

Strategies for Renewal of Unproductive Older Avocado Orchards with Severe Encroachment Problems

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INTRODUCTION

The avocado industry is presently in a strong export market, where quality and size of fruit are important factors. However the producers are experiencing problems with management of tree size, which makes harvesting of fruit in the tops of the large trees difficult and hazardous. Most of these fruit are usually not of the required size, and during picking suffer mechanical damage, which make them unexportable. Labour productivity is severely hampered by these large trees, and tree yield is also low.

To resolve these problems, producers started with a pruning practice of staghorning trees at a certain height. Uncontrolled regrowth made these trees unproductive for two to three seasons while tree size was soon a problem again due to the vigour of avocados. Another measure taken was the removal of alternate trees or rows of trees, but this only postponed the problem.

The aim of this paper is to provide an alternative to the above mentioned pruning strategies. An alternative which will not only be more effective, but will enable the producers to stay in production over a longer period of time, without losing crop.

Principles involved in pruning trees

Pruning of trees is normally done in order to correct a situation of low light penetration into the orchard, which makes the orchard unproductive. With pruning, the plant as a factory of energy and dry mass is optimised, enabling it to produce a good yield of quality fruit of the right size. The following principles are involved in optimising the tree by pruning:

- Photosynthesis is related to total leaf surface that is effectively exposed to light. The more leaves exposed to sunlight, the more energy and dry matter can be produced.
- At least 30% of full sunlight radiation is required for all plant processes to function normally. Lack of enough sunlight results in die-back of branches and reduction in yield, fruit size and quality.
- Crops can only utilise the light intercepted by the leaf canopy. Therefore tree shape determines the amount of sunlight penetration onto the leaf surfaces. The conical or pyramidal shape gives the best light penetration and interception.



Figure 1
Dense avocado orchards with overshadowing of lower branches



Figure 2
Severe pruning of alternate rows with light shaping of the remaining rows.

It is evident that the existing mature avocado orchards do not comply with the above mentioned principles of light interception and penetration. It is therefore expected that yields should decline under these circumstances, and that fruit size and quality are not optimal. Bare branches and dead wood inside the tree are common phenomena in avocado orchards. With increasing encroachment, the occurrence of pests and

diseases increase.

Strategies for regenerating mature trees

The following strategies and practices are proposed to alleviate the problems.

Bearing in mind the principle that light interception and penetration are the most important factors involved in increasing yield and fruit size, the pruning of trees must be seen as a continuous practice and not simply a once-off operation.



Figure 3

Shaping and pruning of encroached avocado orchards.

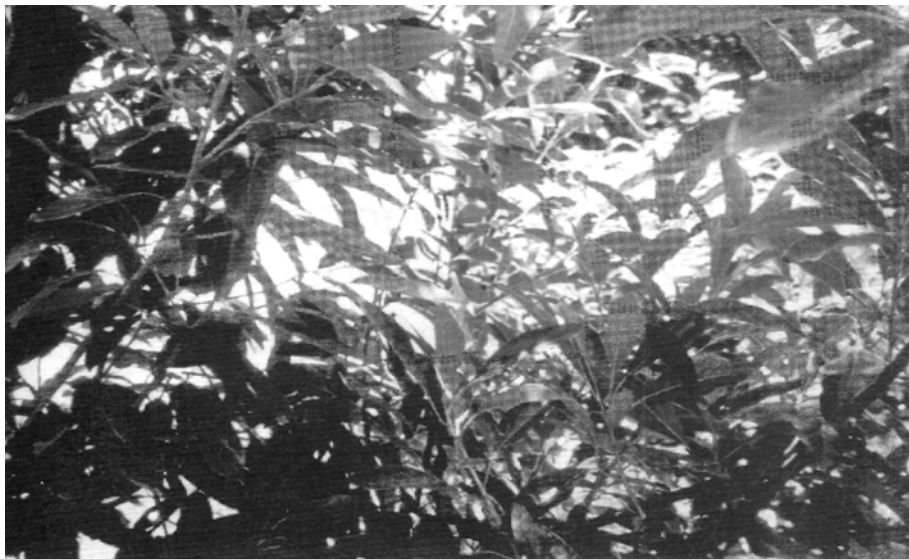


Figure 4

Development of strong, new production branches on the innerside of the tree framework.

Severe encroachment situations

- Stag-horning orchards.

This strategy was used in the past with little success, due to the fact that new growth was not managed, and trees were back to their original size within a few seasons. However if management of new growth is done regularly, the tree shape and size can be maintained. The tree will bear sooner with management of the suckers and side shoots, and yields can be maintained over a much longer period.

- Removal of alternate trees or rows.

This strategy is mainly used in higher density orchards, to alleviate the encroachment problem for a few years. If tree size and shape of the remaining trees are managed these orchards could remain productive, with good yields of quality fruit of the correct size.

- Stag-horning alternate rows.

This strategy can be used to alleviate the encroachment situation, without losing the whole crop. If the remaining trees are shaped to the pyramidal shape as will be described below, these trees will stay productive, and tree size will be decreased over a number of years. On the other hand, the stag-horned trees must also be managed the moment new growth starts developing. Select 4-5 leader branches, and keep them growing upright. Other branches must be pruned to develop into bearing units with enough side branches for good yields close to the main framework. These actions must be taken during the growing season; otherwise bearing wood is lost due to overshadowing of branches.

Light encroachment situations

- Severe pruning of alternate rows the first strategy to alleviate this problem is by pruning alternate rows severely. These trees are shaped into pyramidal form and the height of the trees is reduced where possible. Light penetration into these trees is very high and redevelopment of branches is extensive. The other rows of trees are only pruned lightly to let the light penetrate the tree canopy, and branches overshadowing the other row are pruned back to strong branches lower in the tree.
- Pruning and shaping all trees. In light encroachment situations, drastic steps as described above do not have to be taken. In these cases it requires the removal of only a few branches which are causing overshadowing problems, while other branches are only pruned back lightly.

The pruning of trees in this situation is done just after harvesting the crop. Select three to four leaders which are upright growing branches *inside* the trees. Any other branches growing upright and situated on the outside of the trees, are pruned back to strong, healthy side branches, growing sideways. In this way windows are created into the tree and light interception and penetration is increased.

Keep in mind that the pruning back of branches must be done in such a way that the pyramidal shape is created, and that the eastern and western side of the trees are reduced, to allow light penetration onto the lower branches. A hedgerow situation is

created in the north south direction, with the trees touching only on the lower parts.

Once the growing stage has commenced new shoots and suckers will develop near the cutting points, as well as inside the trees on the thicker branches. This growth has to be managed in order to obtain the right amount of light penetrating into the tree. Suckers are normally removed at an early stage to reduce the amount of energy they utilise. If the suckers can be used to replace older wood in the trees, they are cut back to strong side branches to make them fruitful in the shortest time. Upright growing shoots are removed as they overshadow lower branches; horizontal branches are encouraged to develop into bearing units by tipping them. This will force these shoots to develop side shoots, thus creating a complex branching framework. It is very important to do this summer pruning. Without summer management all the initial benefits are lost within weeks.

PRACTICAL IMPLICATIONS

To gain the most advantage from tree pruning it is very important that pruning is done at the right time, to avoid strong regrowth of trees. To get the best reactions it is necessary to do major pruning work just after harvesting. In winter when fruit is harvested, the trees are dormant, and when the growing season starts most energy is relocated to the flowers and young fruit. This results in productive wood being developed in favour of water shoots. Summer pruning is a very easy task which should be done two to three times during the growing season. Lighter pruning where side branches are pruned back to stronger branches can also be done during this time. Bear in mind that unnecessary application of nitrogen will stimulate growth of water shoots.

Results which have been achieved thus far with the pruning trials in the Kiepersol area indicate that light penetration can be increased considerably as shown in the following Table 1.

Table 1 Influence on pruning and subsequent management on the light penetration into the tree.	
<i>Treatment</i>	<i>Light penetration at 1,5 m above ground level</i>
No pruning	7 % of total sun radiation
After pruning	58 %
In summer	no management 11 %
In summer	with management 40 %
In summer	reshaping trees 49 %

From the table it is evident that summer pruning is necessary to increase the light in the tree above the 30% minimum level for optimising tree productivity.

If trees are unproductive, trees can also be pruned in late summer to achieve the right shape. Make sure the trees are not yet in, or starting the last growing stage before winter, to ensure the maximum advantage from pruning. Follow-up pruning is again necessary to ensure the right development of shoots. This period of time will enable the newly formed shoots to harden-off and become fruitful before the new season starts. Productive trees should however only be pruned after harvesting, to save the fruit. When pruning trees in the growing season, the fruit could develop sunburn and are then unexportable.

CONCLUSION

It is evident that the avocado tree can be managed in such a way as to retain the right size and shape and increase the yields of orchards. The time for pruning the trees is however one of the most important factors determining the success of the operation. Productive trees with low yields should be pruned just after harvesting, to get the best results. Summer management of the new shoots and suckers is the second most important factor determining results.

The minimum light penetration required for optimal functioning of the plant, i.e. 30% of full sunlight can be easily achieved by pruning unwanted branches to strong and healthy side branches. Light penetration levels of up to 58% were achieved but these levels diminished during the growing season to 11% which is only 4% better than unpruned trees. With normal summer management of the new growth these levels can again be increased to 40%.

Bringing avocado trees back into production without yield loss can be achieved over two to three seasons. It requires the correct timing of the pruning operation and the follow up management during the summer months. The height of the trees is reduced only in the second season, to allow the tree to first develop new side branches as well as replacements for the leaders lower in the tree.



Figure 5
Pyramidal shaped avocado tree (16yr old)
to intercept maximum sunlight.

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