Proceedings of The World Avocado Congress III, 1995 245 - 250

AVOCADO TREE STRUCTURING

Gray Martin and Guy Witney
Department of Botany and Plant Sciences
University of California, Riverside
C.A. 92521 U.S.A.

Abstract

Tree form in *Persea americana* varies from tall and open to short and compact with varying composites. Tree form is modified in the nursery by grafting, pinching, pruning and nursery spacing. Therefore, the resulting tree is not necessarily in the shape programmed by its genetic information, but has been modified by nursery conditions. The authors point out the problems with the present tree form, and offer an alternative form, the central-leader. Where the central-leader form is most appropriate and how it may enhance orchard productivity is discussed.

1. Introduction

Effective and efficient light distribution in the avocado grove is a controversial and somewhat complex problem (Witney, 1992). It has both historical roots and causes. Unlike some researchers seeking to manipulate tree form to a prescribed formula designed to maximize light efficiency, both in terms of leaf light exposure and shade effect on neighboring trees (Barrett, 1938; Köhne and Köhne, 1991; Stassen, et el., 1995), our work does not compare various tree forms (e.g. open-vase, hedgerow, espalier, etc.) but rather compares the traditional semi-spherical with what may be the more natural columnar form, which will be herein referred to as a central-leader (Martin, 1991).

Historically, one has to ask if much consideration was given to manipulating the tree form in the very early years of the avocado nursery industry. In those early years certainly some knowledge was at-hand regarding propagation, and the general knowledge of citrus was growing rapidly. Therefore, avocado nursery practices likely mimicked citrus advances rather than finding an individual identity. Yet when comparing mature citrus and avocado seedling trees one observes very different canopy forms, or shapes. Citrus seedling canopies tend to be semi-spherical or dome-like, avocado seedling canopies tend to be columnar. Standard citrus nursery practices routinely top and groom young container trees to spherical canopies. And, so too are avocados "trained". But, what influence does this early "training" have on the form of the older, mature trees? In citrus, the nursery tree canopy develops to a semi-spherical canopy similar in form to older seedling trees. But, pruned avocado nursery trees grow very different in form compared to adult columnar seedling trees.

The "Hass" avocado is genetically inclined to a moderate apical dominance (Thorp, 1992). Any pruning to encourage a canopy "head" of multiple branches in the nursery will cause branch competition for single shoot domination. This competition results in tree spread. It can be

demonstrated that mature "Hass" avocado trees can be grown as upright trees (central-leader), thereby considerably narrower in width than multiple-branched specimens. The central-leader apical dominant shoot naturally subordinates the typically problematic lower lateral branch vigor.

The topic of tree structuring is incomplete without first addressing the problems of avocado tree convergence and shading (Witney, 1992). And, one cannot fairly discuss this topic of crowding, converging trees without including pruning and stumping techniques. And any discussion of stumping will include a description of avocado regeneration and tree structuring. Thus, all these topics are interrelated and connected (Table 1.).

2. The Problem

Currently many of the groves in California look and act like avocado forests. As trees begin to crowd the loss of the canopy reduces not only production surface area but reduces the trees ability to be productive (Figure 1.).

(The graph in figure 1 is based primarily on personal observation and on the assumption that evolutionary events support this argument. For example; A single avocado tree growing with a full canopy exposed to light has a "job" to perform in perpetuating the species and building an immediate avocado population; as a result, the tree produces large numbers of offspring in the form of fruit and seed. Conversely, the avocado that is squeezed in among many of its own kind -- an avocado forest -- is under no "pressure" to produce offspring. In crowded conditions, with only a small portion of the original canopy exposed to light, any seed (fruit) production would not likely survive on the forest floor absent of light. This is not a very efficient use of plant energy, therefore it is likely that the crowded tree typically reduces production and goes into a "dormant" reproductive stage.)

Cultural discussions of extensively shaded groves usually results in pruning or stumping recommendations. In recent years more attention has been devoted to these topics and both traditional and novel approaches are advanced. Admittedly, the authors have a research interest in the topic of avocado pruning (Martin, 1993), and we are studying several novel, albeit unproven, theories to increase and sustain high yields from this work. But, as valuable and appropriate as pruning is for crowding trees, the topic of tree structuring is in our minds equally or more important (Martin, 1991).

3. The Central-Leader Tree

The central-leader avocado can be roughly defined as the managed tree structure of one main trunk with non-competitive, fully developed lower lateral limbs. Obvious attributes can be summarized as: 1) Narrower tree width or spread; 2) Less wasted canopy volume inside the light deficient tree interior; 3) Maximum light exposure to canopy is easy to achieve and maintain; 4) The trees are easy to prune and manage; 5) There is potential for high density plantings. A distinct drawback is the necessity to train and stake the young leader shoot.

4. Training the Central-Leader

After all that has been said it would appear reasonable that the best place to begin tree structure training would be in the nursery. And, to this end we are working with field systems of encouraging central-leader development from nursery trees. This effort is currently stalled, primarily because of an infestation of a newly introduced spider mite; Persea. The mite damage to the leaves resulted in a temporary cessation of growth and affected the central-leader development in a significant portion of the trial. Additionally, the properly trained central-leader tree requires the retention of all the lower lateral branches--even for young nursery trees. Technically this requirement is difficult to achieve in the nursery where trees must be tightly packed in multiple rows for space efficiency. Central-leader shoots defoliated of low lateral branches will result in a terminal growth flush causing top-heavy, bent shoots if not topped (a standard nursery practice). Nevertheless, in spite of these problems the issue of central-leader trees no less important or practical.

Central-leader trees can be successfully trained from regrowing, stumped trees in the crowed grove. Avocado regeneration potential is both tremendous and underutilized. Currently work is being conducted in commercial groves in California as an alternative to traditional thinning practices. Alternate trees are stumped, low (generally 30-60 cm), rather than being removed completely. The stump regrowth is trained to a single shoot rather than allowing the normal abundance of shoots to compete for dominance. The single shoot is staked and managed to a central-leader. Obviously, many variations exist on how to manage the remaining uncut trees to benefit from light penetration into the grove. Some of these variations are being studied, including stumping the remaining trees once the trained central-leader trees come into production. Each variation operates on the new assumption that the current "Hass" avocado tree form can be modified from spreading to more narrow, and that it is no longer necessary to totally remove trees, thereby, reducing tree density.

References

Barrett, C. 1938. Pruning practice on the avocado. Calif Avocado Soc. Yrbk. 9: 113-118.

Köhne, J. S. and S. Köhne. 199 1. Avocado high density planting--a progress report. So. African Avocado Soc. Yrbk. 14:39.

Martin, G.E. 1991. Avocado tree structuring. Calif Avocado Soc. Yrbk. 75: 51-56. Martin, G.E. 1993a. The avocado prune. 1. Pruning young or rejuvenating avocado trees. Calif Avocado Soc. Avocado Quart. 26: 5, 6, 11, 12.

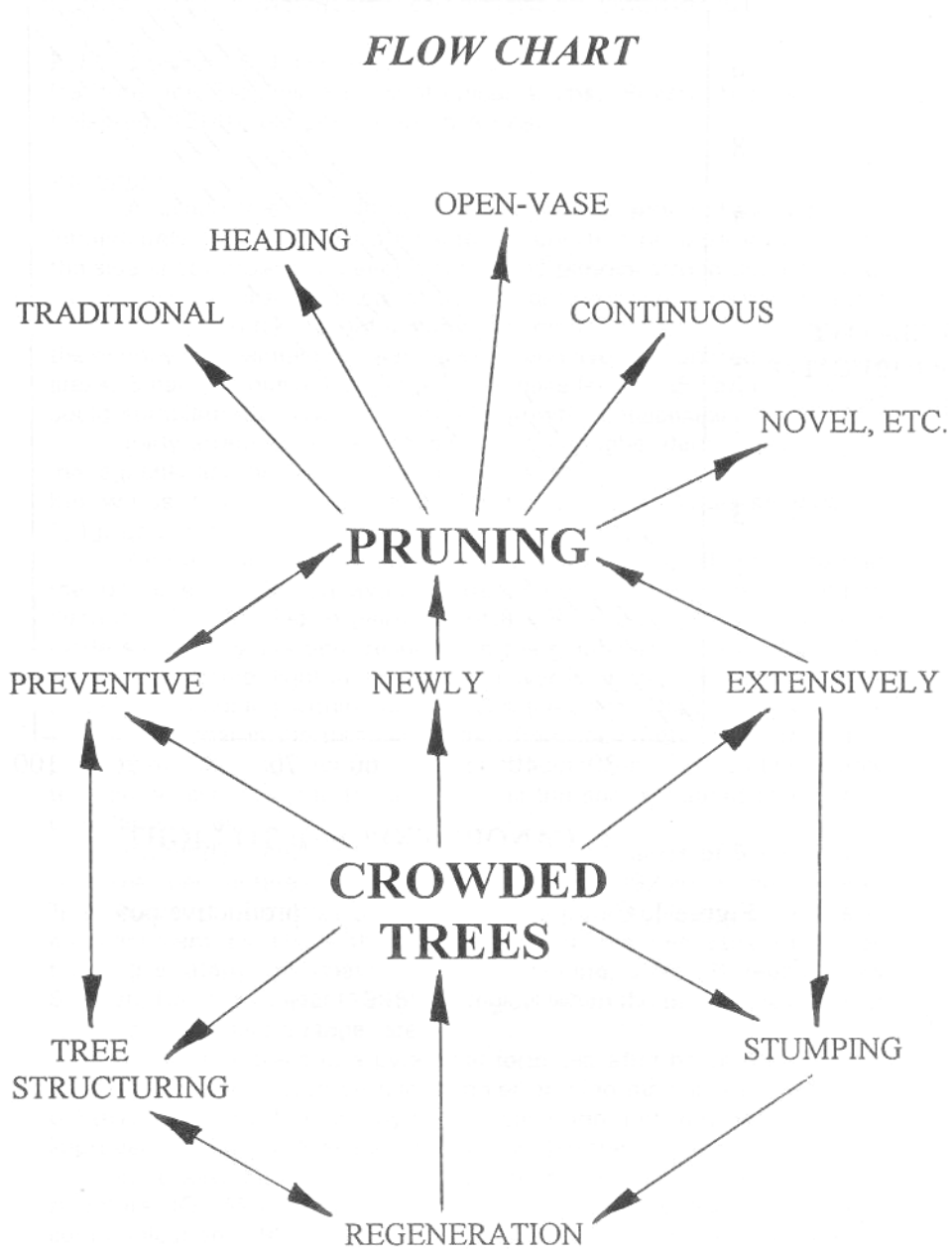
Martin, G.E. 1993b. The avocado prune. II. Becoming a chain-saw expert. Calif Avocado Soc. Avocado Quart. 27:3.

Stassen, P.J.C., S.J. Davie, and B. Snijder. 1995. Principles involved in tree management of higher density avocado orchards. Institute for Tropical and Subtropical Crops, Private Bag X1 1208, Nelspruit, 1200. 12p.

Thorp,G.T. and M. Sedgley 1992. Shoot growth and tree architecture in a range of avocado cultivars, p.237-240. In: Lovatt, C.J. (ed.), Proceedings Second World Avocado Congress, Orange, CA. April 21-26, 1991.

Witney, G.W. 1992. Avocado grove thinning. UCCE Riverside County Publication. September 1992. 10p.

Table 1 - Flow chart.



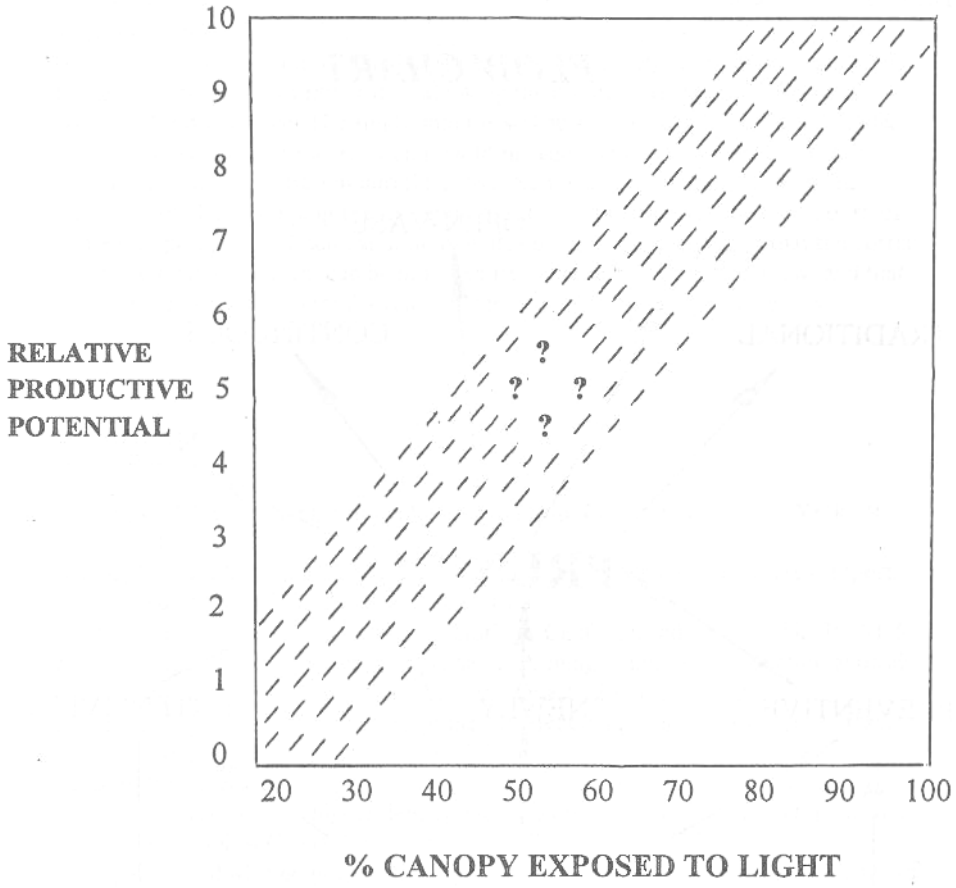


Figure 1. Canopy light exposure vs. productive potential