# FRUIT LOAD AND FERTILIZATION IMPACTS ON LATE SEASON FOLIAR DECLINE

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## Abstract

Fields of Acala and Pima cotton showed late-season foliar discoloration (red, bronze, purple) and limited late-season fruit development and maturation in various fields in 2002 through 2007. Plant sampling was done across a wide range of fields in Tulare, Kings, Fresno and Merced County, California in 2002 through 2007, Pathology analyses were done to assess plants for Verticillium wilt, and soil and tissue samples were done for nutrient (nitrate, phosphorus and potassium) analysis. Out of the samples collected during this time, a significant number of the sampled sites tested positive for wilt caused by *Verticillium,* but this still represented less than 1/3 of the total sampled locations. No sampled sites tested positive for race 1 or race 4 *Fusarium vas infectum*, but many did not clearly shown either foliar or vascular symptoms of a disease such as *Verticillium*. However, it might be useful to point out that late-season, as the foliage deteriorates and the soil dries after final irrigations, it gets progressively more difficult to identify *Verticillium* in plant tissue even if it is present. Many late-season foliar breakdown issues still appear to be related to or at least correlated with low tissue nutrient status. While much of the usual focus of concern is directed toward potassium deficiency, many of the fields we have visited in recent years showing late-season foliar decline show not only low K, but also are low in P, N and some micronutrients. In 2002, 2004, 2006 and 2007 field sites, many late-season decline issues showed up in fields with relatively good early fruit set, decent fruit loads, and relatively small plant size (for the fruit load). Results from plant and soil sampling in these years and some prior years showed a wide range of situations even in fields showing apparent symptoms looking like K deficiency or some combination of nutrient deficiency and *Verticillium* wilt.

## Field Conditions and Late-Season Decline Observations

Combinations of situations where late-season foliar decline have been repeatedly seen included:

- Some fields where soil tests indicated “deficient” exchangeable-K levels in the upper soil profile according to UC Potassium Guidelines (these fields have a higher probability of a favorable yield response to fertilizer or manure applications as a K source)
- Quite a few other fields had soil tests that indicated “sufficient” or even relatively high exchangeable-K levels (expectations would be that K response from fertilizers would be limited and not cost-effective)
- Less than 25 percent of fields sampled that year showed clear vascular streaking indicative of Verticillium, so Verticillium was only a factor in some of the fields
- In fields showing Verticillium injury, there were clear indications of some varietal differences in extent of Verticillium injury. (This was not a particular concern, but rather an indication that growers and consultants should continue to assess relative levels of Verticillium and consider the extent of injury when making field crop rotation choices).
- While results of these field evaluations in many cases were not conclusive in determining base causes of the foliar decline and growth limits, the general low fertility status (not just K) in many plants also suggests a root system that is limited or unable to keep growing and accessing available soil nutrients. (A wide range of factors could impact root activity late season, including compaction, earlier disease or mechanical injury, and competition for nutrients and carbohydrates between developing bolls and the roots).

Soil and plant tissue nutrient samples were collected for evaluation in over 90 fields showing plant symptoms corresponding with described late-season foliar decline problems, both Pima and Acala. Potassium deficiency has

been implicated in some (less than 30 percent) but not all of these fields. The relationship to low potassium soil levels in at least some fields was not surprising, since "bronzing" and some of the foliar decline and early leaf loss problems are also symptoms of severe potassium deficiency. Over 90 percent of the fields tested showed low leaf and petiole potassium levels in August and September, but they also showed low N, P and Zn levels. Soil test K and P levels in the 5-15 inch and 15-25 inch zones in affected fields ranged from borderline deficient to sufficient (according to University of California guidelines). Soil test data did not suggest a clear linkage of the "early decline" symptoms with deficient soil potassium levels across the full range of locations, although low soil K was likely a major contributor to the symptoms seen in plants at some sites.

Strip applications of soil applied potassium (200 or 400 pounds $K_20$ per acre) at seven Kern and Kings County Pima and Acala fields have been inconsistent (some positive effects, mostly neutral or slight negative effects) in alleviating "late season decline" symptoms. This includes four sites where soil test exchangeable-K levels were not at borderline levels as defined in UC Potassium Guidelines for cotton. Soil test exchangeable-K levels greater than 140 ppm in the upper 2 feet of soil, combined with low plant tissue K, P, and N values 2 to 4 weeks after peak bloom at these sites suggest that the low tissue K levels and to some degree, even the leaf "reddening" or "bronzing" may not be indicative of limiting soil K, but perhaps may indicate a compromised root system not able to fully access soil K or other nutrients. One final suggestion in fields showing some of these described symptoms this year would be to mark maps (either by hand or using GPS measurements) while you can still identify the worst-affected parts of the field. With that information in mind, you can decide on the utility and cost of targeted changes in practices (either your own strip trials or partial-field areas) you could consider for next year to try and reduce impacts in future cotton crops.