Organic Chemicals on Citrus

stimulation of tree growth resulted from addition of certain pure compounds to nutrient cultures in glasshouse studies

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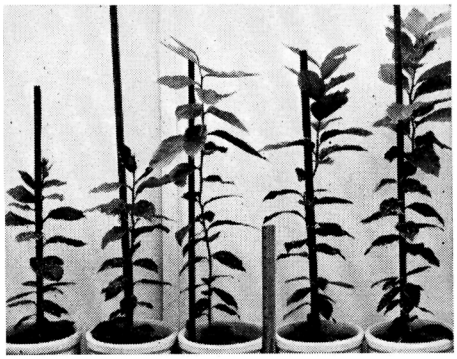
Organic manures or cover crops in southern California citrus orchards have —to a large extent—been abandoned. Scarcity, increased costs, rapid disappearance of organic matter in many soils, and a lack of strong evidence as to its actual benefit to the tree, are among the factors that have limited their use.

Carbon dioxide production, solvent action on various soil constituents or compounds, improvement in tilth, nitrogen phosphorus potassium fertilizer and trace element content and the often erroneous concept of improvement of the water-holding capacity of the soil are among some of the reasons that had favored the use of organic manures. Now large acreages of citrus orchards are operated without the addition or use of organics, in fact, special care is taken to prevent the growth of live plants such as weed or cover crops by the use of oil sprays and to limit plant growth in the soil as far as possible to that of the tree itself.

Apart from field practice it was deemed worthwhile to study whether some pure organics in the nutrient medium can be of benefit in the growth of citrus. Such studies might also have value as regards tree-growth rejuvenation.

Certain organic insecticides have growth stimulating properties when added to citrus cultures. Seedlings of several citrus varieties have been shown to be greatly stimulated in their growth when various concentrations of 2,4-D were added to the nutrient applied to soil cultures.

In soil cultures, it is possible that the 2,4-D brought about changes in the soil that in turn produced the growth stimulation. To study this, tests with silica sand instead of soil cultures were conducted with rooted Prior Lisbon lemon cuttings in order to note whether such growth stimulation by 2,4-D in soil also occurs in sand cultures. Chemically pure salts or compounds—including repurified ferrous sulfate—were used in the tests. The most pronounced stimulation of growth occurred when the nutrient solution contained at all times 0.05 ppm—parts per million—2,4-D. The average fresh weight of the tops of the control lemon cultures was 97 grams as against 153 grams when 0.05 ppm 2,4-D was used. The corresponding dry weights of the roots were 11.9 grams and 17.8 grams.



Stimulating effect of certain pure vitamin powders on the top growth of rooted Prior Lisbon lemon cuttings in silica sand cultures.

Certain pure organic compounds—glucosides—are able to stimulate the growth of rooted Prior Lisbon lemon cuttings when grown in silica sand cultures. For example, esculin, a glucoside obtained from the inner bark of horsechestnut trees was capable of stimulating the top growth of these lemon cultures. This organic compound is reported as being fluorescent and capable of absorbing ultraviolet rays.

The concentrations of esculin used were: 0, 50, 100, and 200 ppm present in all applications of nutrient solution. The tops of the lemon cuttings weighed: 9, 13, 14, and 13 grams fresh weights at the various esculin concentrations.

Another type of organic compound is that of vitamins which may occur in various plant tissues. A study was made to determine whether growth stimulation occurs when certain vitamins are added to silica sand cultures of rooted Prior Lisbon lemon cuttings. Hoagland's nutrient solution containing trace elements was added at intervals after the single application of the vitamin powder to the sand cultures. The cultures were grown from January 18 to June 13. The effects of vitamin concentrations on the top growth of lemon cuttings are shown in the photograph. The culture on the left was the control; the second culture received 0.01 gram of crystalline vitamin B_{12}; the third, 0.02 gram. The fourth, to the right of the straight-edge, received 0.01 gram of vitamin B_6 hydrochloride—pyroxidine hydrochloride—and the fifth culture, 0.02 gram. Only the third culture received, on April 13, a second application of 0.01 gram of vitamin B_{12}.

The smaller of the two vitamin B_{12} applications produced no better growth than that of the controls without the added vitamin. However, with an increased application of vitamin B_{12}, the growth of the lemon top was stimulated. Both concentrations of applied vitamin B_6 greatly improved the top growth of the cuttings.

The beneficial use of corn cobs by other research workers in the fertilization of trees has raised the question as to whether certain pure organic compounds derived from corn cobs might be effective in stimulating the growth of citrus. Accordingly, tests were conducted with rooted Prior Lisbon lemon cuttings in three-gallon-capacity well-drained soil cultures in the glasshouse. Hoagland's nutrient solution—A, B, C stock solutions —was used and contained the trace elements: 0.2 ppm boron as boric acid, manganese as sulfate, repurified iron as ferrous sulfate, and molybdenum as sodium molybdate, one ppm zinc as sulfate, three ppm aluminum as citrate, 0.1 ppm copper as sulfate, and 0.05 ppm chromium as potassium chromate.

To this nutrient solution were added at all times various concentrations—0, 100, 200, 300, 400, and 500 ppm—of wood sugar. Wood sugar—d-xylose—was used because it can be obtained in a pure state from bran, straw, and particularly corn cobs by heating with dilute acids and because it does not ferment and can be dissolved in the nutrient solution. Citrus trees are often grown in areas of high air and soil temperatures and in soils in which the soil solution is acidic in nature.

Seven rooted Prior Lisbon lemon cuttings were grown in soil cultures—to which d-xylose had been added—from November 5 to June 13. When harvested, the heights of the tops were: 63″, 57″, 69″, 68″, 68″, 76″, and 71″; the fresh weights of the leaves were: 123, 91, 138, 154, 151, 159, and 155 grams; and the fresh weights of the entire tops were: 214, 179, 239, 250, 229, 256, and 240 grams.

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