

DEVELOPMENT OF NUTRITIONAL DEFICIENCY SYMPTOMS IN PISTACHIO — BY V. GONZALEZ, K. URIU, AND J. CRANE, DEPARTMENT OF POMOLOGY, UNIVERSITY OF CALIFORNIA, DAVIS

There is a definite need to know the symptoms that are caused by different mineral deficiencies so as to provide a better basis for diagnosing nutrient problems in the pistachio.

With that in mind, one-year-old trees ("Kerman"/*P. atlantica*) were grown in water culture for one year before starting of treatments. In mid-1982, these trees were individually placed in five-gallon pots and subjected to deficiencies of several elements (N, P, K, Ca, Mg, Mn, Zn, Fe, Cu and B) under greenhouse conditions. As expected, several of the deficient trees developed symptoms during the current growing season. Some of the symptoms are briefly described for the nutrients in which deficiencies appeared.

NITROGEN

Top and root growth was reduced. Leaves were small, but normal in shape. The foliage was pale. As the season advanced the leaves became paler and eventually yellow, the change starting from the lower leaves and progressing upward. Early abscission of leaves followed.

Also, shoots were thinner, shorter and, about mid-season, the bark became reddish, especially in the youngest shoots.

The petioles and mid-ribs became red in N-deficient leaves, in sharp contrast to green in normal trees.

POTASSIUM

As the potassium supply decreased in the plant, a general paling of the leaves became evident. Also, the plant slowed down in growth and produced smaller-sized leaves.

Perhaps the most obvious symptom of potassium deficiency appeared in the older leaves of current shoots. Chlorosis started at the tip and progressed down the margins, the area widening with time. Later on, the chlorotic margins became necrotic. The symptoms were most pronounced on the older leaves and as the young leaves aged, they in turn developed deficiency symptoms.

Potassium is probably retranslocated from the older leaves to the growing points and, because of this, basal leaves exhibit the most pronounced deficiency symptoms. Early leaf abscission was evident in the later part of the season. Downward curling of the leaves may precede the symptoms described above.

CALCIUM

Top and root growth was seriously affected. Leaves were few, small and roundish. Petioles and shoots were short and thin. Internodes were also short. Early in the season, the youngest leaves at the shoot tip showed the first deficiency symptoms. The tip of the leaflets became chlorotic and curled downward, becoming necrotic later on. Also, growth ceased and the terminal buds became dormant. Later, the basal leaves showed tip scorching, which progressed over the whole leaf with the leaves eventually collapsing and shedding. In mid-season, the plant appeared stunted, was almost defoliated, and the remaining leaves had wilted appearance.

BORON

Boron deficiency symptoms appeared on the main shoots early in the season as tip burning of growing points and of young leaves. Apices later died back, or the terminal buds, if not killed, remained dormant. Directly behind the terminal bud, lateral dormant buds pushed into growth with short internodes. Sometimes, this new growth died back resulting in a dense, bushy "witches broom" effect. In some shoots, these symptoms were preceded by the appearance of brown-gray areas on the bark. These water-soaked appearing areas became necrotic and were distributed irregularly over the shoot.

With pronounced boron deficiency, new leaves tended to be malformed, dwarfed, crinkled, with tips curled upward or cupped.

Mature leaves were thick and brittle and earlier abscission occurred. Petioles and stems also may be thickened, corky, cracked and shorter.

Boron deficiency also affected the root system drastically, reducing tip and lateral growth.

MAGNESIUM

Leaf symptoms started in mid-season on the lower leaves of shoots as tip and lateral marginal fading, or even interveinal chlorosis. Later on, the margins became scorched, and the scorching progressed inward, leaving a green, inverted "V" at the base of the leaf.

In some instances, scorching appeared also as isolated, large interveinal or marginal necrotic areas, irregularly distributed. Because of leaf scorching, early defoliation was also observed.

Some of the magnesium deficiency symptoms resemble potassium deficiency and may be confusing.

ECOPHYSIOLOGICAL ASPECTS

Several ecophysiological responses to nutritional deficiencies were also measured and the data are now being evaluated. One of them was the influence of nutritional depletion on the photosynthetic rate of the plant (expressed as CO₂ exchange rates). Another was chlorophyll content and dry matter accumulation. Also, water consumption (transpiration) and leaf conductance were evaluated in an attempt to understand better the behavior of pistachio under mineral-nutrient deficient conditions.