Leaf Drop in Citrus

excessive fall regardless of cause may lower soluble solids in fruit

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Excessive leaf drop of citrus—resulting from oil sprays, insect or mite damage, or physiological disorders—probably materially interferes with the total carbohydrate production of the tree, and may result in a lower level of total soluble solids in the fruit at harvest.

To determine whether oil spray applications cause dropping of the leaves and are harmful to citrus trees or—because the oldest and the youngest leaves are those most frequently dropped—such leaf drop is inconsequential, a study of the ability of leaves of different ages to produce food for the whole tree was conducted at the Riverside Citrus Experiment Station.

The total amount of carbohydrates supplied to the nongreen portions of the tree by each leaf is determined by two processes:

1. Photosynthesis, by which carbohydrates are manufactured from carbon dioxide and water using energy from the sun.

2. Respiration, by which the carbohydrates are reconverted to energy for use in all the processes in the living cell.

The excess of carbohydrates produced by the photosynthesis of a given leaf, over the amount used by that leaf is available for use by other portions of the tree.

For this experiment, the usual respirometer was modified so as to illuminate the leaf samples. Using this instrument the rates of photosynthesis and respiration were determined by measuring the production and consumption of oxygen by the samples. By using a buffer which maintained a constant percentage of carbon dioxide in the atmosphere, it was possible to determine the rates of photosynthesis on the basis of oxygen evolved in the light, and the rates of respiration on the basis of oxygen utilized in the dark.

In this manner the rates of photosynthesis and respiration in four different age groups of Washington Navel orange, Valencia orange and Eureka lemon leaves were studied. The experiments were set up to learn at what point in the life of a leaf it becomes capable of producing more food photosynthetically than will be used in self maintenance, and whether, at some point before normal leaf drop occurs, the leaf ceases to contribute food to the fruit and branches.

Age Groups

The citrus leaves tested in this study were in four age groups:

Group I—Very small leaves, characteristically found at tips of new growth flushes. These were sampled when they were approximately two centimeters wide and three to four centimeters long.

Group II—Young leaves found in the new growth flushes which had almost reached maturity but had not hardened.

Group III—Mature leaves which had not begun to show signs of aging.

Group IV—Old leaves that were not showing obvious signs of aging.

Generally it was found that the respiratory rate in the youngest leaves was relatively much higher than in the older leaves, and that there is a continuing decrease in the respiratory rate for the life period studied. Although the respiratory rate of the youngest lemon leaves is relatively higher than the rates for either navel orange or Valencia orange leaves, the pattern of development of respiration rates in all three varieties is approximately the same.

The photosynthetic rates likewise have a common developmental pattern. In all three varieties studied the youngest leaves have a very low rate of photosynthesis which increases up to the time of leaf maturity, after which there is a very slow decline. This provides for a long period of high photosynthetic activity.

The graph at the left on this page presents the relative rates of apparent photosynthesis and respiration in the different ages of Washington Navel orange leaves. These data indicate a low photosynthetic rate in the youngest leaves which increases rapidly and reaches a plateau at full leaf maturity, while the old leaves retain a relatively high photosynthetic rate.

On the other hand, the very young leaves have a relatively high respiratory rate which decreases as the leaves mature; and the lowest respiratory rate is reached in the old leaves.

The data resulting from the study of Eureka lemon leaves is presented in the graph on the right, on the same basis as for navel orange. The pattern of development of the photosynthetic capacity is similar to that of the navel orange except that the lemon has relatively lower rates in the very young and the young leaves. The lemon leaf does not reach maximum rates of photosynthesis as quickly as does the navel orange on the basis of external leaf appearance.

The respiratory rates of the different ages of lemon leaves follow a pattern similar to that of the navel orange, although all age groups have relatively much higher respiratory rates than navel orange. Experiments conducted using Valencia orange leaves indicated the same relationship found with navel and lemon leaves.

The results of this study indicate that only the youngest citrus leaves are parasitic on the rest of the tree, in the sense that they produce insufficient food for their own use, and that when large numbers of leaves are dropped—because of oil sprays, or other causes—the total carbohydrate production of the tree may be affected, which could result in a lower level of total soluble solids in the fruit at harvest.

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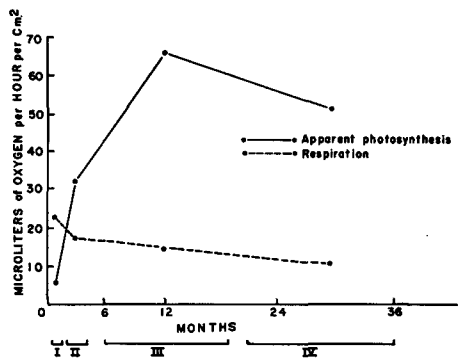

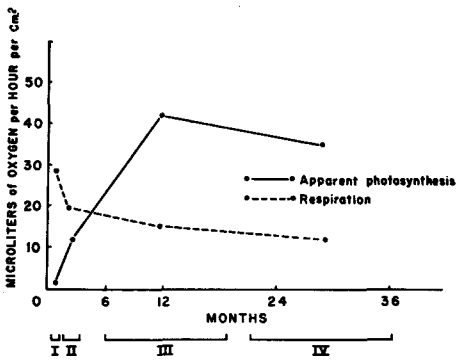

Rates of respiration and photosynthesis of *Left*, Washington navel orange leaves and, *Right*, Eureka lemon leaves, of four different relative ages. The brackets represent the estimated age span included in each of the age groups indicated.