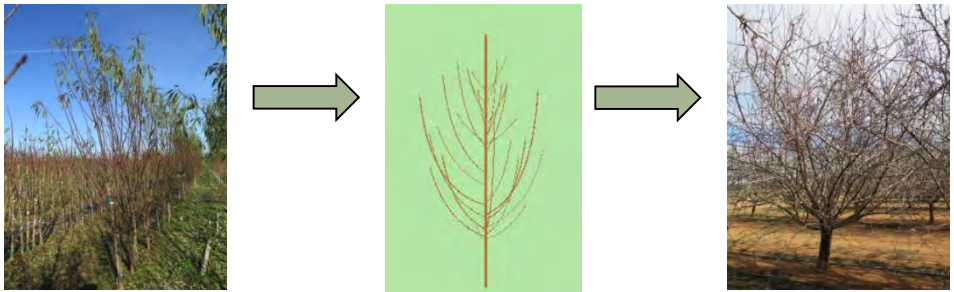
Almond tree architecture

Does the growth of a one-year-old “unpruned” tree in the nursery reflect the form of the mature tree?

‘Nonpareil’

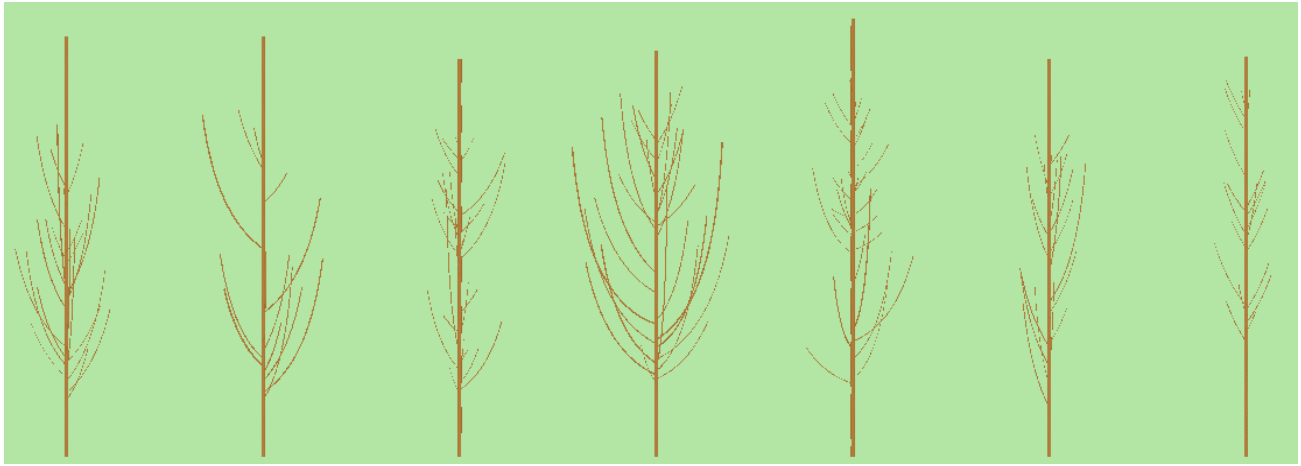


‘Monterey’



Almond tree architecture

Which cultivars are better suited to ultra high density growing systems?



New growing systems

New growing systems #1

New growing systems for traditional orchards with wide row spacing designed for standard harvesting equipment

- Use **“selective limb removal” pruning on ‘Nonpareil’** trees to create more productive, open spreading canopies
- **Prune polleniser trees as a narrow “palmette-style”** to create more space for the ‘Nonpareil’ trees, with **trunk girdles** applied to increase yield of the polleniser trees

(Do not trunk girdle Nonpareil trees)

New growing systems #2

1. **High-density** growing systems with traditional row spacing but with close planting along rows

2. **Ultra-high-density** growing systems with close planting along rows and across rows **(new orchard machinery needed)**

- Grow central leader trees with multiple non-vigorous side shoots (feathers) to produce **a slender pyramid tree shape**
- Alternative with trees that want to spread wide is to apply a **narrow "palmette" style pruning**
- Key will be to select cultivars with **architecture** suited to this style of management

Central leader almond trees

Ultra-high-density growing systems:

- Grow central leader trees with multiple non-vigorous side shoots (feathers) to produce **a slender pyramid tree shape**

Nectarine

Central leader almond trees

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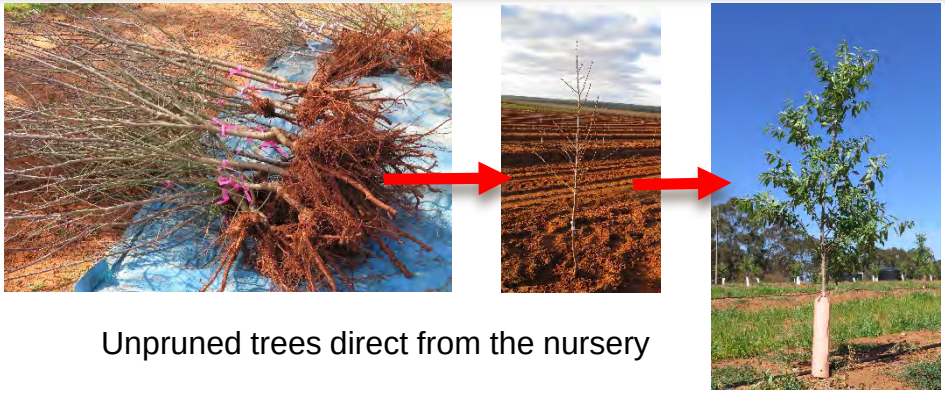
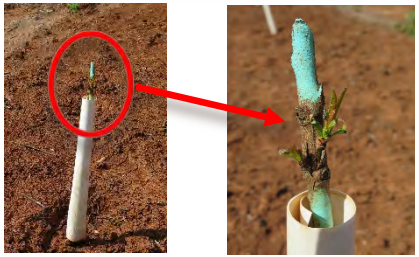
Your nurseryman is your best friend!!



Unpruned trees direct from the nursery

Side branches pruned in nursery, but trunk not headed back



Dormant budded trees

Summary

- There are some new options worth trying
  - Selective limb removal
  - Narrow “palmette” style pruning
  - Trunk girdling (but not with Nonpareil)
  - Central leader trees (slender pyramid shape)
  - High and ultra-high density planting distances
- New systems must:
  - Maintain minimal cost for the grower
  - Produce a commercial crop sooner
  - Increase yield per hectare and **grower profit!!**

Research Team and Collaborators

PFR Australia:	Grant Thorp, Andrew Granger, Belinda Jenkins, Ann Smith, David Traeger
PFR New Zealand:	Stuart Tustin, Jill Stanley, Carlo van den Dijssel, Steve Green, Edouard Périé, Andrew Barnett
DAFQ Queensland:	Neil White
California:	John Slaughter, Tom Burchell, Burchell Nursery
Australia:	Ben Brown, John Kennedy, Brett Rosenzweig, Lacton Farms, CMV Farms, Select Harvest, Mossmont Nursery

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