Lemon Response to Phosphate

substantial increase in yield of lemons followed
application of phosphate in trials in two counties

D. G. Aldrich and J. J. Coony

Vegetative Growth response of lemon
trees—showing phosphate deficiency
symptoms—toward phosphate applications
has been outstanding but the effectiveness of
fertilizer treatments must finally be eval-
uated in terms of yield.

In February 1950, arrangements were
made with the owner of a lemon grove
located near Fillmore to maintain picking
records on all of the trees involved in the
fertilizer test plots. On several occa-
sions this has required monthly picking
records from this grove.

A summary of the lemon yield data
obtained from the trees in these plots is
shown in the accompanying table. While
much more yield data must be obtained
before sound conclusions can be drawn,
it appears that phosphate fertilization
has substantially increased the yield of
lemons in this grove.

The data reveal on the other hand that
potassium fertilization is reducing the
yield of lemons when compared with the
yield of trees receiving only nitrogen.

An explanation of this reduction in
yield by potassium fertilization may be
found in the leaf analysis data collected.
Potassium additions to the grove near
Fillmore have reduced the magnesium
content of the trees to a level that is sug-
gestive of magnesium deficiency. Further,
the addition of potassium with phos-
phorus appears to have reduced the phos-
phate level of the nitrogen, phosphorus,
and potassium treatment when compared
to the nitrogen plus phosphorus treat-
ment. The effect of potassium on the yield
of phosphate-deficient lemons was noted
for the first time in these trials and undue
emphasis of this relationship should not
be made until more yield information is
obtained.

Through the cooperation of packing
house managers in San Diego County it
will be possible to obtain yield data on
lemon fertilizer test plots established more
recently in that area. The first picking
records from two of those plots were re-
cently obtained and are included in the
table.

While the yield data from these groves
are far from conclusive, the relationship
of treatment to yield is similar to that ob-
tained from the orchard near Fillmore.
Yield estimates made on groves for which
actual yield data are not available suggest
the beneficial effect of phosphate fertil-
ization.

All of the experimental groves cited
in this report were selected on the basis
of a general occurrence throughout the
grove of the deficiency symptoms de-
scribed in Part I of this report. Diseases
such as shell bark, gummosis—often
found in lemon trees were absent in the
groves selected for study.

Chemical analyses of leaves collected
from these groves indicated consistently
a direct relationship between the de-
scribed leaf symptoms and a deficiency
level of phosphorus. Leaf analysis also
indicated a direct relationship between
vegetative stimulation and increased fruit
production and a substantial increase in
the phosphorus content of these lemon
trees as a result of phosphate fertilization.

There are possible exceptions to the
relationship that lemon trees showing leaf
symptoms described in this article will
respond to phosphate fertilization.

These exceptions involve lemon trees
that function abnormally due to the pres-
ence of diseases like shell bark, gummosis,
and phloem collapse. When any one of
these diseases makes sufficient headway
in the lemon tree, root decay occurs and
nutrient absorption is impaired. Defi-
ciency symptoms may be produced which
cannot be corrected by fertilizer applica-
tions. The inability of the diseased lemon
trees to absorb nutrients can be confirmed
by leaf analysis.

When phosphate deficiency symptoms
occur in lemon trees as a result of a soil
deficiency, symptoms occur generally
throughout the grove. Deficiency symp-
toms which are a secondary effect in-
duced by disease occur sporadically in a
grove inasmuch as they are associated
with diseased trees. Such trees are not
likely to respond to fertilization. An ex-
ception to this case, of course, would be
the diseased tree located on a phosphate-
deficient soil. Here correction of the pri-
mary deficiency might be possible if the
inroads of the disease were not severe and
some improvement in vigor of the tree
would result. However, the effects of the
disease itself would still have to be con-
sidered.

Phosphate fertilizer trials have been
established in Santa Barbara County on
lemon trees infested with phloem collapse
and which show scattered phosphate defi-
ciency symptoms. These trials have been
established for approximately one year,
period sufficient to produce stimula-
tion where a soil deficiency of phosphorus
is involved. Yet no evidence of vegetative
stimulation or phosphorus uptake by the
tree has been detected up to this time.
These experiments will be continued to
determine if nutrition plays a part in the
lemon collapse problem.

Surveys of the incidence of phosphate
deficiency in lemons due to soil deficiency
are being completed in lemon-producing
areas. A resume of these findings will be
included in a future report on this subject.

Part I of this progress report, published in the February 1951 issue of California Agriculture, described
the marked improvement observed in the vegetative characteristics of lemon trees receiving soil
applications of phosphate fertilizer in field trials in Ventura and in San Diego counties in 1949-50.

Preliminary Lemon Yield Data from Fertilizer
Plots Located near Fillmore, Escondido,
and Rancho Santa Fe, California
(Yield in field boxes)*

<table>
<thead>
<tr>
<th>Grove</th>
<th>N</th>
<th>NP</th>
<th>NK</th>
<th>NPK</th>
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</thead>
<tbody>
<tr>
<td>Fillmore†</td>
<td>14.5</td>
<td>21.6</td>
<td>10.8</td>
<td>22.3</td>
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<tr>
<td>nonmulched plots</td>
<td>15.0</td>
<td>24.4</td>
<td>12.3</td>
<td>21.8</td>
</tr>
<tr>
<td>Rancho Santa Fe †</td>
<td>21.3</td>
<td>23.3</td>
<td>41.3</td>
<td>41.1</td>
</tr>
<tr>
<td>Escondido†</td>
<td>5.8</td>
<td>8.3</td>
<td>6.6</td>
<td>8.8</td>
</tr>
</tbody>
</table>

* Each yield figure represents the total number of field boxes picked to date from the 5 trees in
each treatment.
† The yield data for the plots at Fillmore re-
represent the total number of boxes picked from
the 5 trees in each treatment during period Feb-
ruary to September, 1950.
‡ The yield data from the plots at Rancho Santa
Fe and Escondido represent the boxes of fruit
picked from the 5 trees in each treatment at the
time of the first pick made September, 1950.

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The field trials in Santa Barbara County were
established with the cooperation of Arnold
White, Farm Advisor, University of California
College of Agriculture.