

BORON LEACHING

J. L. MEYER · ROBERT S. AYERS

A study of boron removal by flooding and sprinkling during one winter's leaching program indicated boron was leachable and that sprinkling and flood irrigation were equally as efficient at removing boron. The 25 inches of water applied by flooding removed 61 per cent of the boron from the 4-ft rooting depth sampled. Fifty-two per cent of the boron was removed by sprinkling.

AN IRRIGATION WELL, drilled on the west side of the San Joaquin Valley, Stanislaus County, in 1948, and used for 14 years as the source of water for 160 acres of almonds, was found to contain 2.5 ppm boron. At the time of diagnosis in 1962, trees being irrigated were showing typical boron burn symptoms on tips of leaves and necrotic spots on the back side of the leaf midribs. Soil analysis revealed boron levels between 2½ and 3 ppm within the 4 ft. profile sampled. According to leaf analysis, leaf boron levels were 87 to 90 ppm. The irrigation source was then changed to CVP canal water. During the winter of 1962 and the spring of 1963, heavy leaching irrigations were applied in an attempt to flush the accumulated boron below the reach of the almond roots.

One acre of the orchard was irrigated with water carefully metered into flooding basins. The remainder of the orchard was sprinkled. Irrigation water was applied in four flood and five sprinkler irrigations. The total water applied was similar for both sprinklers and flood irrigation. Twenty-five inches of water were applied from September, 1962 to May, 1963. The water used for these leaching irrigations came from the Delta-Mendota Canal (CVP) and contained .3 to .5 ppm of boron.

Soil samples after each irrigation were taken at 12 selected sampling sites and in 1-ft. increments down to 4 ft.

More than half the boron was removed from the soil profiles with the 25 inches of water applied. Actually, 24.8 inches of water from flood irrigation removed 61 per cent of the boron from a 4-ft.

depth of soil, whereas, 25.8 inches applied from sprinklers removed 52 per cent. The difference in these figures is not significant under the conditions that existed during this trial.

This experiment seems to indicate that using more water at each irrigation removes greater amounts of boron salt. However, small amounts of water applied with sprinklers remove the same amount of boron when the total amount of water used during several irrigations is equal to fewer irrigations, but with greater amounts of water applied. The total amount of water applied seems to be the critical factor in boron removal.

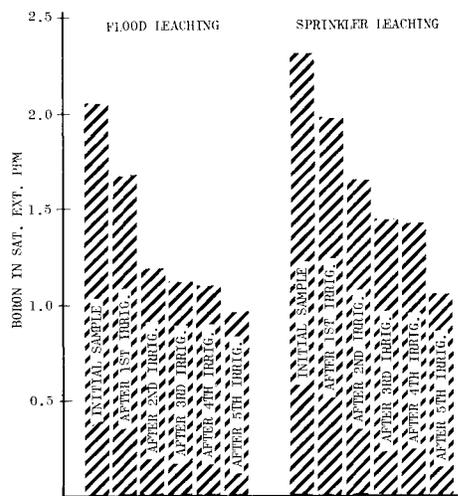
From 1963 to the present, the almond orchard was observed to determine the success of leaching both for tree replanting and for tree recovery.

Within the 160 acres of almonds, most varieties recovered. However, differences in their abilities to withstand boron toxicity were noted. Mission variety suffered the most severely, Ne Plus less severely and Nonpareil suffered the least. About 20 acres of trees had to be removed. In 1968 with the soil relatively free of boron, and most severely damaged trees replaced and growing well, the orchard is again in full production.

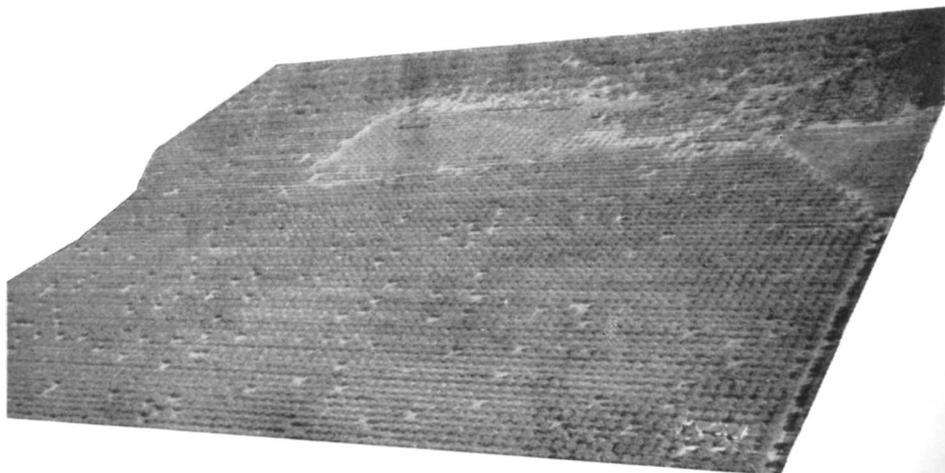
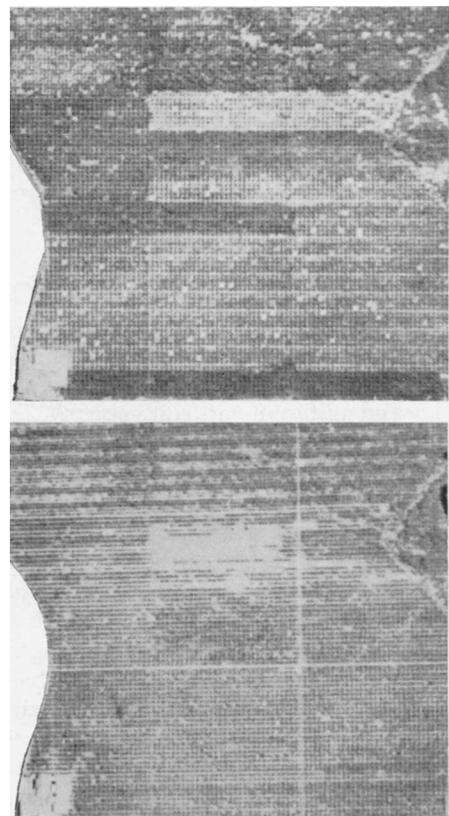
J. L. Meyer is Farm Advisor, Stanislaus County; Robert S. Ayers is Soil and Water Specialist, University of California, Davis.

Aerial photo, above, taken in 1963 of an almond orchard on San Joaquin Valley West Side, after 15 years of irrigation with high-boron well water, shows large blocks of trees dying or in poor condition. Attempts to leach boron from the soil were made using newly available water from the Central Valley Project canal. Photograph of same orchard in 1964, right, shows block of dead trees removed, and recovery of other trees well underway.

Photo below of the same almond orchard in 1967, shows recovery of trees from effects of excess boron, and growth of replanted area resulting from leaching program with new water source.



Soil boron (ppm) in 4-ft depth of soil shown in graph above is for five observations in a flood vs. sprinkler leaching comparison at the San Joaquin Valley west side almond orchard considered in this report.



LEACHING APPLICATIONS

Irrigation	& Time	in inches	
		Flood area	Sprinkler area
1st—September	'62	8.0	4.5
2nd—November	'62	6.3	6.3
3rd—January	'62	5.5	5.5
4th—February	'63	5.0
5th—March	'63	5.0	4.5
TOTAL		24.8	25.8