NSW GOVERNMENT Department of Primary Industries

primefact

Afourer canopy management Spain Tour 2022

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Summary points

- Intensive pruning was a common practice in most Afourer orchards.
- Key reasons to prune include:
    - maintaining tree height below 3 m because pickers are not allowed to use tall ladders in Spain
    - pruning to open up the tree structure helps them to dry more quickly and reduces fungal infections
    - if the trees are not pruned, yields decline once the trees mature
- Pruning takes about 5 to 10 minutes per tree depending on tree size ($4–$10 AUD/tree); labour cost is about $18 per hour Australian equivalent.
- An orchard in Morocco was trying to manage trees by allowing watershoots to grow; yields have declined in mature orchards, and they need to change their strategy.
- Spain has been in drought for a couple of seasons, with some growers receiving as low as 50% of their allocation. In Murcia, they also have high salinity water (3–5 ds/m). The growers recognise the value of good irrigation monitoring and practices.

Introduction

An Afourer mandarin (Nadorcott) tour was conducted in November 2022, visiting many orchards in Spain and one in Morocco. The focus of the study tour was to learn about canopy management strategies to maintain productivity. There are 18 videos, one for each farm visited, and videos range from 2 to 10 minutes that are available from the NSW DPI website. This report summarises the information from each videoed farm visit.

1) Transforming large Afourer trees with intensive pruning

9 min: Crescasa Farms, Seville. A mature Afourer (Nadorcott) orchard transformed over several years from large unmanageable trees to intensively pruned trees that can be managed from ground height.

https://youtu.be/Ci16UBvm_RM

- 6 × 3 m planting, 7 years ago the trees were 5 m tall. They were mechanically pruned and produced a low yield of about 35 t/ha.
- The trees were hand pruned, and size was gradually reduced to about 2.5 m over 3 to 4 years.
- Average yields have improved to about 55 t/ha.
- Hand pruning takes about 8 to 10 minutes per year.
- Tall watershoots are removed. Smaller, less vigorous shoots are left to crop and removed the following year.

2) Intensively pruned 4-year-old Tango trees, Seville

4 min: Polonio Farms, Seville. Intensive pruning of a 4-year-old Tango orchard to develop an open tree structure.

https://youtu.be/O39UWqajVys

- Tango mandarin 7 × 3 m planting, 4-year-old trees on citrange.
- Pruning is important from a young age and a key focus is keeping the trees below 3 m height.
- Brotomax®, a type of natural cytokinin, is used to help promote lateral growth.
- Keeping the trees open and well pruned is also important for fungal control; the more open the trees are, the quicker they will dry after rain or heavy dew.
- Young trees need less than 30 seconds of pruning per year.

3) IFAPA research station mechanical pruning and high density

5 min: Andalusian Institute of Agricultural and Fisheries Research and Training (IFAPA), Seville. Inspecting mechanical hedging trials of high density Valencia and Navel orchards.

https://youtu.be/RWprbizF1Ts

- Experimenting with high density hedgerow Valencia, common orange and navel trees.
- They have tried row spacing from 2 to 4 m, and the 4 m spacing seems optimal.
- The main pruning strategy is mechanical hedge pruning and some minor manual hand pruning is also conducted. In the early years, productivity is very good.
- As the trees mature, the yields become limited or decline because mechanical hedging cuts off too much of the productive wood. Mechanical hedging also does not promote a good limb structure and fruit tends to crop more on the upper parts of the tree.

4) Intensively pruned maturing Tango orchard, Murcia

4 min: maturing Tango trees that are intensively pruned to develop an open tree structure.

https://youtu.be/VFW97iOTClA

- Eight-year-old Tango trees on a 6 × 2 m spacing that have been well pruned from a young age.
- Annual pruning is about 4 to 6 minutes per tree.
- Large watershoots are removed annually and branches are spaced to allow light and air penetration.
- Yields have been high at about 60 to 80 t/ha.

5) Murcia minimal vs intensive pruned 7-year-old Tango orchard

2 min: a quick inspection of 7-year-old Tango trees that were pruned or not pruned.

https://youtu.be/mT6RmvPKEKc

- The pruned trees had a good crop load and a very good limb and branch structure that allowed light to penetrate throughout the tree.
- The un-pruned trees were congested, carrying a lighter crop load than the pruned trees and already carrying deadwood.

6) D'Quart Tango orchard Afourer pruning demonstration

4 min: Afourer pruning demonstration by the grower.

https://youtu.be/VGqGOU0PENw

- 6 × 2 m spacing, on macrophylla rootstock because it is salt tolerant.
- Annual pruning is essential. It costs about €1,000/ha (AUD 1,600), but if a year is missed, pruning is more difficult and costs €3,000 to €5,000/ha ($5,000 to $8,000).
- Removing suckers is the key practice, however, some shorter ones (e.g. 750 mm) are left behind as cropping wood.
- Intensive pruning has been averaging 50 to 60 t/ha.

7) Observations of intensively pruned navel trees

2 min: observations and commentary of intensively pruned Navel trees in Murcia.

https://youtu.be/OL4yDnR4Gvs

- Tree height is maintained below about 2 m.
- Annual pruning is essential.
- Light penetration and cropping are throughout the tree.
- Intensive pruning has been averaging 50 to 60 t/ha.

8) 7-year-old Tango trees late summer pruning, Angel Mateo orchard

3 min: 7-year-old Tango trees with late summer pruning, grown with high salinity water.

https://youtu.be/3SFbPOvPH7g

- 7-year-old Tango trees on macrophylla rootstock.
- 8–10 minutes pruning per tree per year in late summer to early autumn.
- Tall watershoots are targeted, low vigour watershoots (e.g. below 700 mm) are kept to provide cropping wood. Some branches are removed to make space around the tree (window layering).
- High salinity water (peaking at 5,000 EC) is used to irrigate and special fertigation and water management techniques are used to manage the trees with high salinity water.

9) Murcott pruning, Angel Mateo orchard Murcia, Spain

2 min: removing watershoots from the centre of Murcott trees.

https://youtu.be/D2FbCpRi3ak

- 15-year-old Murcott orchard.
- Murcotts are not as vigorous as Afourer but pruned similarly.
- Take vigorous watershoots out of the tree's centre and leave behind medium-sized ones.
- Currently not much management on the sides of the tree.

10) Oronules clementine pruning Murcia, Spain

2 min: annual pruning of Oronules.

https://youtu.be/rOCcO-jip1Q

- Annual pruning costs about €3 per tree, 4.2 trees per hour.
- It is important to open the canopy to let light inside the tree. This also helps to improve spray penetration and coverage.

11) Afourer mandarin growing under nets – autumn watershoot pruning

3 min: Afourer mandarins growing under hail netting are annually pruned in spring and autumn.

https://youtu.be/n-uoK6PIR_g

- Apart from obtaining less blemish, the orchard is enclosed in spring to prevent bees from entering the orchard (bees cross pollinate flowers and produce seeds in fruit).
- Pruning is done straight after harvest to thin out the branches and then again in autumn to remove watershoots.
- They believe the ideal spacing is 6 m × 4 m; this orchard is 6 m × 2.5 m, and they will probably remove every second tree.
- Pruning costs about €2 to €3 per tree.

12) Automated in-field soil solution analysis iOLAND, Murcia, Spain

4 min: in-field soil solution analysis and a soil moisture device that analyses soil solution regularly.

- A soil solution analysis unit is placed in the orchard so samples can be taken regularly and the results transmitted to a cloud server (internet dashboard).
- A soil moisture probe is installed with the soil solution device.
- Nitrate, potassium, ammonium, chloride, magnesium and calcium are quantified.
- The machine has calibration solutions to stabilise the accuracy of results.
- The results help modify fertiliser rates to best suit the site conditions. In combination with soil moisture monitoring, we have achieved a 30% saving in water.

13) iOLAND Tango pruning trial

6 min: comparing 6-year-old Tango trees that were pruned or un-pruned for 2 years.

https://youtu.be/Wn_1xA7KYSY

- 6 × 2 spacing, 6-year-old Tango orchard with FA5 rootstock.
- The trees that have not been pruned are growing large watershoots that will cause row access issues, deadwood is forming in the trees and fruit are not bearing in the middle of the trees.
- The pruned trees have enough space between the branches for light to penetrate the centre of the tree and pickers can access the tree's centre.
- Pruning aims to structure the tree with 4 or 5 main limbs. Branches are at different stages of growth and this year's shoots produce next year's crop.
- Pruning is done after spring and again in autumn to remove undesirable watershoots.

14) iOLAND Afourer plant spacing discussion

2 min: discussion on planting Afourer mandarins at 6 × 2 m spacing.

https://youtu.be/yMP141Jpmos

- Planting at 6 m × 2 m spacing produces high early yields; current yields are about 60 t/ha.
- Pruning annually is essential.
- The annual expenses are the same as a lower density orchard but with higher yields.

15) Tango mandarin high density trial

3 min: 3 m × 2 m 4-year-old Tango high density trial.

https://youtu.be/P2c0surPEtM

- 3 m × 2 m 4-year-old Tango high density trial.
- Last season's yield was 50 t/ha and this season crop load estimates predict 70 t/ha.
- Combination of mechanical pruning and hand pruning is essential.
- Need to manually spray trees from late summer because there is no tractor access.
- We will need a few more years of results to make a conclusion on the spacing.

16) Ori mandarin growing principles

9 min: techniques to maintain Ori mandarin production.

https://youtu.be/7iFwR3L8wvU

- Moderate reduction (~25%) in irrigation and fertiliser application during fruit set.
- Need to assess if there are too many or too little flowers; we can use growth regulators such as FenGib or GA to help increase fruit set.
- After fruit set, we count the fruit to assess if we need to thin the crop (two whole trees per hectare). Growth regulator thinning timing depends on the percentage of fruits within a particular size range. We also monitor the growth and assess if further fruit-sizing strategies are needed.
- Ori's have too much growth during fruit set so we use FenGib® to reduce vegetative growth and increase fruit set.
- Trees are pruned after harvest and again in late summer to early autumn if there are too many watershoots or excessive crop load. Pruning costs €2 to €2.5 per tree (€800–€1000 per hectare).
- The aim is to prune the trees to have an open structure, remove the old branches to encourage new ones and create windows into the tree.

17) Afourer growing; watershoot layering, Morocco

6 min: experiences growing Afourer mandarins by allowing watershoots to produce fruit.

https://youtu.be/PQUyq7MggHk

- Watershoots are allowed to grow and crop fruit. To harvest the fruit on watershoots, they use a pole with a hook to bend down the watershoot.
- Pruning is done straight after harvest with hand saws, 5 min per tree. A portion of the watershoots is removed and the tree's centre is cleaned out to obtain a V-shape.
- Sometimes watershoots are bent by pushing them under other branches or tying them down with string onto a rock.
- Trees on macrophylla rootstock are less vigorous, have wider opening branches, require less pruning and are easier to manage than those on more vigorous Volkamariana rootstock. C35 is slightly less vigorous than Volkamariana rootstock.
- Wooden stakes are also used to prop up limbs with a heavy crop load (labour ~ $2 AU/day).
- They are considering planting trees at a 1 m spacing and removing every second tree at year 5, as this should obtain enough yield in the first 5 years to profit from planting and removing the tree.
- The watershoot layering method is productive for young trees that have not filled the allocated row space (6 m) but is not productive once the tree has filled their allocated space as seen in a mature orchard with row access issues and declining yields. The farm is exploring other pruning options to maintain mature tree productivity.

18) Afourer watershoot bending and pruning, Eurosemillas

10 min: bending branches at a young age to form a V-tree shape and pruning the tree to continually turn over new wood, including using watershoots as bearing wood.

https://youtu.be/nH81TmOdBQU

- Young trees are planted on weed mats to save water (the region is in drought) and reduce weed problems. Branches are bent at a young age with string and tied down to a ground wire to get higher early production by developing a larger canopy area with good light penetration (angled branches are more productive than vertical ones). Bending occurs in the first 4 years, and then the tree is managed by pruning.
- Five-year and older trees are pruned to clean out the centres and obtain a V-shape.
- Pruning takes about 5 min per year (labour ~ $18 AU/h); pruning is done in summer (3 months after petal fall).
- A key focus of pruning is letting light into the tree and minimising the shading of branches.
- The canopy and cropping wood are rejuvenated every few years by removing old branches, watershoots and limbs and allowing the younger wood to crop. Branches or watershoots can also be bent under other branches. A proportion of new shoots, especially watershoots, are removed because too many emerge and need to be thinned out.
- Tall branches are cut down or removed once their productive time is expired to maintain tree height at about 2 m. All fruit needs to be picked from ground level; pickers can only use one-step elevation devices.
- Trees are spaced at 7 m rows because it provides more air circulation to help the tree dry faster from morning dew (or rain) during the winter harvest. Tree spacing is 1.7 m.

Acknowledgements

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