

Water Stress and Leaf Drop

healthy appearing leaves dropped by small orange trees after applied soil moisture ended induced periods of water stress

Extremely heavy leaf drop has affected young orange trees in some inland areas of southern California in recent years.

The occasions of leaf drop usually followed and seemed to be related to prolonged conditions of relatively high temperature and low humidity following cessation of a regular irrigation schedule. In at least some cases the maximum fall of leaves occurred after a rain or an irrigation had ended, or interrupted, a period of moisture stress.

Laboratory investigation of a different problem had disclosed that apparently healthy leaves on small potted citrus plants would drop following a severe drying of the soil. To determine the extent to which leaf drop could be induced, an experiment was set up with rooted cuttings of Washington navel and Valencia oranges in one gallon cans. The plants—3'-4' high—were held in a small controlled-temperature room supplied with artificial light of about 1,000 f.c.—foot candles. The temperature was held at approximately 80°F. The relative humidity was not controlled and ranged from 20% to 95%. Under those conditions, the plants were watered daily for seven days. Then water was withheld for



Valencia orange plant defoliated after being watered following eight days without water. The leaf petioles still adhere to the stem, but the leaf blades have fallen.

given periods to dry the soil to different levels of moisture content. The maximum time without watering was eight days.

In several repeated experiments, near or complete defoliation occurred after stressed citrus plants were resupplied with water. When water was withheld for periods longer than eight days, many of the leaves became severely wilted and rolled. These leaves continued to develop water deficiency symptoms after the addition of water to the soil and within a few days they were dead. However, these dried and discolored leaves fell at a later date than the healthy appearing leaves that dropped shortly after the plants were watered.

To eliminate the possibility that laboratory conditions—artificial illumination or other unusual factors in the room—might influence leaf drop due to water stress, the experiments were repeated in full sunlight and in a half-shaded lathhouse. Rooted cuttings of Washington navel and Valencia orange plants, 4'-5' high, were grown in soil in one-gallon cans. Typical results of these experiments are summarized in the table in the first column. The sizes of the plant and the root system, the volume of the container, the temperature, relative humidity and sunlight are all factors in the length of drying time required to produce a maximum leaf drop after the addition of water. Therefore, the results of the laboratory studies are valid for the experimental plants only and do not apply directly to trees in the field. However, the results do show that extensive

drying of the soil is capable of producing severe leaf drop in small potted plants under environmental conditions similar to those encountered in the field.

The character of water stress induced leaf drop is illustrated in the upper photograph, which shows that the leaf blades have abscised at the point of their attachment to the petiole. Usually the petioles also fall within a few days.

In the experiments under outdoor and lathhouse conditions there were some indications that several short periods of drying may result in as much eventual leaf drop as one severe period of stress. However, because of the variable conditions, the cumulative effect of drying periods could not be established.

The results of the experiments with container-grown young plants do not prove that the same factor of water stress is responsible for the leaf drop in commercial plantings. However, the similarity in the conditions which produce the drop in trees and in small plants and the similarity in the appearance of the dropped leaves do suggest that a relationship of the same type may be operating in both cases.

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Effect of Withholding Water for Varying Lengths of Time on Leaf Drop of Small Orange Plants

Variety	Location	Consecutive days each week without watering	Percent of leaves dropped after	
			1 week	2 weeks
Valencia	Lathhouse	6	57	78
		5	81	100
		4	31	41
		3	0	7
		0	0	0
	Outdoors	6	98	100
		5	90	97
		4	73	99
		3	79	99
		0	0	0
Washington Navel	Lathhouse	6	87	91
		5	74	85
		4	0	14
		3	0	34
		0	0	0
	Outdoors	6	79	79
		5	72	90
		4	46	54
		3	2	9
		0	0	0

Leaf drop by rooted cuttings of Valencia orange. Left, no water for eight successive days; middle, no water for four successive days; right, watered daily. All plants received water at 5 p.m. on the eighth day, when no leaves had fallen from any plant; the photograph was taken at 11 a.m. on the following day.

