cultural commissioner. The sequential coverage provided by ERTS-1 was useful in identifying and mapping cotton fields in these studies. Although the accuracy for cotton field identification by computer was only 63%, accuracy equivalent to that of field mapping was considered probable with a full cotton season available for analysis. With the crop calendar method, identification and mapping of cotton fields has been possible in less time and with less cost. The bare field method does not appear to be useful at this time.

The planimetry of the ERTS-1 imagery is such that a base map prepared from USGS topographic maps can be superimposed on the image with almost perfect accuracy. As such, a base map can be drawn directly from ERTS-1 imagery eliminating the need for tedious cartographic work. High flight imagery such as is possible with U-2 aircraft can be used (if available) for updating field lines, which do change, and which are not always seen on ERTS-1 imagery. However, greater resolution of the ERTS-1 imagery would eliminate the need for high flight photography.

Color combining

Color combining of bands 4, 5, and 7 from the MSS to simulate color infrared provided the best color contrasts for field condition identification, which is vital to actual crop identification. In addition, field size, time of year, and a crop calendar of the area to be studied must be available for crop identification.

Three recommendations for improved results leading to practical application of crop inventory and management findings include: (1) camera system improvements (especially resolution); (2) a longer study period (at least one full cotton season) to minimize such factors as weather, crop conditions, and operator inexperience; and (3) imagery must be received by the user no more than two weeks after the pass is made.

Virginia B. Coleman was Staff Research Associate, Citrus Research Center; Claude W. Johnson is a Research Specialist, Department of Earth Sciences and Geography; and Lowell N. Lewis is Associate Dean for Research and Professor of Plant Physiology and was Principal Investigator for the project at Citrus Research Center, Agricultural Experiment Station, University of California, Riverside. *This study was supported by the National Aeronautics and Space Administration Contract No. NAS5-21771.*

INFLUENCE OF
and interstocks on the
in Valencia

C. K. LABANAUSKAS
W. P. BITTERS

THE NUTRITIONAL EFFECTS of the most commonly used citrus rootstocks have been extensively investigated. It is known that the citranges and trifoliate orange rootstocks produce the highest concentration of chloride in the leaves, and that sodium accumulation is higher in trees on mandarin rootstock than those on trifoliate orange hybrid rootstocks. But no information on interstock effects on nutrient concentrations in any citrus scion leaves has been obtained. This paper evaluates the effects of five trifoliate [*Poncirus trifoliata* (L.) Raf.] cultivars used as both rootstocks and interstocks on the accumulation of nutrients in 'Valencia' orange scion leaves. Five of the most commonly used trifoliates were selected for this study, since the literature indicated that trifoliate as a rootstock was not too tolerant to higher amounts of chloride and boron in the soils. Sweet orange *Citrus sinensis* (L. Osbeck) was used as a control rootstock.

Valencia orange was propagated on the following rootstocks: Sweet orange (control), Rubidoux trifoliate (C), Rubidoux trifoliate (A), English small trifoliate, Benecke trifoliate, and Jacobson trifoliate. Rubidoux trifoliate (C) is the same as "UCLA old," and Rubidoux trifoliate (A) is the same as "UCLA young." The same five trifoliates were also used as interstock material between Valencia orange scion and sweet orange rootstock.

Trees were grown for ten years at the South Coast Field Station under uniform cultural practices. Every spring the trees were sprayed with 1 lb of zinc sulfate (36% Zn) and 1 lb of manganese sulfate (28% Mn) per 100 gals of water. The experimental plot was under clean cultivation. Each variation was replicated five times with two trees per plot. In September 1966 and 1967, fifty spring cycle leaves per plot were obtained from non-bearing terminals for chemical determinations of plant nutrients.

Rootstock effects

Nitrogen concentrations in leaves from sweet orange on Rubidoux trifoliate (C) rootstocks were substantially lower than in the leaves from scions on Rubidoux trifoliate (A), English small trifoliate, and Benecke trifoliate rootstocks, but not different in the leaves from trees grown on Jacobsen trifoliate rootstock. The potassium concentration was significantly lower in the leaves from trees on Benecke trifoliate rootstock than in leaves from trees on sweet orange rootstock. Leaves from trees on English small trifoliate had a significantly lower calcium concentration than the leaves from trees on sweet orange. Rubidoux trifoliates (A) and (C), and Jacobsen trifoliate rootstocks, but not different from that found in the leaves from trees on Benecke trifoliate rootstock. Although the concentrations of nitrogen, potassium, and calcium levels in the leaves of trees grown on these different rootstocks varied considerably from each other, these levels were still in the optimal range for citrus production. Substantially lower concentrations of chloride and boron were found in the leaves from

ROOTSTOCKS

macro- and micro-nutrients

Orange Leaves

trees on sweet orange rootstock than in the leaves from trees on the trifoliate rootstocks. Although the concentrations of chloride and boron in the leaves of trees on trifoliate rootstocks were substantially higher than those found in the leaves from trees on sweet orange rootstock, the levels were still not in the high or toxic ranges for citrus production. High range of chloride is from 0.4 to 0.6%, and is toxic when greater than 0.7% on a dry weight basis in citrus leaves. High range of boron is from 101 to 260 ppm, and is toxic when boron concentration exceeds 260 ppm on a dry weight basis in citrus leaves.

The copper concentration in the leaves from trees on sweet orange and Rubidoux trifoliate (C) was significantly higher than in leaves from trees on English small trifoliate rootstock. Leaves from trees on Rubidoux trifoliate (C) rootstock had a lower iron concentration than did leaves from trees on English small trifoliate and Benecke trifoliate rootstocks, but not different from that found in the leaves from trees on the other rootstocks. Effects of rootstocks on leaf phosphorus, magnesium, sodium, zinc, and manganese in this experiment were not statistically different.

Interstock effects

The five trifoliate interstocks had no significant influence on leaf nitrogen, phosphorus, potassium, calcium magnesium, sodium, chloride, manganese, copper, boron, and iron concentrations when compared with sweet orange rootstock with no interstock. Leaves from trees on sweet orange rootstock with no interstock contained a significantly higher zinc concentration (93 ppm) than the leaves from trees containing Rubidoux trifoliate (A) and (C) interstocks 47 and 51 ppm, respectively. The other trifoliate interstocks tended to reduce the concentration of zinc in the scion leaves as compared with leaves from trees grown without an interstock.

Concentrations

The concentrations of zinc and manganese in the leaves of all trees studied were higher than normally found in zinc and manganese unsprayed leaves from citrus trees grown on the South Coast Field Station soil. These concentrations were more in line with the values found in zinc and manganese sprayed leaves.

The data obtained from this experiment clearly demonstrate that rootstocks have a strong influence on nutrient concentrations in scion leaves. The concentrations of chloride in leaves from Valencia trees on several trifoliate orange rootstocks were 56% higher than in leaves from trees grown on sweet orange rootstock. The corresponding figure for boron was 43%. On the other hand, the concentrations of nutrient in leaves from trees grown on sweet orange rootstock were not affected by Rubidoux trifoliate (C), Rubidoux trifoliate (A), English small trifoliate, Benecke trifoliate, and Jacobsen trifoliate interstocks.

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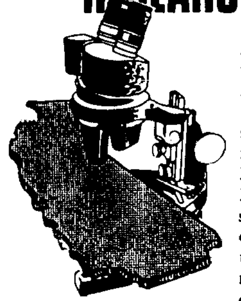
RESEARCH PREVIEWS



A continuing program of research in many aspects of agriculture is carried on at University campuses, field stations, leased areas, and many temporary plots loaned by cooperating landowners throughout the state. Listed below are some of the projects currently under way, but on which no formal progress reports can yet be made.

INSECTIVOROUS BIRDS FOR FOREST INSECT CONTROL

BIOLOGICAL CONTROL specialists at Berkeley are investigating parasites and predators for control of insects that cause great economic damage to forest resources. The research includes study of the feeding and nesting habits of insectivorous birds, and analysis of potential methods for increasing population densities of several beneficial species.

EGGS HELP ENVIRONMENTAL RESEARCH

EGG YOLK DEPOSITION rates may be significant in determining the exposure of birds to environmental hazards, such as pesticides, toxic metals, and oil-soluble pollutants. A recently developed staining technique yields yolk rings which scientists at U.C. Davis will study, to determine the recent history of the female bird's environment during the period of yolk formation. Eggs of representative wild birds will be studied in cooperation with state and federal agencies.

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