1. Public Area
2. Service Area
3. Private Area

1. The public area comprising the land between house and street (minimum distance often proscribed by city ordinance) is best given over to conservative treatment merely to help frame-in facade (front view) of residence.

2. The service area, usually as small as possible, is to one side of residence (and part of rear, if a utility garden is desired) usually on the same side as the garage and or the kitchen. This permits services and deliveries without violating privacy of the private area.

3. The private area or “Outdoor Living Room” uses the largest space mostly to the rear and preferably connected to the living room of house by a terrace or patio, and contains the garden feature or features (such as garden-house, pergola, pool, bird bath, statue, seats, fountain, barbecue, etc.) for gracious outdoor living. In this mild climate with a maximum of warm sunny days, and especially in lieu of the tendency to build our homes ever smaller and smaller, the “outdoor living-room” should become more and more a fixed minimum requirement for modern living and entertaining.

It of course should be given complete privacy from neighbors by generous border plantings or other barriers which incidentally provide the best background for features or flower beds if desired. It goes without saying that the central area or lawn should be kept open to serve as background and liaison for the complete setting.

The following merely outlines the various considerations which should determine the selection of plant materials (trees, shrubs, vines) for South Florida gardens.

The appended list of recommended species (12 bests) is tentative only, as many local and circumstantial factors may affect a final choice.

**ORNAMENTAL TREES, SHRUBS & VINES FOR SOUTH FLORIDA GARDENS**

1. Landscape uses on Private Properties in Composition for:
   (a) Framing, Background, Skyline
   (b) Shade, Shadows, Borders, Screening, etc.
   (c) Utility, Flowers, Fruit.
   (d) Beauty of (Tree, Shrub or Vine itself)

2. Woody Plants for Home Plantings. Selected for:
   (a) Scale
   (b) Hardiness
   (c) Adaptability to Soil
   (d) Long-lived
   (e) Disease & Pest Free
   (f) Wind storm resistant
   (g) Beauty
   (h) Effect in Flower or Fruit

3. Planting Recommendations
   (a) Get nursery-grown stock (not dug from wild)
   (b) Transplant when dormant or in Rainy Season
   (c) Prune top to balance root reduction
   (d) Prepare adequate hole
   (e) Tamp and soak down
   (f) Do not plant too deeply
   (g) Wrap trunk from sun and mech. injuries.
   (h) Guy or brace with stakes or wire
   (i) After care (watering, feeding, mulching, etc.)

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**SOME STUDIES OF MINERAL DEFICIENCY SYMPTOMS IN MANGO**

**Paul F. Smith and G. Kenneth Scudder, Jr.**

**U. S. Subtropical Fruit Field Station**

United States Department of Agriculture

Orlando, Florida

The foliar symptoms of nutrient deficiencies in mango have not been clearly understood. Even experienced growers are unable to recognize distinctive symptoms of short supply of most of the mineral nutrients required for growth. This condition has persisted for many years in Florida despite the fact that mango trees are frequently grown on very light, infertile soil or on calcareous soils on which other plants usually show deficiencies of several elements. Until 1947 the only description of a deficiency symptom was for zinc (4), although the general yellowing of foliage undersupplied with nitrogen has been recognized for a long time.

The present study was started with the objective of producing foliar-deficiency patterns for a possible eleven mineral elements, with the view that such information would be of value in mango culture. Sand culture studies
were started in the fall of 1947 and continued for about three years with partial success in distinguishing specific leaf symptoms of the various essential elements. The present report gives an outline of the study, along with pertinent descriptions and illustrations of the leaf symptoms which developed and some discussion on the elements which failed to cause any foliar abnormalities.

**MATERIALS AND METHODS**

Two young budded trees1 each of the Haden and Zill varieties were used for each solution tested. A complete solution and solutions omitting nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), iron (Fe), copper (Cu), zinc (Zn), boron (B), manganese (Mn), and sulfur (S), respectively, were prepared essentially as described by Hoagland and Arnon (1). Two additional solutions were one containing only calcium nitrate (Ca(NO₃)₂) and a complete nutrient in which all of the N was in the form of ammonia (NH₃).

The young trees were about a foot high and in one-gallon cans of soil when received. They had been well fertilized, were of excellent vigor, and had deep green foliage. The soil was washed off as carefully as possible and the plants were set in 8-gallon crocks of coarse sand in October 1947. Occasional applications of full nutrient solutions and frequent watering with lake water were given to all trees until March 1, 1948, when all were starting to grow. Treatments with the 14 described solutions were then started on a total of 56 trees.

It was not possible to provide distilled water, which would have been highly desirable, in quantities which would take care of the demands of so many trees. Therefore, until the end of 1948 lake water was used both for making the solutions and for watering the crocks between feedings. The solutions were applied twice weekly in one-half liter doses. The pots were also flushed with water twice weekly.

By the end of 1948, or after 10 months of treatment, no response was evident other than that to the lack of nitrogen, and it was decided to use rainwater as a water source henceforth. The crocks were outdoors all 3 years of culture except for short periods in winter when they were kept in a greenhouse for protection against cold.

Leaf samples were taken in the summer of 1949 and certain analyses were made to determine the quantities of the major elements. After nearly two years of growth the trees had attained such a size that it was very difficult to keep them adequately supplied with water, and it was necessary to cut off most of the top to allow continued growth. The trees were cut off 8 to 12 inches above the sand. Total shoot length, including branches, was measured and fresh weights of the excised tops were determined on December 10, 1949.

During the spring and summer of 1950 a young tomato plant was planted in each crock to observe the effect of the treatments on another species.

**RESULTS**

Symptom expression was very slow and definite patterns were found for only 6 elements during the entire experimental period. These were nitrogen, phosphorus, potassium, magnesium, manganese, and sulfur. A marked reduction in growth preceded leaf pattern expression for most of these elements. In some cases defoliation was common and only a few of the remaining leaves showed distinguishing symptoms. Growth was reduced in the absence of calcium, boron, or copper, but no specific leaf symptoms developed. The omission of iron and zinc from the solution had no apparent effect on tree growth. No difference in response between the two varieties in any respect was noted.

It may be safely concluded that the mango shows "hunger" symptoms for elements except nitrogen under severe and prolonged duress only. This would appear to be attributable to very efficient root absorption, to low mineral requirement of the tissues, or to very efficient re-utilization of the elements once they enter the plant. Tomato plants grown in the same cultures showed an immediate response and manifested deficiency symptoms for all elements. These closely fitted the descriptions given for tomato and related species (2).

After the severe topping-back in Dec. 1949, a number of trees died. Death appeared to be due to the action of a parasitic fungus (*Diplodia sp.*), although the resistance may have been conditioned by the nutritional feeding as the greatest die-back incidence occurred in those treatments which had previously caused the greatest reduction in growth. Some of the more vigorous trees were also infected.

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1—Trees provided through the generosity of Lawrence Zill of Delray Beach.
but lateral shoots lower down on the main stem made normal growth.

**Nitrogen deficiency.**—Severe retardation of growth and presence of yellow, undersized leaves (Fig. 1) are the most striking characteristics of nitrogen deficiency. The difference in leaf dimensions shown in table 1 would doubtlessly have been accentuated except for the fact that small applications of nitrogen were given these trees once or twice a year. Even so, only one side shoot developed on one of the 4 trees and the old leaves turned completely yellow and fell each time there was a flush of new growth. Much higher concentrations of phosphorus, potassium, and calcium were found in the mature leaves of these trees than in the other treatments (table 2).

**Phosphorus deficiency.**—Stunted growth of

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**TABLE 1.**

**MEAN GROSS GROWTH MEASUREMENTS AND OBSERVATIONS ON MANGO TREES SUBJECTED TO NUTRIENT SOLUTIONS DEFICIENT IN THE INDICATED MINERALS AFTER 21 MONTHS.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Top growth (in.)</th>
<th>Fresh top weight (gm.)</th>
<th>Side branches (No.)</th>
<th>Petiole length (cm.)</th>
<th>Leaf length (cm.)</th>
<th>Growth flushes (No.)</th>
<th>Date leaf symptom first noted:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>95</td>
<td>640</td>
<td>3.25</td>
<td>2.62</td>
<td>19.7</td>
<td>11.2</td>
<td>May 1948</td>
</tr>
<tr>
<td>-N</td>
<td>23</td>
<td>30</td>
<td>0.25</td>
<td>1.98</td>
<td>14.7</td>
<td>7.5</td>
<td>June 1949</td>
</tr>
<tr>
<td>-P</td>
<td>97</td>
<td>290</td>
<td>4.35</td>
<td>2.35</td>
<td>18.1</td>
<td>10.2</td>
<td>July 1950</td>
</tr>
<tr>
<td>-K</td>
<td>96</td>
<td>800</td>
<td>2.00</td>
<td>2.50</td>
<td>16.0</td>
<td>10.5</td>
<td>Feb. 1950</td>
</tr>
<tr>
<td>-Ca</td>
<td>74</td>
<td>390</td>
<td>0.75</td>
<td>3.05</td>
<td>19.6</td>
<td>10.0</td>
<td>Dec. 1949</td>
</tr>
<tr>
<td>-Mg</td>
<td>84</td>
<td>240</td>
<td>3.00</td>
<td>2.22</td>
<td>17.8</td>
<td>11.0</td>
<td>June 1949</td>
</tr>
<tr>
<td>-Mn</td>
<td>92</td>
<td>290</td>
<td>3.55</td>
<td>2.55</td>
<td>18.8</td>
<td>11.5</td>
<td>Feb. 1950</td>
</tr>
<tr>
<td>-Cu</td>
<td>110</td>
<td>450</td>
<td>3.75</td>
<td>2.22</td>
<td>19.6</td>
<td>11.0</td>
<td>Dec. 1949</td>
</tr>
<tr>
<td>-Zn</td>
<td>88</td>
<td>530</td>
<td>1.75</td>
<td>2.22</td>
<td>20.0</td>
<td>11.5</td>
<td>June 1949</td>
</tr>
<tr>
<td>-B</td>
<td>91</td>
<td>280</td>
<td>3.50</td>
<td>2.50</td>
<td>16.7</td>
<td>11.5</td>
<td>June 1949 (P)</td>
</tr>
<tr>
<td>-S</td>
<td>96</td>
<td>230</td>
<td>2.75</td>
<td>2.55</td>
<td>18.3</td>
<td>11.5</td>
<td>Dec. 1949 (Mg)</td>
</tr>
<tr>
<td>-Fe</td>
<td>150</td>
<td>560</td>
<td>1.00</td>
<td>2.85</td>
<td>16.1</td>
<td>11.5</td>
<td>July 1950 (K)</td>
</tr>
<tr>
<td>Ca(NO₃)₂</td>
<td>84</td>
<td>640</td>
<td>0.75</td>
<td>2.85</td>
<td>20.1</td>
<td>11.5</td>
<td></td>
</tr>
</tbody>
</table>
areas began to develop along the margins of the leaf was greatly reduced. Also, necrotic some cases coalesced so that the green area of weeks later these spots had enlarged and in

viable on both surfaces. The leaves were
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were shown until the new growth developed

Mature leaves had a tendency to be thicker

Potassium deficiency.—For the first two years of the experiment the trees from which potassium was withheld were the largest and most vigorous in the experiment. They showed a remarkable tendency to carry the old leaves. At the time of topping back in Dec. 1949, virtually every leaf that had been formed was still firmly attached and apparently functional. This was very striking because about 10 new cycles of growth had developed in the preceding two years and stem enlargement was very great. After the trees were cut back the trees without potassium made vigorous growth for 6 or 7 months. In late July 1950 small yellow spots (freckles) started to develop on the oldest leaves (Fig. 1). These were of irregular distribution over the leaf and were visible on both surfaces. The leaves were smaller than usual and very thin, and the tips tapered out to a very fine point. A few weeks later these spots had enlarged and in some cases coalesced so that the green area of the leaf was greatly reduced. Also, necrotic areas began to develop along the margins of the leaf (Fig. 1) and these enlarged with time. Abscission did not take place until a leaf was completely dead and often leaves that were dead still persisted.

Magnesium deficiency. — Although tree growth was greatly reduced the first year, no leaf symptoms of magnesium deficiency were recognized. During 1949 these trees flushed regularly but defoliation took place continu

Maganese deficiency.—As with shortages of phosphorous and magnesium, tree size was substantially reduced by shortage of man

ganese but the number of cycles of growth was not affected (Table 1). No symptoms were shown until the new growth developed after the trees were cut back. About one-month-old leaves, fully enlarged but still ten

d, showed a yellowish-green background with a round frontal margin between each pair of lateral veins (Fig. 1). In severely affected leaves the chlorosis may extend to the midrib and little or no green color may remain, and both margins may die more or less regularly. Surprisingly few leaves developed symp

chars, probably because of the premature de

foliation induced by magnesium shortage.

Sulfur deficiency.—The general behavior of the trees without sulfur was somewhat similar to that of phosphorus-deficient trees. Growth was gradually reduced and defoliation was severe. The leaves were very deep green, but upon reaching maturity they developed necrotic areas along the margins and abscised soon thereafter. The location of the dead leaf areas was the chief distinction between these two deficiencies, being a tip scorch in the case of phosphorus and a side scorch with sulfur (Fig. 1).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>N</th>
<th>P</th>
<th>K</th>
<th>Ca</th>
<th>Mg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete</td>
<td>1.54</td>
<td>.055</td>
<td>0.97</td>
<td>0.91</td>
<td>0.26</td>
</tr>
<tr>
<td>—N</td>
<td>0.67</td>
<td>.076</td>
<td>1.48</td>
<td>2.01</td>
<td>0.56</td>
</tr>
<tr>
<td>—P</td>
<td>1.50</td>
<td>.050</td>
<td>0.99</td>
<td>1.12</td>
<td>0.27</td>
</tr>
<tr>
<td>—K</td>
<td>1.48</td>
<td>.063</td>
<td>0.85</td>
<td>1.13</td>
<td>0.31</td>
</tr>
<tr>
<td>—Ca</td>
<td>1.61</td>
<td>.080</td>
<td>1.10</td>
<td>0.87</td>
<td>0.34</td>
</tr>
<tr>
<td>—Mg</td>
<td>1.65</td>
<td>.066</td>
<td>1.18</td>
<td>1.04</td>
<td>0.20</td>
</tr>
<tr>
<td>—Mn</td>
<td>1.39</td>
<td>.054</td>
<td>0.92</td>
<td>1.25</td>
<td>0.54</td>
</tr>
<tr>
<td>—Cu</td>
<td>1.49</td>
<td>.054</td>
<td>1.19</td>
<td>1.45</td>
<td>0.26</td>
</tr>
<tr>
<td>—Zn</td>
<td>1.36</td>
<td>.057</td>
<td>0.91</td>
<td>0.76</td>
<td>0.22</td>
</tr>
<tr>
<td>—S</td>
<td>1.48</td>
<td>.066</td>
<td>0.93</td>
<td>1.20</td>
<td>0.23</td>
</tr>
<tr>
<td>—Fe</td>
<td>1.58</td>
<td>.100</td>
<td>0.91</td>
<td>1.12</td>
<td>0.22</td>
</tr>
<tr>
<td>—B</td>
<td>1.49</td>
<td>.066</td>
<td>1.18</td>
<td>0.90</td>
<td>0.35</td>
</tr>
<tr>
<td>Ca(NO₃)₂</td>
<td>1.71</td>
<td>.065</td>
<td>0.67</td>
<td>0.78</td>
<td>0.15</td>
</tr>
</tbody>
</table>
Other elements.—Shortage of the other elements tester did not cause definite deficiency leaf patterns. Trees deprived of calcium were small and slightly lighter green than normal but they appeared to be healthy otherwise. The same was true of those deficient in copper and boron. The trees simply grew only as much as they could with the small supplies of these elements obtained as impurities and by reutilization within the plant. The growth of each successive flush was progressively less, but leaf patterns did not develop during the 3-year period. Trees without copper showed suggestions of the S-shaped limb growth described as an orchard symptom of copper deficiency (3). Trees given minus-iron and minus-zinc treatments showed no symptoms of deficiencies and were among the more vigorous in the experiment. It seems likely that more rigid cultural conditions, involving greater purity of chemicals, water, and sand would be required to induce greater stress for these elements. It seems possible that smoke from a nearby gas plant might have supplied some of the trace elements. Light deposits of soot were occasionally found on the leaves and sand. It is conceivable that enough copper, zinc, boron, or iron might be provided in this manner to supply a slow-growing tree, yet be inadequate for a very rapidly growing tomato plant.

Calcium nitrate.—The trees fed Ca(NO₃)₂ only showed the first typical phosphorus deficiency symptoms at the same time as the trees given the minus-P treatment and later showed definite magnesium and potassium deficiency patterns.

Ammonia nitrogen.—The four trees that receive all of the nitrogen in the form of ammonia became sickly in appearance soon after the start of the experiment and all died during the first year. A reddish-brown scorch of the entire margins of the leaves developed and defoliation followed soon. A repetition of this procedure took place on each new cycle of leaves until the trees died. The trees apparently are unable to use ammonia in their metabolic processes. pH did not seem to be a factor. The pH of the drainings from these crotches was almost equal to that of the applied solution (5.5). Also, suspending CaCO₃ in the nutrient solution applied to an extra Haden tree had no beneficial effect. It died back in the same manner until the NH₃ was replaced with NO₃, after which it recovered. Thus, it seems rather certain that mango cannot utilize ammoniacal nitrogen, and it might be advantageous to use only fertilizers with nitrate nitrogen. Field tests, however, should be made on both the light, acid soils and the heavy, calcareous soils in the mango-producing areas before practical recommendations are made.

The major nutritive minerals were determined on a complete collection of leaves made on August 2, 1949 (table 2) and on individual samples at other times. The concentrations of the elements other than magnesium are on a distinctly lower plane than would be found in citrus trees grown under similar conditions (6). There was such similarity in the values obtained from the two mango varieties that they were all averaged. Thus, each figure in table 2 is a mean of the values found in each of the four trees of each treatment. The level of calcium is much lower than is normally found in other kinds of trees, and it is surprising to note that the trees fed only with Ca(NO₃)₂ had less calcium in the leaves than those with any other treatment except the minus-calcium one. Apparently calcium is excluded to some extent by the root system. Leaves from the -P and -S trees were somewhat younger than the others because of the defoliation induced by these treatments. This probably makes the percentage of phosphorous slightly higher than would be expected. Values as low as 0.035% P were found in old leaves from the -P trees in other samples. Necrotic leaves from the -K trees contained 0.18% potassium.

In general, the deficiency levels of nitrogen and phosphorus found by leaf analysis are considerably lower than in citrus while potassium and magnesium are of about the same order of magnitude.

Summary

Two trees of each the Haden and the Zill variety of mango were grown for 3 years in sand cultures with solutions from which eleven essential mineral elements were systematically omitted in an attempt to define as many leaf deficiency symptoms as possible. Deficiency symptoms in leaves were found for six elements as follows: nitrogen, small leaves and general yellowing; phosphorus, a leaf-tip necrosis, premature abscission and stem dieback; potassium, irregularly distributed yellow spots and necrotic areas along the margins of small, thin, attenuated leaves...
which are very persistent; magnesium, a green-wedge pattern formed by the lateral intrusion of a bronzed chlorosis along the leaf margin; Mn, yellowish-green chlorosis over the small veinal network; and S, lateral necrotic spots on a very deep green leaf and premature defoliation.

No specific symptoms were found when Ca, Cu, B, Zn, and Fe were omitted, but omission of the first three resulted in considerable growth reduction.

Trees fed only calcium nitrate showed deficiency leaf patterns for phosphorus, magnesium, and potassium in succession.

LITERATURE CITED

TROPICAL AND SUB-TROPICAL FRUITS IN FLORIDA

Wm. R. Grove
Laurel

The value of citrus fruits to the world is so well established and receiving so much attention that a short paper need not discuss them. This applies, only to a lesser degree, to avocados, bananas, pineapples, guavas, coconuts, and papayas. They are thoroughly discussed in bulletins of the United States and Florida Departments of Agriculture.

Mangoes are considered by many to be the world's finest fruit. So many fine varieties are being developed in Florida that it is difficult to make selections that would satisfy all. One of the best mango growers and experts in the state recently remarked that the situation is so confusing that if he were to plant a new grove this year he would not know what varieties to select. However, the confusion comes from so many good varieties rather than a dearth of them. It will probably require at least another ten years for the best commercial varieties to become established. Mangoes for commercial planting must bear well, look well, eat well and ship well. Of the four, shipping may not be a prohibiting factor, as some one will, doubtless, develop a mango especially for freezing purposes. This one would not have to be shipped fresh. Many factors enter into the marketing problem.

At a Florida mango forum a riot of color is displayed that rivals a flower show. Color, however, is not always a quality criterion. It is quite a disappointment to a judge on a quality committee to observe that the next fruit to be examined has a most gorgeous color and upon tasting it to find that it has no better flavor than a raw potato. Time will eliminate the undesirable and there will remain a lot of very fine mangoes. The mango, when a good marketing organization is in operation will become a great industry in Florida. The climate and soil are satisfactory in the southern parts of the state from south of the Manatee River on the West Coast to the area of Merritt Island on the east coast and south to Homestead. An excellent bulletin has been prepared by S. John Lynch and Margaret Mustard of the University of Miami and recently issued as Bulletin 135 by the State Department of Agriculture.

The Lychee is rapidly becoming an industry in Florida. On October 11th of this year the first meeting looking to the formation of an organization of growers was held. Several hundred acres are now planted, including probably the largest Lychee orchard in the world—a few miles east of Bradenton, where there are now more than 200 acres already planted. A number of small orchards (ten acres seems to be the popular size) up to 40 acres have been planted south of the line from Dade City to Oviedo, with scattered small plantings from Leesburg to DeLand and as far south as Miami and Homestead, where much difficulty is encountered, especially with the very young trees. One hundred and forty acres have been or are being planted within four miles of Venice. The Lychee is in great demand as a fresh fruit, deep freezes very well, is always in demand dried, and can be