were obtained. The numbers in parentheses show the distribution when geomagnetic key days were chosen in exactly the same manner as they were in 1956–57. On two occasions, two troughs followed a single magnetic disturbance; this accounts for the numbers 17 and (11) shown in the totals.

Both sets of data show an association of large troughs following geomagnetic disturbances. A chi-square test of the cases selected by the "loosened" A_{CH} criterion shows that the probability, p, is slightly less than .01. The p for the 1956–57 criterion is slightly greater than .02.

The assumption of a normal distribution of the underlying population of A_{CH} and I_t values necessary for chi-square tests may be questioned, but we chose this simple test because of the obvious significance of the table.

It should also be pointed out that the theoretical frequencies shown in the A_{CH} columns in both Tables 1 and 2 are only slightly larger than the minimum of five set by Yule and Kendall (*5*). But the 1957–58 sample is independent of the pilot study, and a table combining both samples would yield theoretical cell frequencies well in excess of 10 and probability, p, of less than .001.

The pilot study had also suggested that the deepening troughs reach a maximum about 8 or 9 days after an A_{CH} key day, and that this results in a maximum length of the 30,400-ft contour between 180°W and 90°W. This is not supported by the 1957–58 data.

A third hypothesis, based on the 1956–57 sample—namely, that the large troughs follow a set pattern of development—was partly supported by this year's analysis, but the statistics would not be, by themselves, significant.

We do not offer any suggestions about the physical mechanisms which must be in effect if the statistical analyses are valid. Indeed, most numerical-dynamical investigations of the vertical propagation of disturbances from high levels to the troposphere indicate that this is a weak mechanism (*6*). Thus, even though the statistical level of significance is reasonably convincing, no real confidence can be attached to the observed relationships until the analyses have been extended further in time and over a much larger area of the earth. To do this, we plan to use similar procedures at the 500-mbar (18,000-ft) level, for which data are available for the whole Northern Hemisphere back to 1946.

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12 September 1958

Tenderness, Climate, and Citrus Fruit

Abstract. Tenderness of coastal-grown citrus fruit to fumigation, spray, and storage practices, and to frost, as compared with fruit grown in the drier interior districts of southern California, is correlated with lower puncture-pressures and higher moisture content of peel. The hardening effect of moisture stress is also exhibited by fruit from tree tops.

It has been common horticultural experience that plants grown in submaximum light intensities and near maximum soil moisture (mesophytic habitat) are more tender than those grown in maximum light intensity and low soil moisture (xerophytic habitat). This concept of tenderness is associated with the succulence and edible quality of vegetables, but plants grown in mesophytic habitats cannot be transferred abruptly to xerophytic habitats without severe injury. Plants known to be sensitive to low temperatures may be made more resistant or "hardened" by exposure to short periods of sub-low temperatures. Tenderness in these cases has generally been associated with high moisture content.

Maximov (*1*) reviewed evidence showing the responses of leaf structure to xerophytic conditions. These responses were smaller leaf area, thicker leaves, thicker cuticles, epidermal layers, and greater palisade development. Cellular responses were those that might be associated with a lower moisture content—that is, smaller cells and thicker cell walls. Leaves appear to be the organs most sensitive to water supply and insolation and, because of their relatively simple structure, are more readily studied than other organs. But the few studies on other plant organs have not been definitive. This has been a result of the complexity of fibers, vessels, collenchyma, epidermis, and so forth, and of their cellular organization as well.

A greater sensitivity of citrus fruit grown in coastal locations in southern California to fumigation with hydrocyanic acid and to damage from oil spray (*2*) has also been referred to as tenderness. Also, it has been shown that coastal fruit keep in storage for a shorter period than fruit from the interior (*3*). Careful observers have noted also that coastal fruit freeze at higher temperatures than those growing in the desert.

A study has been recently completed in which the peels of four varieties of mature citrus fruit from four climatic districts in southern California were examined for moisture content and tenderness, as measured by the puncture-pressure of the peel. As many of the variables as possible were put under control before the fruit was randomly picked. The population was defined as (i) four varieties, (ii) two rootstocks, (iii) four climatic districts further defined by mean daily air temperature and evaporation, (iv) mature fruit, (v) without surface scars, (vi) one season, (vii) eight positions on the tree (0.5 to 6 ft high, N-S-E-W, and 6 to 30 ft high, N-S-E-W), (viii) shaded fruit, (ix) midway between irrigations, (x) commercially productive grove or equivalent, (xi) without bruises, (xii) controlled nonexperimental water loss, (xiii) moisture variation within individual fruits, (xiv) noninterplanted, (xv) nonshaded, (xvi) afternoon samples, (xvii) uniform tree spacing, (xviii) clear, quiet weather.

Five fruits were picked from low on the tree and five fruits were picked from high on the tree, at random, from each of five distantly spaced trees randomly

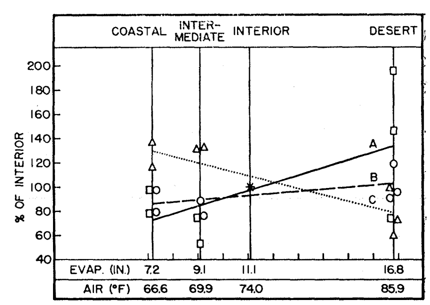

Fig. 1. Regression lines for four varieties of citrus fruit. *A*, puncture-pressures of peels; *B*, dry matter per unit volume of fresh peels; *C*, percentage of moisture in peels of whole fruit, plotted as percentage of the interior against mean daily air temperature and total evaporation for June, July, August, and September of 1955 for four climatic districts in southern California (*4*). Squares represent puncture-pressure; circles, dry matter per unit volume of fresh peel; triangles, percentage of moisture.

Table 1. Mean air temperature characterizing four climatic districts in southern California during the summers 1949–55, mean air temperature and total evaporation during the summer season during which four varieties of citrus fruit were grown (1955), and physical characteristics of the fruit peel.

Fruit	Year	Climatic district: Coast	Intermediate	Interior	Desert
		Air temperature (°F)			
	1949–55	66.5	71.0	73.2	86.7
	1955	66.6	69.9	74.0	85.9
		Evaporation (in.)			
	1955	7.2	9.1	11.1	16.8
		Peel moisture (%)			
Lemon	1955	448.6	—	388.3	380.9
Grapefruit	1955	—	505.9	388.1	300.3
Valencia orange	1955–56	329.3	—	242.3	273.1
Washington navel orange	1956	—	405.4	309.2	—
		Weight of dry peel per unit volume of fresh peel (g/cm^3)			
Lemon	1955	0.1737	—	0.1788	0.1700
Grapefruit	1955	—	0.0973	0.1284	0.1529
Valencia orange	1955–56	0.1726	—	0.2182	0.1982
Washington navel orange	1956	—	0.1500	0.1711	—
		Peel-puncture-pressure ($lb/in.^2$)			
Lemon	1955	1094	1123	—	833
Grapefruit	1955	—	190	254	496
Valencia orange	1955–56	258	—	332	485
Washington navel orange	1956	—	224	423	—
		Storage life			
Citrus		Short	—	Long	—
		Injured by fumigation			
Citrus		Readily	—	Not readily	—
		Injured by oil spray			
Citrus		Readily	—	Not readily	—

selected, in a randomly selected grove of a given variety in a given climatic district. Eleven groves were sampled in a 5000-mi² area; groves of the same variety were separated by the random sampling with the result that two pairs of groves were 30 air-line miles apart, one pair 38, one pair 72, one pair 107, and 2 pairs 133 miles apart.

Variation between individual fruits, heights on tree, trees in a grove, varieties in a climatic district, and between climatic districts (varieties disregarded) was measured statistically. Variables such as tree age, bud sources, pest control, cultivation, cover crop, fertilizer, frost protection, soil type, depth, water capacity, *p*H, and so forth, and irrigation water quality, irrigation quantity, irrigation interval, nutritional sprays, picking and pruning practice, wind protection, leaf surface, tree height, weed control, and so forth, which in part make up the minimum of 3.67×10^{11} permutations and combinations of variables in citrus culture, were not under control but were segregated as a group and measured as error. Peel moisture and dry weight were determined for each whole fruit peel by drying the peel to constant weight in an air-draft oven at 65°C. The puncture-pressure of the peel, the measure of tenderness used in this work, was determined by six puncture-pressure tests around the equator of each individual fruit used in the moisture and dry weight determinations.

Table 1 shows that the mean daily temperature for the four months June, July, August, and September 1955 and the six previous summer seasons (that is, for 1949–1955) is progressively higher for each climatic district in the order coastal, intermediate, interior, and desert. Fruit which were growing on the trees during these four months in the summer of 1955 were grown under a similar trend of mean air temperature and air evaporation in the four districts, as is shown in Table 1. In general, the puncture-pressure and dry weight of the peel per unit volume of peel increased from coastal to desert district, and the percentage of moisture in the peel decreased. These factors appear to be correlated with other observations of tenderness to a high degree.

The trends of these three factors with climatic district, mean air temperature, and air evaporation for the four summer months are shown in Fig. 1. The multiple correlation coefficient between the puncture-pressure of the peel (y), evaporation (x_1), and the reciprocal of peel moisture as percentage of dry peel (x_2) is very high ($R = +0.9898$).

It therefore appears that climatic conditions such as prevailing mean daily air temperatures and evaporation probably induce the same types of morphological responses in fruit as they do in leaves, the leaves probably playing a strong role by withdrawing water from the fruit in periods of water stress as has been long known in citrus.

Differences between mean maximum and mean minimum daily temperatures for the different districts appear not to be the major influence on these responses, because (i) the difference was smaller in the desert district than in any but the coastal district, and (ii) in all districts fruit from the tops of trees where they would be subjected to greater water stress had significantly greater peel puncture-pressures and higher dry weights per unit volume of peel, and lower percentage of moisture, than fruit from the lower regions of the trees.

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Rapid Diagnosis of Herpes Simplex Virus Infections with Fluorescent Antibody

Abstract. A fluorescent microscopy technique is described which may prove useful in differentiating clinically similar lesions into lesions of herpes simplex virus etiology and nonherpetic lesions. Herpes simplex virus was isolated from the specimens which yielded positive fluorescence, and no virus was isolated from the specimens which yielded no fluorescence.

The laboratory diagnosis of a herpes simplex virus infection is dependent upon the isolation and identification of the virus, the observation of type A inclusion bodies, or the demonstration of a rise in specific antibodies, or upon a