# INFLUENCE OF CLIMATE ON POUNDS SOLIDS AND ACID PRODUCTION UNDER FLORIDA CONDITIONS

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Studies by Reuther and Rios-Castano (1969) demonstrated that warm tropical climates (Colombia) accelerated maturation of citrus compared to subtropical climates (California). Fruit volume and soluble solids increased more rapidly but volume growth and solids accumulation stopped earlier. At the same time, acidity declined more rapidly, presumably because of the higher respiration rates at the higher growing temperatures in the tropics. Generally, Florida climate results in better solids production and sugar to acid ratio balance than either a Mediterranean subtropical or a tropical climate. Still large differences in soluble solids (pounds solids per box) from year to year have been noted in Florida. Does climate vary enough from year to year to account for observed differences in pounds solids? To answer this question a multiple regression study was undertaken to relate pounds solids and it's components (brix and percent juice) to climatic variables.

Data was obtained from the Florida Agricultural Statistics Service (FASS) for the years 1968 through 1994 (26 years). These data for Valencia oranges were evaluated in a multiple regression program against climatic data from the four (until 1984) or five (after 1984) geographic production regions of citrus in Florida as established by FASS. Weather data used in the regression study were average temperatures and accumulated rainfall in two month increments starting each year with the December and January before bloom (Albrigo, 1990 and 1993).

Significant relations were found of increasing pounds solids and warmer winter temperatures both before bloom and during final maturation. This effect was not because of changing fruit size which does effect pounds solids per box. It appears likely that higher winter photosynthetic rates produce more sugars that eventually are stored in the fruit. Additional variables that positively influenced pounds solids production were higher temperatures in February-March and increasing winter rainfall. Increases in rainfall during April-May decreased pounds solids.

Further evaluation of the winter temperature effect demonstrated that both winter temperatures and pounds solids increased and decreased in cycles of three to five years between highs or lows. It was determined that these cycles were the effect of El Ninos on Southeastern US winter climate (Albrigo, 1993). It now appears that Brazilian winter climate is similarly affected by El Ninos but preceding the Florida winter by six months. Brazilian production is affected by drought periods also. The temperature effects may be dampened or otherwise altered by these dry periods. These winter temperature effects on pounds solids result in swings of more than one pounds solids per box or a yield difference of over two million pounds of solids in Florida from a high yield to low yield year. If a similar effect occurs in Brazil, then a swing of over five million pounds solids is possible from low to high solids years (Albrigo, unpublished).

The other major change from year to year is the level of acidity in the fruit. The effect of warmer temperatures later in maturation of the fruit to accelerate degradation of acidity is well known and can be easily demonstrated from available data in Florida. What is not so clear is why acidity levels can be quite high or low going into the final maturation period in the fall when acidity begins to decline. Some possible factors may be rate of fruit growth and dilution of acid levels by water uptake from wetter than average years (Sites et al., 1951). Another factor could be time of bloom. In years with earlier bloom dates, final maturation and acid decline would start earlier while hot summer temperatures still prevail. Conversely, later blooms would favor slower acid decline since final maturation would occur under cooler fall temperatures. These factors do not appear to account for all of the differences observed.

A similar evaluation to the pounds solids study was done by regressing acid levels of several years to temperatures and rainfall throughout fruit development. Higher bloom time temperatures were correlated with decreased final acid levels in early oranges and grapefruit (Albrigo, unpublished data). Higher June and July temperatures also were related to reduced acidity at harvest for late oranges and grapefruit. At this time we have not determined a possible mechanism by which higher than normal temperatures, during these development times, can account for lower acid levels by Fall. It may be that these are critical times for acid synthesis or development of the enzyme systems that eventually produce or facilitate transport of the acids.

## Literature Cited


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