Photo 1. Valencia orchard near Calexico.

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SOIL TYPE AND WATER MANAGEMENT

Essential Considerations for Citrus Plantings Irrigated with Colorado River Water

Although Colorado River water has been used for irrigating various crops in southern California for many years, careful consideration to soil type and water management is especially important to successful use for new citrus plantings. The Colorado is the principal source of water for the Imperial and Coachella valleys and is being used increasingly for crop production in San Diego and western Riverside counties.

THE QUALITY of Colorado River water varies somewhat from year to year, depending upon the precipitation in the drainage basin. Generally, the amount of total soluble solids varies between 800 to 900 parts per million (ppm). The average composition of the water (in milliequivalents per liter) includes: bicarbonate, 2.8; chloride, 2.7; sulfate, 7.2; nitrate, 0.02; calcium, 5.2; magnesium, 2.6; and sodium, 5.0. The sodium percentage of total bases is about 39. This water source contains approximately one ton of soluble salts per acre-foot. Removal of these salts where this water is used for irrigation is important to prevent the accumulation of excessive amounts in the soil.

This report summarizes experiences with the use of Colorado River water on citrus at three representative locations in southern California: (1) Calexico—a 30-year-old Valencia orange orchard growing on tiled but imperfectly drained Imperial silty clay; (2) Hemet—a 35-year-old grapefruit orchard growing on deep, well-drained Hanford sandy loam; and (3) Lake Mathews area near Riverside—a three-year-old navel orange orchard growing on an unclassified, shallow, calcareous soil with a calcium carbonate cemented hardpan at about 20 inches, which restricts drainage of applied water.

Photo 1 shows a view of the Valencia

Photo 2. Grapefruit orchard near Hemet.

orange orchard at Calexico. In the foreground, trees affected by excessive amounts of salt are smaller than trees in the background, which are not being appreciably affected by excessive soil salinity. Analyses of soil and leaves at this location confirm that where the water table at various times of the year rises to within three to four feet of the surface, excessive salts as well as excessive moisture adversely affect the trees. Crop production in this orchard as a whole averages approximately two field boxes per tree and, with relatively low operating costs, satisfactory economic returns are obtained.

Tiles assist

Without tiles to assist in removal of leaching waters which carry away excessive salts, this orchard would, no doubt, soon produce very poorly. Recently, tiles have been placed at 80-foot intervals from about four to six feet in depth. Formerly, tiles were spaced every 240 feet. The spacing of tiles at closer intervals in the areas troubled with excessive soil salinity should prove very helpful in leaching out excessive salt. In this orchard, the water must be managed to avoid excessive salts, and at the same time avoid iron chlorosis from excessive water on a calcareous soil. Approximately 6⅔ acre-feet of water (per acre) are applied annually in this area of hot summers with low humidities.

Second location

At the second location in Hemet, Photo 2 shows very large, excellent grapefruit trees growing on well-drained Hanford sandy loam. Here production will average close to 10 to 15 boxes per tree on trees of the size shown in the picture. About 3⅔ acre-feet of water (per acre) are used annually in this orchard. This is sufficient to supply water needs of the trees and keep excessive soluble salts leached out of the root zone in this soil with excellent internal drainage. Near this orchard, Colorado River water caused problems when applied with an overhead sprinkler. Between each pass of the jet of water, enough time elapsed for evaporation of the water droplets to take place on the leaves. This resulted in concentration of the most water-soluble salts, such as sodium chloride. During an irrigation season, excessive amounts of sodium and chloride are absorbed by the leaf tissue and salt damage results.

This salt damage from sprinklers is shown in Photo 3. In interior districts of California, where summer humidities are low and evaporations high, special precautions must be taken when using irrigation waters which have sodium and/or chloride in the neighborhood of 100 ppm.

Photo 3. Sprinkled young grapefruit orchard, Hemet.

Photo 4 shows a navel orchard in the Lake Mathews area near Riverside. About three acre-feet of Colorado River water (per acre) were used annually on this shallow soil with little or no internal drainage. Soil salinity quickly developed in a three-year period, with the resultant death of trees (seen in foreground) in areas where drainage is impaired. In the background, trees are still growing reasonably well because salts are moving out of the soil as a result of downhill movement of water and soluble salts into the area of dead trees below. Soil depth is quite variable in the Lake Mathews area of Riverside County, and conditions should be carefully checked before planting citrus.

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GROWTH REGULATORS FOR GRAIN CROPS

A STUDY IS UNDERWAY to determine the feasibility of incorporating growth regulators into a mineral nutrition program to obtain increased yields of agronomic crops. Studies conducted under both greenhouse and field conditions have shown that foliar applications of 2,4-D have increased the yields of beans, barley, and wheat up to 30 per cent. Protein content of both barley and wheat seed was increased in the 2,4-D treated plants.

Laboratory studies involving cell-free extracts have shown that several enzymes essential for carbon dioxide fixation showed increased activities in systems from bean plants treated with growth stimulating levels of 2,4-D. Activities of these enzymes were decreased in systems from plants treated with growth inhibiting concentrations of 2,4-D. An auxin-induced increase in carbon dioxide fixation could well be one of the major factors leading to over-all increased growth in plants treated with growth stimulating levels of auxin.

Further studies are in progress to better understand the applications of auxins in agriculture and their physiological bases. *—R. C. Huffaker, Lecturer in Agronomy and Assistant Agronomist in the Experiment Station and Milton D. Miller, Extension Agronomist, University of California, Davis.*

Photo 4. Navel orchard, Lake Mathews area near Riverside.