

SULFUR BUILDS LEAF TISSUE COTTON YIELDS



Applied sulfur (S) can dramatically increase the production of leaf tissue in cotton plants, leading to a significant increase in yield, says Dr. W. Hunter Frame, field crops agronomist at Virginia Tech's Tidewater Agricultural Research and Extension Center in Suffolk, Virginia.

Right Rate

"We can see a substantial amount of yield increase just from a small amount of sulfur being applied," Frame says. "In one trial we did this year (2018), by increasing sulfur from zero to 10 pounds, we increased lint yield by 420 pounds. That's almost a bale at the same nitrogen rates. And because the site is highly responsive to sulfur, by just going from 10 to 20 pounds of sulfur, we increased it another 110 pounds."

Similarly, Dr. Glen Harris, extension agronomist-soil fertility at the University of Georgia, also saw yields in a 2014 Camilla, Georgia, sulfur trial jump from two to three bales following an application of S. Though his 2018 trial at the same S-deficient site was destroyed by Hurricane Michael, Harris says S continues to prove itself in Coastal Plains soils, attracting the attention of growers.

"What's interesting is sulfur keeps hanging on; there's still a lot of interest in it," Harris says. That continues to drive research into rates and timing to help farmers apply S most effectively, he notes, adding that he plans more S trials this season.

Yet, the ballpark sulfur rate recommendation for cotton is similar in both states. As Frame states, "The overarching theme is we need about 10 to 20 pounds of sulfur in cotton production."

Right Time, Right Place

"Another key theme is that our sulfur split probably needs to be changed to 50 percent at planting and 50 percent at sidedress, compared to nitrogen which is more 25/75," Frame says.

The difference between N and S timing recommendations, Frame explains, is that while N is largely used in seed and boll production during the reproductive stages of crop growth, S is used to build leaf tissue earlier in the season.

"We don't see much sulfur in seed or the lint fiber, or really in the stem or bracts," he says. "Sulfur is contributing to vegetative growth, specifically the leaf area. That's why we need to apply enough sulfur up front, at planting, and before the rapid vegetative growth stage to give the plant a strong push.

"This allows the plant to grow vegetatively early in the season," he continues. "On the other hand, you need more of your nitrogen at sidedress time because it's mainly going to be used for seed production in the plant."

In fact, applying too much S too late in the season can stimulate rank growth, boll lock and delayed senescence, he warns — all the more reason to apply a significant proportion of S fertilizer at planting.

Right Source

To make sure S is available to the crop in time to promote early vegetative growth and be consumed before late summer, it is important to apply the sulfate form of S, particularly when sidedressing, Frame adds.

"We want to put more sulfur on early, and to use sulfur sources that are in the sulfate form, he says. "That's our strategy now. Ammonium sulfate is plant-available in all its forms — liquid, dry, straight or in blends. By contrast, elemental sulfur must be mineralized by soil microbes before it is available to crops, a process that can take weeks."



Plants deficient in sulfur are short, have few vegetative branches and develop small bolls.

Photo courtesy of Auburn University

Tissue Samples

Though petiole analysis is widely used to determine the N status of a cotton crop, Frame warns that it is not a reliable measure of S in cotton. Part of the problem is that there is not much S in petiole tissue, and catching the nutrient as it travels through the petiole into the leaf is a hit-or-miss proposition.

“Basically, a petiole is a straw,” he says. “When the plant is really kicking photosynthesis, that sugar is moving fast and the sample will test high. Even within the day, sulfur levels in the petiole can change whereas the (S level in) tissue in the leaf is pretty stable.”

Fluctuating levels of N in petiole samples, compounded by wide variations in S levels, can also make it difficult to determine whether N and S are in the proper ratio to create chlorophyll and other proteins, or if low S levels are limiting the plant’s ability to utilize N.

“I’ve shifted my thinking more to leaf nutrients ratio, so that would mean a ratio of 8:1 nitrogen-to-sulfur in the leaf,” Frame says, noting that he would like to conduct more research into the relationship between N and S nutrition. “From our research to date, the leaves are the sink for sulfur, so if you’re going to have problems, leaf analysis will be more reliable than petiole sulfur analysis.”

Quick Correction

For most producers growing cotton on light, leaching-prone coastal soils, Frame offers a few simple guidelines:

“We recommend 20 pounds of sulfate-S per acre unless cotton is following peanuts,” he says. “If they’re following peanuts, we recommend 10 pounds of sulfate-S because there is so much sulfur out there from the calcium sulfate they put on in peanuts.

“We have seen some rate response in soils that are lighter and deeper, up to 20 to 30 pounds,” he adds, “but typically our response is going to plateau in the 10- to 20-pound range.”

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