

ALL ABOUT ALMONDS

Almond planting and early tree establishment — a researcher's experience

Part 3. Establishing a strong fruiting canopy



New planting and training systems are required for high density almond orchards.

Plant & Food Research began working with the almond industry in 2014 to help re-design almond orchards. This meant taking a fresh approach to lift productivity above the norms established by Californian growers.

Knowledge generated from this study is helping the almond industry move towards higher profits from new, high density growing systems.

**Dr Grant Thorp
and Ann Smith**

Our approach to developing new growing systems for almond has been to produce trees with tall, narrow canopies that enable early high yields with better utilization of incoming sunlight.

A tall, narrow tree shape avoids the formation of large volumes of heavily shaded, unproductive canopy in the centre of trees.

Our focus has been to plant unpruned (fully branched) central leader trees direct from the nursery. But even these trees, once planted in the orchard, require some pruning to maintain a clean trunk for the tree shakers.

Beyond this there is also a need for some remedial pruning to maintain the desired narrow canopies.

In this article we describe our experiences with establishing a strong fruiting canopy on trees of the new highly productive varieties that can struggle to support heavy crop loads especially when trees are still young.

Remedial pruning and hedging

Regardless of variety, each year we found it useful to undertake one or more rounds of remedial pruning to remove any aberrant branches. These are branches that if left would either grow out towards the centre of the rows and impede machinery access (Figure 1) or would contribute to the tree becoming top-dominant and shade out the lower scaffold branches (Figure 2). This remedial pruning can be regarded as preventive, as if left, the problems become compounded. As with all orchard operations, timing is critical and a few small cuts applied to young trees is easier to deal with than returning to remove large branches in later years.

As the trees planted in 4.5 m wide rows in our high-density trials move into their 4th year, we are evaluating the response to hedging treatments to maintain adequate light and access down the rows for herbicide control and harvesting (Figure 3). Our first attempt has involved an angled under-cut along both sides of all rows for machinery access as well as an angled upper-cut along the east-facing side of each row for light interception. This angled side cut was made using a cutting angle 8 degrees off vertical, sloping towards the top/centre of the tree. Next season, our plan will be to repeat the angled upper-cut but on the west-facing side of each row.

Figure 1. A narrow pruning technique was applied in winter to two-year-old trees to selectively cut back any strong branches growing out towards the centre of the rows. Images are examples of before (left) and after (right) pruning.



Figure 2. Remedial pruning was required in early summer, after the spring growth flush, to remove any branches that were contributing to the tree becoming too top-dominant and shading out lower scaffold branches. Images are examples of before (left) and after (right) pruning.



Figure 3. Three-year-old 'Carina', 'Maxima', 'Nonpareil', Shasta® and 'Vela' trees in 4.5 m wide rows were machine pruned using an angled under-cut along both sides for machinery access as well as an angled upper-cut along the east-facing side of each row for light interception. Images were taken after harvest and before pruning in April (left) and after pruning in May (right).



Over-cropping young trees

'Nonpareil' is a very forgiving variety in terms of early tree management. It requires relatively little pruning/training when young to produce trees with a strong fruiting canopy. Some of the new higher yielding varieties, however, require more detailed management to mitigate the effects of over-cropping. With these varieties the weight of the crop on young trees can

cause branches to collapse and the trees to form a flat, spreading tree structure sometimes called mushrooming or pancaking. We have had experience of this with Shasta® ('BA2') and 'Carina' (Figure 4) trees producing 5.7 and 4.4 kg/tree of kernel in their 3rd-leaf, respectively, and we understand it can also be an issue with 'Monterey'.

Figure 4. Heavy crop loads on young trees of 'Carina' and Shasta® can cause branches to collapse under the weight of the fruit and for the trees to form flat, spreading tree structures sometimes called mushrooming or pancaking. This is rarely an issue with 'Nonpareil' which tend to have moderate crops when young trees. Images were taken before harvest in February 2019 (left) and 2020 (right) of standard, spring-budded trees planted in 2016.



A variety of strategies have been adopted by growers to prevent tree collapse from over-cropping, including variations of selective pruning, hedging, topping and roping. While these methods can create a more compact tree structure, this generally comes at the expense of early fruit yields which is counter to our ambitions with orchard intensification to produce higher yields earlier in the life of the orchard.

Selective limb removal pruning with young trees generally involves reducing the number of scaffold limbs in the first winter after planting, selectively removing the weaker limbs and those with poor attachment either because of acute branching angle and/or included bark. The remaining limbs are then headed back. This open-vase style of pruning can stimulate very strong vertical growth in subsequent years, in which case growers in California will start using ropes to loosely tie the scaffold branches together to prevent them collapsing under the weight of the new season's crop (Figure 5).

With some varieties, growers may repeat this roping exercise until the tree structure becomes stabilised. Previously the standard method of early tree management in California, pruning and roping is becoming less popular now, mainly because of the cost involved and the loss of crop from heavy pruning of young trees.

Machine hedging and topping during spring and summer is an alternative and less expensive option to selective pruning and roping of young trees. It is becoming more popular in Spain, not only for orchards with super high density plantings (> 1,000 trees/ha) but also for orchards with more standard planting distances (Figure 6). The method requires several passes of light pruning during the growing season to produce a more compact tree but retaining the small, potential fruiting wood and spurs in the centre of the trees. So no open-vase pruning!

Figure 5. Some growers will use ropes to loosely tie scaffold branches together to prevent them collapsing under the weight of fruit (arrows indicate location of ropes).





Figure 6. Machine hedging and topping during spring and summer is popular in Spain, not only for hedge rows in super high density orchards with > 1,000 trees/ha (upper images) but also for orchards with more standard planting distances (middle and lower images). The method requires several passes of light pruning to produce a compact tree with very complex branching in the centre of the trees. Trees with a combination of hedging plus thinning out of the centre of the trees (lower right image) are likely to be less productive.

In-season firming cuts

As described for central leader trees in “Part 2. In the orchard – tree staking and tying” of this All About Almond series, we applied a combination of leader release pruning and hedging during the first two years of growth to encourage tall, narrow tree structures. We were not interested in reducing the height of the trees but rather focused on applying “firming” cuts around the perimeter of the trees to prevent the mushrooming or pancaking response. This involved cutting back by one third any long, unbranched shoots that if left unpruned would, under the weight of fruit, bend out into the centre of the rows and impede machinery access. In turn the vertical growth from these pruned branches would help support the central scaffold branches.

Depending on the variety, these firming cuts could be done by hand or by machine. ‘Carina’ trees produce numerous, relatively fine shoots/branches amenable to machine pruning without involving any large cuts. Likewise ‘Vela’ trees with their characteristic decurrent branching habit, in which shoots curve downwards when they grow and produce new shoots along the apex of the curve (Figure 7) responded well to machine pruning. While ‘Vela’ trees do not readily develop a tall narrow tree shape, this decurrent growth habit produced a highly productive, complex branching system on third-leaf trees. In our experience, ‘Maxima’ trees required little pruning and naturally formed a firm, complex branching framework that easily supported the high yields typical for this variety (refer “Part 2. In the orchard – tree staking and tying” of this All About Almonds series for yield data). In contrast, varieties such as Shasta® and Independence® (‘Alm-21’), which produce heavy crops on relatively few large limbs, are not particularly amenable to machine pruning. If one of these large limbs is inadvertently cut back during machine pruning then this can create a large gap in the canopy with significant yield reduction for this variety. Selective pruning by hand is more suitable for these varieties. ‘Nonpareil’ trees have a moderate growth habit which can be managed with a light machine prune.



Figure 7. ‘Vela’ trees two years after planting as unpruned central leader trees showing an extended branching zone along the central leader and remnants of the downward decurrent branching habit expressed in the young tree.

Economic analysis

We have not yet been able to complete a detailed cost analysis of the various pruning/training strategies described here. When we started this project, the current mantra was that almond growers did not prune their trees and so any pruning operations we introduced would simply add cost.

However, early tree establishment has always incurred significant costs for growers. Whether it be heading and trimming trees at planting, installing spray guards, staking and tying the trees, establishing and maintaining (de-suckering) a clean trunk for the shakers, lifting canopies to provide access for herbicide spray rigs, removing the broken branches and trees caused by wind and mechanical damage, replanting blow outs

with replacement trees, removing the stakes and wires when tree shakers need to harvest the first crop ... all of these operations incur cost and invariably they are costs which can quickly escalate if operations are not undertaken on time.

We believe that many of these costs can be reduced through subtle changes in the way growers manage their young trees.

Hopefully some of the different approaches described here from our experiences in setting up and managing new blocks for research trials will provide useful indicators of a better way to establish new orchards and obtain early high yields as a precursor to longer term sustainable high yields.



For more information

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