Chlorine Absorption

all portions of citrus trees grown in soil cultures absorbed chlorine in test

Joseph N. Brusca and A. R. C. Haas

Citrus trees utilize very little or no chlorine in their nutrition processes. They do, however, tend to accumulate chlorine in certain tissues. When such accumulations become excessive, they may cause the tissue to burn as in leaf tips and margins. In addition, the leaf size may be reduced and a fading may take place in the chlorophyll or green coloring matter of the leaves.

These effects of chlorine were studied by means of large out-of-door and well-drained soil cultures of Lisbon lemon trees on sour orange rootstocks. The trees were grown in the soil cultures for three years.

The culture solution—Hoagland's, *A*, with chlorine omitted; *B*, double strength; and *C*, stock solutions—had the following trace elements added: 0.2 ppm—parts per million—boron as boric acid, manganese as sulfate, zinc as sulfate, and iron as repurified ferrous sulfate, 3.0 ppm aluminum as citrate, 0.1 ppm copper as sulfate, and 0.2 ppm molybdenum as sodium molybdate. Distilled water was used at all times.

To this nutrient were added various concentrations of chlorine divided equally between calcium, potassium and magnesium chlorides. These chlorine concentrations and their effects on the chlorine accumulation in the tissues of the tree are shown in the table. The chlorine concentrations range from 0 to 1,680 ppm.

The chlorine determinations reported in the table are the average of closely agreeing duplicates. The changes or differences in the concentrations of chlorine in the nutrients varied from 35 to 280 ppm. The age or maturity of the leaves is a factor that largely governs the content of chlorine that will be absorbed or accumulated from a nutrient solution containing a given chlorine concentration and therefore only mature leaves were collected as leaf samples. Until a lower concentrations of chlorine in the nutrient solution with the chlorine percentages found in the dry matter of the leaves.

Lemon leaves collected in an orchard showed severe tip and marginal burn and a chlorine percentage of 0.817 in their dry matter. In another lemon orchard, severe leaf burn was accompanied by a marked defoliation and the dry matter of the unwashed fallen leaves contained 2.384% of chlorine. When Valencia orange leaves, collected from an orchard, showed severe leaf burn, the dry matter of the unwashed retained leaves contained 0.732% of chlorine, whereas from another orchard an unwashed sample of burned leaves that had fallen contained 1.087% of chlorine in the dry matter.

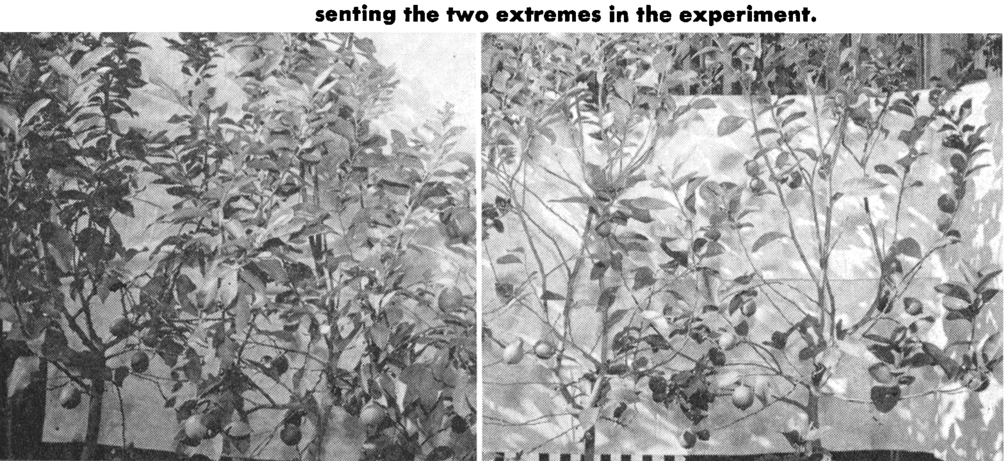
Chlorine in Lemon Trees

Chlorine content in various portions of Lisbon lemon trees on sour orange rootstocks grown in large out-of-door soil cultures that received a nutrient solution containing various concentrations of chlorine divided equally between calcium, potassium and magnesium chlorides

Culture	Chlorine in nutrient	Chlorine difference in nutrient	Mature leaves	Bark above bud union	Bark of main root	Fine rootlets	Blossoms	Peel	Pulp
No.	(ppm)	(ppm)	(Per cent chlorine in dry matter)						
1	0	0	.016	.013	.020	.221	.007	.015	.015
2	35	35	.014	.028	.043	.189	.009	.018	.018
3	70	35	.044	.065	.061	.272	.009	.014	.017
4	140	70	.042	.081	.097	.246	.011	.026	.025
5	210	70	.043	.120	.134	.350	.012	.086	.030
6	280	70	.181	.221	.149	.354	.026	.122	.046
7	420	140	.136	.185	.159	.269	.022	.081	.035
8	560	140	.188	.252	.142	.387	.038	.243	.076
9	840	280	1.035	.380	.192	.348	.177	.247	.128
10	1120	280	1.227	.371	.237	.523	.145	.389	.125
11	1400	280	1.613	.413	.267	.443	.169	.466	.188
12	1680	280	2.058	.486	.321	.638	.339	.365	lost

concentration of 840 ppm of chlorine occurred in the nutrient solution the percentages of chlorine in the dry matter of the leaves remained relatively low. However, in the range of 560 to 840 ppm, the chlorine content in the dry matter of the leaves increased from 0.188% to 1.035%. This abrupt change in the chlorine content of the leaves at the 840 ppm chlorine concentration in the nutrient solution makes it difficult to relate the

Severe defoliation of Lisbon lemon trees on sour orange rootstocks grown in large out-of-door soil cultures that received a nutrient solution containing various concentrations of chlorine. Left to right: 0, 35, 1,400 and 1,680 ppm chlorine representing the two extremes in the experiment.



In the table, the percentages of chlorine in the dry matter of the bark of the trunk above the bud union and of the bark of the main root below the first lateral rootlet tend to increase as the concentration of chlorine increases in the nutrient solution.

Until a concentration of 560 ppm of chlorine is reached in the nutrient solution the percentages of chlorine in the dry matter of the fine rootlets exceeded those of the corresponding leaves. Above 560 ppm chlorine in the nutrient solution, the percentages of chlorine in the dry matter of the leaves greatly exceeded those of the corresponding rootlets. The fine rootlets are considered to be better than leaves as a measure of the sodium content in soils. The data in the table would indicate that neither the dry matter of the leaves or rootlets gives a satisfactory measure of the chlorine content in the soil, the dry matter of the bark perhaps being as good or better indicator.

The dry matter of lemon blossoms may

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Red Mite on Citrus

timing control treatments important and influenced by climate of growing areas

L. R. Jeppson

Populations of red mite—spider—on citrus are influenced by temperature and humidity, local air movements and weather variations.

Observations and measurements have shown that maturing leaves are more favorable for citrus red mite development than old leaves. Climate, in affecting leaf growth, therefore has an important influence on seasonal cycles of mite population.

In oranges, the periods of greatest plant growth are mainly in spring and fall, with the most extensive growth in spring.

In lemons, the greatest growth also occurs generally in spring and fall. However, lemon trees may produce new growth whenever weather conditions are favorable. Therefore, growth favoring mite development in lemons exists through a larger part of the year than it does in oranges. As a result, high mite populations may occur on lemons over a greater part of the year unless reduced by unfavorable weather conditions.

Distinct Growing Areas

Three fairly distinct growing areas of southern California can be distinguished according to their effects on mites in lemon orchards.

The coastal area includes orchards between the ocean and the first coastal hills. The climate is similar to that over the ocean, and warmest daytime temperatures most often occur in fall rather than in summer.

Effective control of mite populations in coastal orchards has been obtained by treatment toward the end of June or in July, with a second application in October or November.

A broad Intermediate—Transition—Area includes citrus districts located between the first coastal hills and the coastal mountains. Here the weather is influenced by daily land and sea breezes. Mornings are typically warm and dry because of the land breezes. In the afternoons the sea breeze brings cooler humid air from the ocean. As a result, there are greater fluctuations in daily temperature and humidity than in the coastal districts. Treatment of orchards in districts toward the interior in August or September followed by a second treatment in the spring has given mite control.

The Valley Area includes the valleys between the coast mountain range and the Sierra Nevada—districts not reached by the sea breezes—which have longer periods of continental climate influence. Hot, dry winds from the interior may bring desert air to all citrus districts in this area. Because hot dry weather often reduces mite populations, applications may be delayed sometimes until September or October.

In making this study 14 or 15 treatment schedules were followed. These schedules generally consisted of two treatments a year, five or six months apart. The fall applications August through January were made with petroleum oil at 1¾ gallons actual oil per 100 gallons of spray. During the other months treatments consisted of one pound of a 50% formulation of ovex—Ovotran—per 100 gallons. Applications were made as full coverage sprays. Timing schedules are based on a 3-year study of population trends resulting from each treatment schedule and from untreated plots in groves at Somis and Tustin and on untreated plots at Oxnard and Fillmore.

Four Groves Studied

Citrus red mite population studies made in citrus groves represented each of the three climatic areas. Population peaks and declines did not always occur at the same time each year, but certain trends were evident.

In an orchard in the Coastal Area—near Oxnard—mite populations were low each June and increased to a peak in July, August, and September. In three of the four years of the study, the mite population declined in October and December to a relatively low level.

In a 3-year study of an Intermediate Area orchard—near Somis—populations were low in June and July, increasing to a peak from August to November unless adversely affected by high temperatures and low humidities. Winter conditions were relatively unfavorable for increases in populations, and by March of each year few mites were found.

In a 3-year study of another Intermediate Area orchard—near Tustin—mite numbers followed the same trends but with higher fall peaks except in 1954 when the highest peaks occurred in early spring. In all three years they decreased in March and were low by June. In contrast to the Somis grove, however, mites seemed to develop unimpeded in July.

At Fillmore—in the Valley Area—1-year studies showed mite populations to increase during August and September. They maintained a moderate level during the winter and spring and decreased during June and July.

It is not easy to predict the time of year when citrus red mite will appear in a lemon grove in numbers sufficient to cause damage, and ideal times for treatment can not always be used because other pests of citrus must be considered when setting up treatment schedules.

L. R. Jeppson is Associate Entomologist, University of California, Riverside.

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also show an increase in their chlorine content. As in the leaf samples, the chlorine content in the dry matter of the blossoms increased very markedly as the chlorine concentration in the nutrient solution was increased from 560 to 840 ppm. In this connection, orange blossoms can increase their accumulations of total sulfur, as was evident in an experiment with large out-of-door well-drained soil cultures of Valencia orange trees on Brazilian sour orange rootstocks. The nutrient cultures were made with distilled water and Hoagland's *A, B, C* stock solutions, plus the seven trace elements and various concentrations of ammonium sulfate. The nitrogen in the various nutrients was equalized by means of ammonium nitrate. The dry matter of the orange blossoms collected in March of the third year of the experiment, showed a total sulfur content, calculated as sulfate: 0.32, 0.36, 0.40, 0.41, 0.44, 0.45, 0.42, 0.41, 0.51, 0.48, and 0.49% for the cultures that received sulfate concentrations of 0, 96, 192 ppm and increasing by 96 ppm until 960.

For the chlorine analysis of the peel and pulp reported in the table, six tree-ripe lemon fruits of average size for the culture were used. The percentages of chlorine in the dry matter of the peel and pulp were found to vary but little until a concentration of 210 ppm chlorine occurred in the nutrient solution. There-

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CHLORINE

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after, the percentages of chlorine in the dry matter of the peel greatly exceeded those of the pulp, both peel and pulp accumulating considerable chlorine.

Joseph N. Brusca is Principal Laboratory Technician, University of California, Riverside.

A. R. C. Haas is Plant Physiologist, Emeritus, University of California, Riverside.

MARKETING

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During the postwar years, retail grocery store sales have tended to trend up, but that trend has not been distributed evenly among all products. Some products and brands have gone ahead faster than others. Another fact in food distribution today pertains to the distinction between major advertised brands and minor brands. The major advertised brands not only account for the larger part of the total food market but the proportion has trended up slightly during the past half-dozen years. However, shifts occur within major brands, and those—like all other brands and products—have to struggle to hold their position. Of the top brands existing in 1948, more than one fourth had been introduced within the preceding six years. However, by 1954, 60% of the top brands in 1948 had been replaced by other brands. Not only is there a shifting among the major or top brands, but a competitive struggle is developing between nationally advertised and private label brands.

Shifting of positions among brands is not limited to the product or where the name of a brand is changed or even where a new brand is introduced. The shift is tied in with the development and introduction of new products. Between 1948 and 1955, the dollar sales of product classes without new or improved products increased 10%; but for product classes with new or improved products, the dollar sales in 1955 were 78% above 1948. As an indication of what is happening, one manufacturer merchandising through retail grocery stores reported that probably 70% of that company's volume comes from products that did not exist 10 years ago, which emphasizes the importance of research in foods and food products.

New product development and introduction has gone along with changes in promotional activities. During the past half-dozen years, remarkable changes have occurred in uses of advertising media. Since 1948, advertising—in newspapers, magazines, network radio, and network TV—as a whole has increased some 80%, but the proportion taken by newspapers and magazines has trended down. There has been a considerable downward shift in network radio, but a fantastic growth in the use of network TV. It is estimated that in 1957 some 45% of the total advertising funds expended is accounted for by network TV.

The competitive struggle by merchandisers for consumer attention has not been limited to printed matter and TV. In 1955, consumer promotions—excluding couponing and house-to-house samples—accounted for 11% of the total sales of seven major commodities; but in 1956, this type of consumer promotion accounted for 14.4% of total sales of those seven commodities. Whether merchandisers do or do not like to bother with promotional devices or whether consumers may be getting tired of them, they have been increasing in number and in dollar importance in the past several years.

Among the most notable changes in food distribution have been in the stores themselves. In 1942, clerk service occurred in about three fourths of the stores and self-service in the remaining one fourth. By 1955, the position was reversed with 75% of the stores classified as self-service and only 25% as clerk service. At the same time, the size of stores in terms of dollar volume has grown tremendously. In 1942, the average grocery store did about $78,200 worth of business a year. By 1955, the volume had grown to over $415,000, an increase of some 480%.

The growth of supermarkets—and in some cases giant supermarkets—has been one of the most significant developments in food distribution. As mass production has come to characterize American manufacturing industries, mass distribution is characterizing food marketing. However, supermarkets do not restrict themselves to food. They often carry hardware, clothing, notions, records, variety and drug items.

In some sense the old-time country general store with its many lines of products has returned in changed form. The medium-sized supermarket today carries 5,000 different items, all of which compete for shelf space and floor space. The food items are being crowded more and more as indicated by what is happening in frozen foods. The original cabinets were introduced primarily for frozen fruits and vegetables, but these items are being crowded for space by ice cream, popsicles, frozen pies, salads, and pizza as well as frozen TV dinners.

As food stores have grown in size and added new product lines, the market structure to which growers sell has changed. Mass buying by corporate chains is now an old story; but in recent years, privately owned or independent stores have been joining together in large-scale buying groups. The expansion of cooperative buying by independents has reinforced the changing market structure facing growers. These large-scale buyers of farm products—voluntary cooperatives as well as corporate chains—do not operate as did the independents acting singly. Product specifications, point of purchase, product mix, and trading terms may be affected. The balance of bargaining power between growers and those to whom they sell is changing.

It is within the current dynamic distribution system that orange marketing today must operate. The changing marketing patterns provide opportunities—and new problems—in the marketing of California oranges.

Sidney Hoos is Professor of Agricultural Economics, University of California, Berkeley.

ALBINISM

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infection during the extraction and preparation for planting. *2,* Its appearance is prevented by treatment of fresh seed with a variety of fungicides. *3,* Treatment of seed with the same fungicides after storage does not always prevent albinism. If infection occurs at the time of planting, treatment at that time would be effective in preventing development of the fungus, thereby preventing albinism. However, if infection with the fungus has occurred before storage, a treatment after storage would not be expected to have the same preventive effect. If a microorganism is responsible for the chlorophyll deficiency, it must produce its effect through some action on the seed coats, because complete removal of the embryo from contact with the seed coats prevents the occurrence of albinism.

Attempts to demonstrate that a fungus is causing the albinism have given inconclusive results.

George F. Ryan is Assistant Professor of Subtropical Horticulture, University of California, Los Angeles.

The above progress report is based on Research Project No. 1068.

James F. L. Childs, Pathologist, and Gustave Hrnciar, Fruit and Vegetable Crops and Diseases, United States Department of Agriculture, conducted the studies in Florida mentioned in this report.

H. B. Frost, Associate Plant Breeder, Emeritus, University of California, Riverside, advanced the possibility that toxic action of fungi or bacteria might affect the presence or absence of chlorophyll in citrus seedlings.

J. M. Tager, Plant Physiologist, University of Pretoria, Pretoria, South Africa, and S. H. Cameron, Professor of Subtropical Horticulture, University of California, Los Angeles, determined that removal of the seed coat prevents albinism.