

TRANSLATING CHANGES IN WATER STATUS INTO COMMERCIAL BENEFIT: A REVIEW TO STIMULATE DISCUSSION

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ABSTRACT

Water relations clearly play a key role in many components of plant development and economic production. Thus, water may be considered the fundamental PGR. Minimization of drought stress is the most frequent goal in managing water relations through irrigation. Such an approach may be ideal to maximize vegetative growth of a young planting of fruit trees, or during the rapid fruit growth phase for many species. However, inducing moderate stress at appropriate times can also be beneficial. Examples of such practices include: regulated deficit irrigation at developmental stages when vegetative growth will be affected far more than fruit growth and the use of drought stress to stimulate flowering or to enhance development of fruit sugar and flavor. In these practices, overt control of irrigation makes it obvious that drought stress, as evaluated by water potential, is being managed. Data from other horticultural practices, such as PGR application and pruning that modify growth, suggest that their effects on water relations may sometimes be substantial. The link between water relations and growth provides a critical and possibly controlling mechanism in achieving a desired response.

Can we increase effectiveness of crop management practices by recognizing this link? Recent experiments suggest that improved water relations through increased root: shoot ratio, may be the primary mechanism for increased citrus fruit size following mechanical hedging and topping of tree canopies. This understanding may increase our effectiveness in using plant water status as a tool to help us identify situations in which pruning is likely to increase fruit size. Other experiments suggest that beneficial citrus fruit thinning may be accomplished through appropriately timed, moderate drought stress. Perhaps there are many other opportunities for extending this concept. Managing the balance between vegetative growth and flowering / cropping remains a central focus in the management of tree fruits for optimal returns. Factors influenced by this often competitive balance include intensity of flowering, percentage fruit set, and fruit size. Perennial crops are increasingly planted at higher densities to encourage earlier production, but this often increases the cost of containing vegetative growth as trees grow beyond their allotted space. In some crops, more aggressive pruning may actually result in lower mature yields than were realized prior to containment pruning. Competition between vegetative growth and fruit development appears to compromise fruit set in parthenocarpic cultivars of citrus. Supply and demand for water and mineral nutrients can be assumed to regulate the growth flushing behavior of perennial roots and shoots and hence, the root: shoot balance. Strangely, however, we don't really know what compels the growing points in a tree to flush. In citrus, individual trees and even branches within trees vary in their time of flushing. A balance between water relations, N, carbohydrates and endogenous PGRs has been proposed to control flush

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growth although details have eluded researchers. Work in annual plants suggests that even if PGRs are central to maintaining apical dominance, their effect may be expressed through water relations. The concept of a threshold water status to stimulate flushing is attractive, may have relevance to many perennial crop species, and may offer the opportunity to improve management. Other PGRs which in turn, influence water relations, may provide additional opportunities for effectively manipulating water relations and commercially significant aspects of plant growth and development.