INVESTIGATING THE ROLE OF BORON IN STONE FRUIT ORCHARD PRODUCTIVITY AND FRUIT QUALITY.

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INTRODUCTION

Using large sand tanks for nutrient management at the Kearney Agricultural Center, we have been studying the role of individual nutrients on stone fruit production and fruit quality. Boron (B) is one nutrient that has shown very interesting results as it has been quite deficient in many of the trees. Mid summer leaf levels as low as 14 ppm have been measured without any leaf deficiency symptoms. However, levels below 25 ppm have caused decreased fruit set and fruit size. The previously published deficiency threshold was set at 18 ppm for peaches and nectarines. On the other hand, peaches are very sensitive to B toxicity and symptoms have been observed at leaf B levels as low as as 50 ppm. Therefore there is a rather narrow window for optimum production.

B deficiency has been documented in many grape vineyards in the San Joaquin Valley. Pete Christensen has recorded over 100 separate sites with the disorder. Peaches and nectarines in similar sites have not appeared to be deficient, but the effects could be more subtle, such as reduced fruit set or fruit size. Since B fertilization under non deficient conditions could easily lead to B toxicity, better guidelines are needed to help orchard managers make decisions about B nutrition.

We have also used the sand tanks to evaluate a new approach to nutrient sampling of fruit trees. The technique is to collect dormant shoots in mid winter and measure their nutrient content. This timing could be particularly useful for B because of its effect on early flower and fruit processes in the spring. If a deficiency is detected in winter, a bloom spray could be applied to prevent problems with fruit set and early fruit growth. Dormant shoot B levels as low as 8 ppm have been measured in the sand tank trees and have caused greatly reduced fruit set and fruit size. Generally, shoot levels above 14 ppm B in the peach and nectarine trees have shown no indications of deficiency.

The first objective of this study was to survey commercial peach and nectarine orchards in the San Joaquin Valley to see if B deficiency could be detected in either mid summer leaf samples or in dormant shoot samples. The second objective was to work in those orchards deficient or very low in B to determine the best timing and rate of bloom B foliar sprays. Since this project was not approved until the spring of 2004, only the first objective was addressed in the first year.

MATERIALS AND METHODS

During July of 2004, leaf samples from 60 peach and nectarine orchards were analyzed for B, as well as 12 other nutrients (N, P, K, S, Ca, Mg, Zn, Mn, Fe, Cu, Mo, Cl). These orchards varied greatly in age, soil type, cultivar, rootstock and vigor. Initially, sites were selected near those where Pete Christensen had documented B deficiency in a grape vineyard. Additional orchards were randomly selected.

RESULTS AND DISCUSSION

Of the 60 orchards surveyed, most had leaf B contents between 30 and 50 ppm. Only one was marginally deficient with a B level of 24 ppm. Several were potentially toxic in B with levels over 50 ppm. One orchard had a B content of 71 ppm.

Several other nutrients tested below the deficiency threshold in some of the orchards. Those found most commonly were nitrogen and zinc. Nitrogen levels below 2.3% were measured in 6 orchards with one orchard as low as 1.88%. Another 8 orchards tested below 2.6% which could be considered marginally deficient. Many orchards (34) tested below the published zinc deficiency threshold of 15 ppm. However, our work in the sand tanks suggests this threshold is too high for true Zn deficiency. About 10 ppm is probably a better threshold. Five of the orchards surveyed had Zn levels at 10 ppm or lower.

For some of the other nutrients there is not enough scientific information to establish good deficiency thresholds. From our work in the sand tanks, we have been able to estimate some of these values. Based on these estimates, we might have a couple of orchards low in P (0.14%), one deficient in K (0.83%), one low in Ca (1.05%) and several marginal in Mg (0.32%), Mn (22 ppm) and Cu (3.5%). Finally, molybdenum (Mo) has not been studied extensively in peach trees. However, in this survey 31 of the orchards tested below 0.1 ppm Mo, which is a level considered deficient in many other fruit species. This element will be studied in greater detail in the future to see if it is causing problems in commercial orchards.

All of the orchards testing low or deficient for any of the nutrients mentioned above will be further evaluated using the dormant shoot technique. Those showing the greatest degree of deficiency will be included in the next phase of the project. This phase will evaluate the effects of varying rates and timings of fertilizer materials on overcoming deficiency symptoms. Even though the original proposal was focused on B, other nutrients showing deficiency will be included as well.