Introduction

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The plant canopy is perhaps the most complex of all plant systems. Not only is it constantly changing in function and form, but it is ever responding to the dynamics of environmental influence. In addition to the biotic stresses imposed upon the plant such as infection by or competition from other organisms, there are many physicochemical factors that induce a response: chilling, freezing, heat, drought, flooding, and chemical stresses from natural and man-made sources. Compounding the issue are plant responses to these stresses that may not coincide with the horticulturists' attempts to manage a particular canopy component.

In deciduous tree crops, canopies are managed to maximize light interception and distribution to optimize the relationship between vegetative growth and fruiting within a single season as well as over the life of the tree. Light distribution and thresholds change as the canopy density increases during the season. This affects photosynthetic rate and efficiency, thereby altering development of vegetative and reproductive tissues. Competition for photosynthate develops between the fruits and the woody tissues, and the efficiency of the tree becomes a challenging study of this relationship. Whereas yield may be accurately determined, a precise index of vegetative growth is less tangible. By measuring growth and development of specific vegetative tissues, one may determine which tissue will be most closely related to yield. Yield may then be predicted based upon models of shoot growth development and light interception and distribution. Models relating light distribution with physiological processes, such as floral bud induction, fruit set, and fruit quality, thus can become valuable in redesigning canopy architecture. In fact, the practical application of light interception and distribution models has resulted in the development of tree canopy modifications that have significantly increased tree efficiency and fruit quality.

In addition to yield and quality components, an improved canopy design must consider other management practices. Particularly as costs for labor and agricultural chemicals continue to increase, strategies that address adjustments to spray technology based upon improved pruning and tree training practices will reward the grower by reducing costs.

This colloquium was organized to examine the nature of canopy development: how to measure it, how it can be modeled, how to modify the structure based on model predictions, and how to change technology when improvements are made. In addition, it demonstrates how individuals of different disciplines might focus on a common target to answer complex questions and effect change.