

TRAINING YOUNG HASS AVOCADO TREES INTO A CENTRAL LEADER FOR ACCOMMODATION IN HIGHER DENSITY ORCHARDS

P.J.C. Stassen, S.J. Davie & B. Snijder
Institute for Tropical and Subtropical Crops,
Private Bag X11208, Nelspruit, 1200,
Republic of South Africa.

Abstract

Avocado trees should be shaped in the nursery and trained immediately after planting to a central leader. It is necessary to balance the side shoot growth at specific times and remove strong upright water shoots. The resultant conical or pyramidal tree shape will allow better light interception by the leaf canopy and improved light penetration into the canopy for maintaining bearing wood and avoiding unproductive bare areas. Small timeous manipulations will make later major pruning, which could stimulate deleterious vegetative growth, unnecessary. Early attention to tree shape will make higher density plantings manageable and highly efficient trees a reality.

Key words: tree structure, manipulation techniques, *Persea americana*

1. Introduction

Avocado producers in South Africa have traditionally believed that the ultimate size of an avocado tree determines the initial planting distance. This has led to plantings of 8 x 8 m and mostly 10 x 10 m made some 15 years ago, resulting in the giant trees found today. The orchards become light-impenetrable caverns with vast unproductive surfaces developing within and between the trees. The bearing surfaces shi-ft ever higher in the tree and further from the centre of the tree. The practise of removing alternate rows or certain identified trees brings only temporary relief and the trees rapidly fill the space created resulting in even larger trees.

Currently orchards are being planted at densities of 5 x 5 m or 400 trees per hectare (Köhne & Kremer-Köhne, 1992 and Köhne, 1993). This, however, accelerates the overshadowing problem and results in encroachment by about the sixth year with the necessity of a tree thinning strategy. Alternatives to tree thinning, which is regarded by Stassen, Davie & Snijder (11995) as illogical when the trees have only just reached their bearing stage, are:

i. to prune trees to a pyramidal form just after harvest and to follow this up with certain summer pruning manipulations (Snijder & Stassen, 1995). In this way light interception and light penetration is improved and die-back at the base and within the tree is prevented.

ii. to saw back alternate rows and develop into a central leader structure (G. Martin, University of California, Riverside - personal communication, 1995). When these trees come into production the remaining trees are corrected.

Köhne & Kremer-Köhne (1992) found that the break-even point higher yield, especially in the initial years, is reached sooner with plantings of 800 trees per hectare as opposed to 400 trees per hectare.

Stassen *et al.* (1995) recommend that new orchards for higher density plantings be spaced, orientated and structured in such a way that they can be maintained within their allocated space for as long as possible. Instead of a grow-as-you-wish approach it is recommended that certain manipulation inputs be made to achieve the most suitable tree structural form, based on the classical recommendations of Cain (1972). A planned framework is obtained with the use of manipulation techniques and adherence to certain principles, such as a hedgerow system orientated in a North-South direction (Stassen *et al.*, 1995).

The purpose of this paper is to provide certain provisional guidelines by which young "Hass" avocado trees can be shaped to a central leader and maintained in an orchard of about 800 trees per hectare. This study is still in the initial stages but there are promising indications that this structuring together with some other manipulation tools as listed by Wolstenholme & Whiley (1990), will supply the means to achieve:

- i. an earlier break-even point
- ii. more manageable trees
- iii. more efficient orchards
- iv. continuous renewal of future bearer shoots

2. Materials and methods

Nursery, newly planted and young bearing Hass on Duke 7 trees in the Kiepersol area were used to test the principles expounded by Stassen *et al.* (1995) on a semi-commercial scale. Information, observations and reactions obtained in the past 24 months will be discussed.

3. Results and discussion

In this paper we are limited to discussing guidelines for developing "Hass" into a central leader. The first trees trained are now 24 months old and have retained an adequate fruit set (figure 1). The following principles must be borne in mind:

- i. avocado trees can be manipulated but the timing and intensity, as well as the type of cuts made, will influence reactions
- ii. tree manipulation is not a one-off treatment especially in the initial formative stages where drastic cuts should be the exception.
- iii. young trees must be strong-growing during the formative stage.
- iv. early fruiting, from the second year, is a requirement and must be induced. Various methods as discussed by Wolstenholme & Whiley (1990) should be applied where necessary.

Manipulation guidelines for successfully shaping a central leader tree are briefly as follows:

i. develop the tree as far as possible in the nursery by selecting or forcing a strong vertical shoot just above the bud union. If the shoot is allowed to develop rapidly, lateral shoots will develop more horizontally with a natural balance relative to the leading shoot. A strong root system is essential. The selected shoot must be supported by wire or a thin rod which does not restrict side shoot development. A strong tree from the nursery that already has only one leader and a few well balanced side shoots can be easily trained further in the orchard (figure 2).

ii. plant trees before a flush period to perpetuate strong growth, preferably between July and October. Fertilise monthly with 30 g nitrogen (LAN) per tree and irrigate.

iii. if the trees from the nursery have the wrong growth structure the tree must be pruned accordingly. Where the tree has no side shoots or has developed crookedly a strong lower vertical shoot must be forced into a central leader. The original part must not be immediately removed but should be bent till the new shoot starts to develop.

iv. side shoots that are more than a quarter of the thickness of the leader must be bent horizontally or cut back 50% to a bud or preferably to a flatter lateral side shoot. Shoots more than half the thickness of the leader must be removed at their juncture with the main shoot.

v. side shoots must be tipped at 200 mm to force lateral shoots if they are not developing normally. These laterals develop into the future bearers.

vi. do not unnecessarily remove leaves but remove unwanted shoots early.

vii. remove strong vertical shoots and shoots in unwanted positions early, especially those with narrow angles of attachment. Keep side shoots reasonably horizontal by cutting to flatter laterals in late summer.

viii. remove very low shoots (to a height of 50 cm) that will hang on the ground or will hamper irrigation and cultivation processes during the first winter. Also remove shoots that are too dense or close together. Continue with the structural forming of the tree throughout the spring and summer. Trees which are 20 months and older should be forced to set fruit by restricting growth during autumn. Scholefield (1985) found that avocado flower initiation took place in autumn. As this is the period when decisions on the trees' reproductive development are made the process must be supported for a good fruit set. In places with lower soil potential, growth will be easily controlled with normal practices. Cincturing can be used in early autumn to force strong growing trees to set fruit.

At a fruit size of about 30 mm, fruit thinning should be done by pruning so that the tree potential is not exceeded and fruits of an acceptable size are produced. About 80 fruit/tree should be left on trees of this age. Further tree manipulation entails cutting back side shoots to laterals, especially to the more horizontal, and keeping in mind the width limitations and the pyramidal shape requirement. This pruning should take place in the post harvest period and with the removal of vertical water shoots in spring and summer. Bearer shoots will be renewed by cutting back branches in the post-harvest period. Vigorous water shoot development indicates excessive nitrogen application in the vegetative stage, which should be avoided.

References

Cain, J.C., 1972. Hedge row orchard design for most efficient interception of solar radiation. Effects of tree size, shape, spacing and row direction. *Search Agriculture* 2(7):1-15. N.Y. State Agric. Expt. Stn, Geneva.

- Köhne, J.S. & Kremer-Köhne, S., 1992. Yield advantages and control of vegetative growth in a high-density avocado orchard treated with paclobutrazol. Proc. of Second World Avocado Congress. 233-235.
- Köhne, S.J., 1993. Spacing trends in the avocado industry. J. S.Afr. Soc. Hort. Sci. 3(2):90-91
- Scholefield, P.B., Sedgley, M. & Alexander, D.McE., 1985. Carbohydrate cycling in relation to shoot growth, floral initiation and development and yield in the avocado. Scientia Hort. 25:99- 110.
- Snijder, B. & Stassen, P.J.C., 1995. Strategies for renewal of unproductive older avocado orchards with severe encroachment problems. S.A. Avocado Growers' Assoc. Yrb. 18:56-58.
- Stassen, P.J.C., Davie, S.J. & Snijder, B., 1995. Principles involved in tree management of higher density avocado orchards. S.A. Avocado Growers' Assoc. Yrb. 18:47-50.
- Wolstenholme, B.N. & Whiley, A.W., 1990. Prospects for vegetative- reproductive growth manipulation in avocado trees. S.A. Avocado Growers' Assoc. Yrb. 13:21-24.



Figure 1. Central leader tree
(24 months)



Figure 2. Young nursery tree