

ALTERNATE BEARING OF CITRUS IN FLORIDA

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The severity of alternate bearing varies over time and among citrus varieties. At times, alternate bearing for a variety occurs synchronously over the state. Alternate bearing occurs more frequently on individual blocks, individual trees within a block, or even on individual branches on a single tree. Although there are many exceptions, alternate bearing is generally a minor problem on Hamlin and Valencia oranges, can be a moderate to severe problem on Pineapple orange and some grapefruit, and is frequently a serious problem on mandarin varieties. Hand and chemical thinning are rarely used, but mechanical pruning with hedging and topping equipment is effective in reducing crop load. Management of irrigation and nutrition may also contribute to a reduction in alternate bearing.

Occurrence of alternate bearing in Florida. Alternate bearing may occur over the entire state or may be limited to individual blocks or trees. Synchronous alternate bearing over the entire state may be initiated by an adverse environmental event that causes a severe crop reduction in a particular year. However, alternate bearing on a state-wide basis has not been severe in recent years. Average Florida yield per acre for several varieties for the last 28 years is shown in Fig. 1. A severe freeze in 1989 substantially reduced average yield and induced alternate bearing in some cases. There was little alternate bearing of early and midseason oranges (Early/mids, mostly Hamlins) over the entire period with the exception of a few years following the 1989 freeze. However, the average yield of Early/mids stabilized rapidly after 1993. Statewide alternate bearing of Valencias also was initiated by the 1989 freeze, and has continued to the present time. However, the magnitude of alternate bearing has been minor on a statewide basis, and appears to be diminishing.

Synchronous alternate bearing of grapefruit over the state has not been a major problem, but was also induced by the 1989 freeze. Production was higher in the 1992, 1994, and 1996 seasons. Alternate bearing of seedy grapefruit was more severe than for seedless varieties. Alternate bearing of mandarins is a major problem in most areas of the world. In Florida, statewide average yield fluctuated considerably from year to year with several indications of synchronous alternate bearing, but no episodes of severe statewide alternate bearing were observed. Although Dancy tangerine is no longer a major commercial variety in Florida statewide alternation for this variety was severe over a number of years in the 1960s (Wheaton, 1986).

The magnitude of alternate bearing observed for individual blocks can be much greater than the statewide averages shown in Fig. 1. Although there is no systematic survey of the amount of alternate bearing by block, many Florida citrus growers experience this problem. Hamlins are rarely a problem, but there are increasing reports of alternate bearing of Valencia oranges. The magnitude of alternate bearing can be large for individual blocks of Valencias. Fig. 2 demonstrates the cycling of yield for a block of Hamlins and an adjacent block of Valencias of the same age and under the same management. Alternate bearing was more severe for the Valencias. Mandarins and hybrids

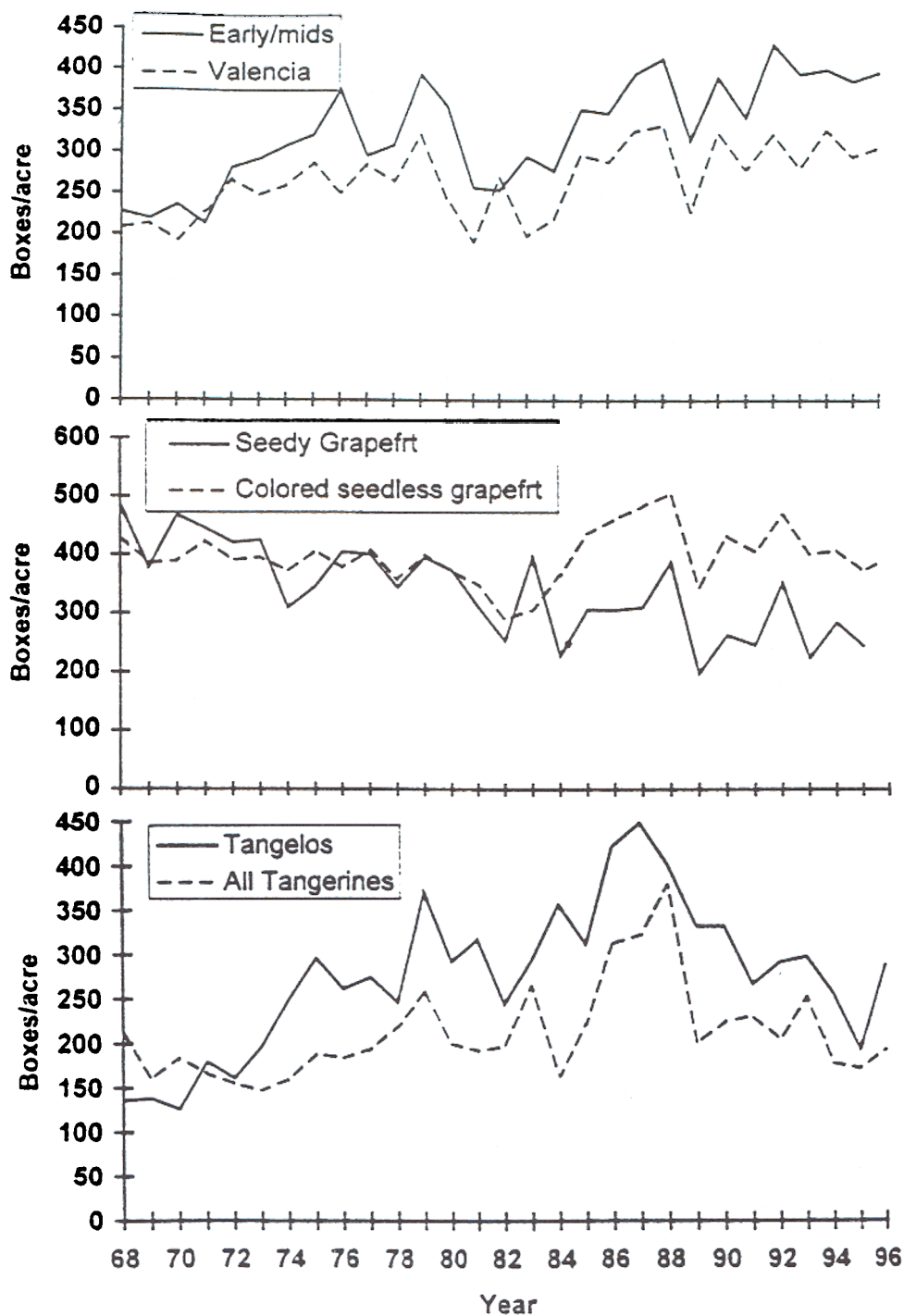


Fig. 1. Average yield (boxes per acre) of orange, grapefruit, and mandarins from 1968 to 1996 vary, but show only limited occurrences of synchronous alternate bearing throughout the state. Several instances of alternate bearing can be observed following the statewide freeze in December, 1989. The year is for the season beginning in that year; i.e, 1970 data is for the 1970/71 season). Data is derived from the Florida Statistical Summary (Freie, 1996) and includes their estimates for the 1996/97 season.

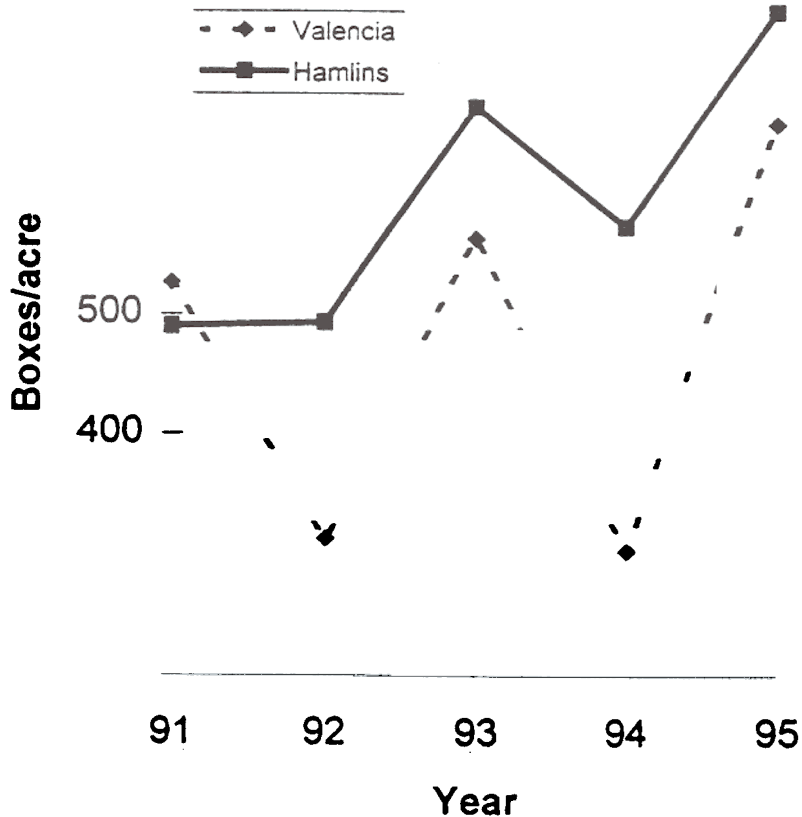


Fig. 2. Alternate bearing of adjacent blocks of Hamlins and Valencias in a South Florida grove. Hamlins and Valencias were the same age and received the same management program, but differed in the amount of alternate bearing.

traditionally exhibit the most severe alternate bearing. It is not uncommon for blocks of Murcotts in Florida to yield as little as 100 boxes per acre in the off year and over 500 boxes in an on year. Alternate bearing in a commercial Murcott grove in central Florida continued for over 30 years without any exceptions (Fig. 3). Murcotts typically lose 25 to 50% of their fruit from preharvest drop in heavy crop years, so alternate bearing was even more severe than shown. Alternate bearing has been observed for individual branches of Murcott and Ponkan varieties, but this is rarely observed in most commercial varieties.

Problems caused by alternate bearing. Alternate bearing for most Florida oranges grown for processing is common but usually is not a major problem. However, the impact of alternate bearing on fruit size and quality for fresh market fruit is a major factor in profitability. Heavy crops of grapefruit lead to small sizes and misshapened fruit of little commercial value. Heavy crops of mandarins cause delayed maturity, poorer external color, and small sizes that are unmarketable or are sold only at a reduced price. Fruit size is a major factor in the returns of mandarin varieties. For many years, a portion of Dancy tangerine production in Florida remained unharvested because of poor fruit size and late maturity.

Honey tangerines

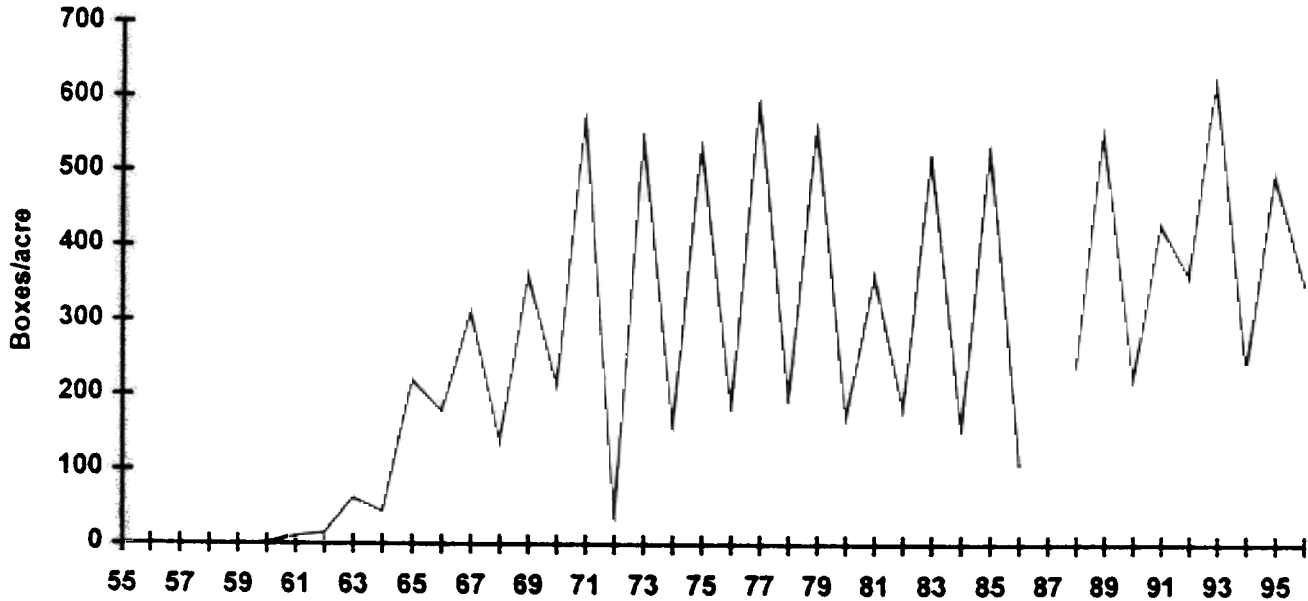


Fig. 3. Thirty years of alternate bearing in a central Florida Murcott (Honey tangerine) block. Data was provided courtesy of Dr. John Attaway.

Heavy crops of mandarins also are destructive to the health of the tree. The 1996/97 crop of Sunburst tangerines was the heaviest on record and broke branches in many areas of the state. In some cases the damage was so severe that the entire tree will be replaced. Heavy crop loads not only cause limb breakage of Murcott trees, but result in dieback or death of the tree. The loss of leaves and fruit occurs quite suddenly during the fall or winter of an on-year crop (Fig. 4), and is known as Murcott collapse (Stewart et. al., 1968). This collapse is preceded by loss of starch from the root system, and may represent excessive carbohydrate and nutrient requirements of the developing fruit. Even in cases where the tree is not killed, the damage may be severe enough to severely limit production for 2 years. The stress imposed by excessive crop load also results in a tree more susceptible to freeze damage.

Management of alternate bearing. Managing alternate bearing involves either increasing production during the off year, or decreasing crop load during the on year. The ability to increase yield during the off year is limited, although some increase in yield in the off year by girdling branches the previous summer has been reported (Augusti et. al., 1992). Several possibilities exist for decreasing yield during the on year including hand thinning, chemical thinning, mass removal by mechanical hedging or topping, and altering management practices. Hand thinning is expensive and is practiced only to a limited extent in Florida.

Chemical thinning is an option that has been available to Florida growers for a number of years, but has received little attention. Naphthaleneacetic acid (NAA) is currently registered for use as a chemical thinning agent in Florida. As with all chemical thinning agents, the amount of thinning obtained by application of NAA varies with the condition of the tree, and with the environmental conditions. However, a number of experiments with this material in Florida demonstrated potential

benefits of NAA in improving fruit size and quality (Wheaton and Stewart, 1973). Because it has received so little use in Florida, reregistration of NAA in Florida appears unlikely. No other chemical thinning agent is registered for use on Florida citrus.



Fig. 4. Sudden loss of leaves and fruit from a Murcott tree characteristic of Murcott collapse. The tree will die.

Pruning or mechanical removal of fruit is the most common method of reducing crop load in Florida. Most mature citrus groves are hedged either every year or every other year to maintain access for equipment and to provide light to the lower portions of the canopy. Trees are topped to maintain a height that can be harvested. Topping almost always causes a yield reduction which is undesirable when growing oranges for processing. However, it can be beneficial for fresh fruit groves where fruit size and quality are critical. Many fresh fruit grapefruit and mandarin groves are maintained at a low height by annual topping and produce small or moderate crops of high quality fruit. A substantial reduction in yield may occur if trees are kept too small, however.

Scheduling topping and hedging operations to reduce crop load during heavy crop years is beneficial. These operations can be done in the early spring before flowering occurs if there is certainty that the coming crop load will be excessive. Or, a decision can be made after flowering and fruit set is largely completed. The final major drop period for Florida citrus generally occurs in mid-May. The benefits of reducing crop load are greater the earlier in the season it is done. Thus it is important to complete the hedging and/or topping operations as soon as possible after crop load can be estimated. It is very difficult to estimate crop load of Murcotts and some mandarins in mid-May because of the small fruit size and distribution in the canopy. A history of alternate bearing may

provide an adequate basis for scheduling hedging and topping even before the current season's crop load can be estimated.

Modification of irrigation and nutritional management may help reduce the magnitude of alternate bearing. Supplemental fertilizer is recommended for Murcotts during a heavy crop year. Leaf potassium levels decline to very low levels as this nutrient is used by the developing crop. It is common to make one or more additional potassium and nitrogen applications during late summer to reduce the nutritional stress of an excessive crop of Murcotts. Supplemental irrigation may reduce the incidence of Murcott collapse by maintaining more favorable water relations during periods of root loss from the stress of excessive crop load.

The importance of alternate bearing depends on several factors including the severity, the importance of fruit size and maturity for the intended market, and the potential for tree damage from over production. Cropping of most citrus varieties is self regulating. For these varieties, alternate bearing following an unusually heavy crop does not last long. However, some other varieties experience severe alternate bearing over long periods of time. The methods described for controlling crop load will reduce the amount of alternate bearing for these varieties.

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