



TAKING TEMPERATURE OF A CITRUS TREE

R. H. Hilgeman and C. R. Everling

Dr. Hilgeman is a Horticulturist and Superintendent of the University of Arizona's Citrus Experiment Station near Phoenix. Mr. Everling is a Research Assistant stationed at the Citrus Station.

Climatic conditions limit the areas where citrus is grown and cause wide differences in fruit production and quality.

Although citrus has been grown commercially in the United States for about 100 years, little is known about the specific environmental factors required. Climatic conditions are normally evaluated from records of air temperature and humidity observed in official U.S. Weather Bureau shelters. The conditions within the shelter represent an artificial standardized situation which frequently differs from conditions around the tree.

Close Up is What Counts

The temperature of the plant parts and the air temperatures very close to these plant parts represent the actual environment of the tree.

To obtain such temperatures, thermocouples have been placed on the leaves and in the air close by them in many places around a large 16 foot high grapefruit tree in the center of a grove. The temperatures measured are constantly recorded on a chart by an electronic recorder, or tabulated manually from the recorder.

Results of such measurements show that wide temperature variations occur around the tree, and that the relationships are constantly changing. For example, with a clear sky at sunrise, temperatures at the top of the tree have been four to six degrees warmer than at two feet above the ground. As the day progresses, temperatures around the tree tend to equalize and then the air near the lower part of the tree becomes two to four degrees warmer than air near the top.

On a hot summer day between noon and 4 p.m. the warmest area was at

Tons of Commercial Fertilizers Reported Sold in Arizona in 1961³

	<i>First Quarter</i>	<i>Second Quarter</i>	<i>Third Quarter</i>	<i>Fourth Quarter</i>	<i>Adjust- ments¹</i>	<i>Adjusted Totals</i>
Liquid commercial fertilizers - - - - -	12,444	22,802	17,238	6,327	4,583	63,394
Mixed commercial fertilizers (dry) - - -	17,745	18,706	7,117	13,490	1,512	58,570
Urea - - - - -	3,211	9,528	5,547	1,525	1,119	20,930
Ammonium sulphate - - - - -	3,484	7,042	3,367	1,745	387	16,025
Calcium nitrate - - - - -	5,660	2,356	1,414	3,347	126	12,903
Ammonium nitrate - - - - -	1,874	3,289	1,298	2,392	276	9,129
Superphosphate, normal - - - - -	2,631	312	2,064	1,234	154	6,395
Superphosphate, treble - - - - -	907	305	439	515	-130	2,036
Potassium, sulphate and/or chloride - - -	298	256	157	182	7	900
Calcium cyanamid - - - - -	56	198	224	97	—	575
Sewage sludge (plant food 5% or more) -	108	204	116	144	1	573
Sodium nitrate - - - - -	98	183	3	175	—	459
Miscellaneous (dry) - - - - -	226	244	249	257	30	1,006
Delinquent reports ² - - - - -	2,111	4,124	1,830	—	—	—
Total - - - - -	50,853	69,549	41,063	31,430		192,895

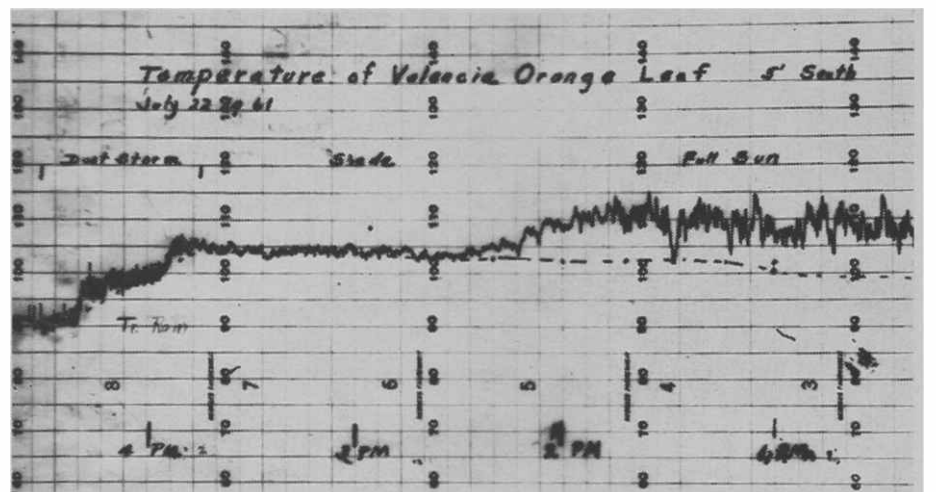
¹Correction for the year incidental to delinquent reports.
²Reported too late for inclusion in compiled quarterly reports.
³Compiled by Mr. Floyd Roberts, State Chemist.

six feet. After sundown the situation changes so the lower part becomes colder. On a cold night this change may occur rather quickly and differences of six to eight degrees between top and six feet above the ground have been recorded by 8 p.m.

Change Can Be Rapid

On a clear day, air temperatures around the tree change almost constantly and leaf temperatures may change very rapidly. The temperature of a leaf in the full sun has changed as much as 8° F. in 30 seconds. Such a leaf ranges from 6° to 16° F. above the "official" temperature in the Weather Shelter. Heat damage, which includes sunburning of leaves, apparently occurs between temperatures of 124° to 130° F.

Leaves in the shade, six feet above the ground on the north side of the tree, have a fairly stable temperature similar to the air nearby. These temperatures are similar to those in the Weather Shelter.



FIVE HOUR variations in temperature on an orange leaf are shown in this electronically-recorded chart. The time sequence is from 12 noon to 5 p.m., the time interval from right to left. Leaf was in sun from 12 to 2:50 p.m., in shade from 2:50 to 3:50 p.m., then a minor storm with wind, dust and a trace of rain dropped the temperature from 3:50 to 5 p.m. In those five hours the temperatures ran from 115 degrees down to 88.

Leaves within the canopy of the tree have been one to three degrees colder than exposed shade leaves.

Modification of extremely high temperatures by irrigating all the area around the trees with the flood system is now being studied. Limited data obtained last summer suggest that maximum temperatures at six foot elevation may be reduced two to four degrees during the five day period after an irrigation when the surface soil is wet.