

NEWS & VIEWS

A regional newsletter published by the
Potash & Phosphate Institute (PPI) and the
Potash & Phosphate Institute of Canada (PPIC)

California and Arizona
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March 1998

It Sure Sounds Like Potassium Deficiency Late-season bronzing of cotton in the 1980s and before was potassium deficiency. Why not now?

WHAT REALLY CAUSES the leaves on the upper portion of the cotton plant to curl and turn bronze in mid-season during rapid boll development? The question was debated for literally decades even though Les Stromberg, now retired Extension Farm Advisor for Fresno County, told everyone and anyone who would listen that it was potassium (K) deficiency....and he had the data to prove it...and he was right! Finally, in the 1980s a group of researchers and Extension personnel led by Drs. Ken Cassman and Tom Kirby, then both with the University of California, proved that there was, in fact, severe K deficiency in cotton growing in the San Joaquin Valley, and the problem was affecting several hundred thousand acres. Estimates ranged as high as fully one-half of the planted cotton acreage.

Research of the Cassman-Kirby group caught the eye of cotton specialists in other states. Soon it was being duplicated, and frequently the findings were the same...yield and fiber quality were significantly improved with K fertilization. The common thread (pardon the pun) among states is that the cotton boll is a strong sink for K. The demand for K sharply increases when the boll begins developing. The bigger the boll load, the greater is the demand. New faster fruiting varieties intensify this demand. As a result, cotton fields that are quite vigorous early in the season can suddenly run out of adequate K to meet their mid- and late-season needs.

Some of the confusion over the years has come from the "chicken or egg" question...that is, which came first? Weakened plants are also more susceptible to disease, not just cotton, but many plant species. As a result it is not uncommon to see more Verticillium wilt...or other

diseases...in K deficient cotton fields. So some thought the primary problem was disease with the K deficiency being a secondary effect caused by disease damaging roots or reducing K translocation within the plant. There has been a lot of research conducted on this topic during the past decade. Results have been reported by researchers from California to Virginia in many presentations at the annual Belt Wide Cotton Conference and at local and state meetings.

Cotton is especially sensitive to low available soil K, more so than many other crops. **Table 1** summarizes the relative yield of cotton compared to other crops. This is a summary of 21 years of crop rotations for 5 experiments. The work was conducted in the southeastern U.S., so only corn and wheat are of real interest for comparative purposes to us in the west. But it sends the message that K nutrition of cotton should not be ignored.

Table 1. Relative yield of cotton with other crops in long-term crop rotation studies*.

Cotton	0.45
Corn	0.81
Soybean	0.73
Vetch	0.63
Wheat	0.96

*Yield of check (No K) treatment divided by maximum yield with added K.

Why was the 1997 season so bad for bronzing? There is a lot of speculation, much looking toward an unfavorable spring affecting root vigor, disease (Verticillium, fusarium, agrobacterium...), nutritional interactions, multiple factors, and even ozone. Pima seems to have



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been particularly hard hit. It is resistant to *Verticillium* wilt and pathologists rarely found vascular streaking or discoloration symptomatic of wilt in it, or apparently in upland cotton for that matter.

Perhaps the cause lies elsewhere. In fact, disease probably was not a primary cause (author's opinion). How about considering a heavy boll load relative to the rooting system? As previously stated, bolls are a strong sink for K. Additionally, K deficiency has been occurring on even well-fertilized fields. This is clear from recent research results in which fields that had been properly fertilized preplant or early in the season with K responded to in-season foliar applications. Check out the information that Dr. Bill Weir, University of California Extension, Merced County, has been collecting in his trials at Dos Palos. It appears that the cotton plant, even under the best of conditions, may have trouble getting all the K it needs...up to 3.0 lb/A/day



during boll formation...to produce a high yielding crop.

An excellent reference on K nutrition of cotton is the recently published *Cotton Potassium Fertility Guidelines for the San Joaquin Valley*, Publication 21562, University of California. Every cotton grower should have a copy. In it, up to 400 lb of K_2O/A are recommended. This is a testament to the K fixation capacity of the San Joaquin Valley soils since a 3-bale crop removes about 180 lb.

Fortunately, K does not freely leach in soil. So, repeated applications will build up, and with time much of the fixation problem can be overcome.

Late-season bronzing of cotton leaves in the 1980s and before was due primarily to K deficiency that was readily corrected by applying K fertilizers. If so then, why not now? The answer may not be so simple, but rather than waste years debating the issue again it seems prudent to at least put some K check strips in troublesome fields ...not at 50 lb of K_2O/A (remember fixation), but at 400 lb of K_2O/A or with foliar sprays at the very first sign of trouble. Let the results do the talking. ■

RN 98061

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