

SOME ECOPHYSIOLOGICAL ASPECTS OF CANOPY MANAGEMENT

B. Nigel Wolstenholme

Horticultural Science, School of Agricultural Sciences and Agribusiness
University of Natal, Pietermaritzburg, South Africa

Avocado orchard canopy management is a controversial subject, and researchers, extensionists and growers have suggested several approaches. My talk will summarize the evolutionary, ecological and physiological features of the avocado tree that have a bearing on orchard tree performance.

The indigenous habitat of the "subtropical" avocado was high latitude rainforests in Mexico and Guatemala, *inter alia*. Rainfall varied from 700 - 1600 mm, with a dry period in winter and spring. The climate was cool and mild throughout the year. Avocado trees evolved as late successional small gap exploiters in forests, or on the forest edge. They conform to the Rauh architectural model, which permits rapid growth through cohorts of short-lived leaves under favourable conditions. Flowering and fruiting is mainly pseudo-terminal (indeterminate) but also partly determinate. Fruiting, due to the high oil content of fruit flesh, is energy-expensive.

In spite of a long history of use, the avocado tree is in fact poorly domesticated in respect of the requirements for modern orchard management. Vigor and large tree size result in inefficient use of space, and a high percentage of shaded leaves. Therefore canopy (as opposed to individual leaf) photosynthesis and whole-tree carbon budgets are compromised. Low yield per hectare and irregular bearing result. Avocado leaves are adapted to the "low sun, low stress" model, with carbon assimilation limited more by shade (low light) than CO₂.

Attempts to improve orchard efficiency by tree manipulation, including high density planting, tree shaping and pruning, growth regulators, girdling etc, are a response to the low yield crisis, and the yield plateau of 10-20 t/ha in spite of advances in technology. There is therefore increasing economic pressure on growers. There are several plausible but under-researched intensification solutions, and the plasticity of avocado tree response to manipulation is encouraging. However, evolutionary ecophysiological constraints still exist in current cultivars and rootstocks. It is probable that all proposed solutions have merit ("there are many ways to skin a cat"). However, practicality and economics will dictate, and how many growers are prepared to take the quantum leap in technology that is demanded? Reliable, long-term research data are lacking, and practice is outpacing research.

In conclusion, the traditional avocado orchard is inefficient and needs to change, but how? Management of light in tree canopies is the key, but avocado trees present more difficulties than deciduous and citrus trees.

By their very nature, avocado trees need to grow vegetatively and renew their peripheral leaves, thus exacerbating the shading problem. Their sensitivity to ecological stress is reflected in reduced yields and poorer fruit quality, and over-vigorous responses to pruning (especially in the humid subtropics) must be curbed by more pruning and growth regulators. Maximizing light interception in smaller canopies is needed. New cultivars and rootstocks are needed even more.