Monitoring Nitrogen Status of Cotton during Bloom in Virginia

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The recent rainfall totals in Virginia's cotton growing region have raised concerns about leaching losses of nutrients. Nitrogen, potassium, and sulfur are the nutrients most susceptible to being lost via leaching. Producers wanting to make decisions about whether to apply additional nutrients to compensate for losses via leaching have time to do so at the current stage of growth in most cotton fields. Producers should consider soil type/texture, amount of rainfall, and stage of growth when making that decision. Another tool that can aid in the decision is the use of tissue/petiole testing to determine if the cotton may be low or deficient for certain nutrients. A key benefit of tissue testing proactively is that a deficiency could be avoided or remedied prior to symptoms being observed in the field. Also, monitoring nutrient status of any crop during the season will aid in a producer being able to fine tune his/her nutrient management program.

The first nutrient of concern is often the most limiting nutrient in non-legume cropping systems, nitrogen. Nitrogen management is key in cotton as too much delays maturity and too little severely limits yields. Nitrogen can be monitored in cotton leaves and petioles in-season and is typically measured during bloom to determine nutrient status. Data from Virginia in recent years indicates that using both leaf nitrogen and petiole nitrate-N together will give an accurate assessment of nitrogen status. Leaf and petiole sampling for nitrogen should take place just prior to and during the first three weeks of bloom. Fig. 1 shows the concentration of petiole nitrate-N during the first nine weeks of bloom at three locations during 2013-2014. Petiole nitrate-N concentrations drop rapidly through the first four weeks of bloom in Virginia and differentiation of applied nitrogen rates is difficult beyond the fourth week of bloom. When comparing leaf tissue nitrogen concentrations and petiole nitrate-N levels the relationship during the first week of bloom can be described by Fig. 2. So if the leaf N % is between 3.75-5.0% and petiole nitrate-N is 4,500+ ppm then that cotton field could be considered sufficient in nitrogen. Though leaf N has been correlated to petiole nitrate-N it has not been highly correlated to lint yield; however petiole nitrate-N has shown promise in predicting lint yield when sampling during the first week of bloom (Fig. 3). A critical petiole nitrate-N level of 4,583 ppm was found in six nitrogen rate studies conducted in Virginia. Tissue and petiole testing will allow for greater insights into the current nitrogen status of a given field and the opportunity to correct problems during a window where cotton can still respond.

Potassium is another nutrient of importance during the bloom period as cotton requires up to 3-4 pounds of K_2O per acre per day during peak bloom. No data is available currently for critical petiole potassium levels in Virginia, however current literature has sufficiency ranges for leaf potassium during early bloom of 1.5-3.0% and petiole potassium levels during the first week of bloom of 4.0-5.5% (Mitchell and Baker, 2000). Data on petiole potassium concentrations during bloom collected from four potassium placement studies in Virginia is presented in Fig. 4. Like nitrogen, petiole potassium decreased throughout the bloom period in all four studies.

Current efforts are underway to determine sufficiency ranges for potassium and sulfur in Virginia. Please contact Dr. Hunter Frame at whframe@vt.edu or 757-657-6450 Ext. 409 if you have any questions.

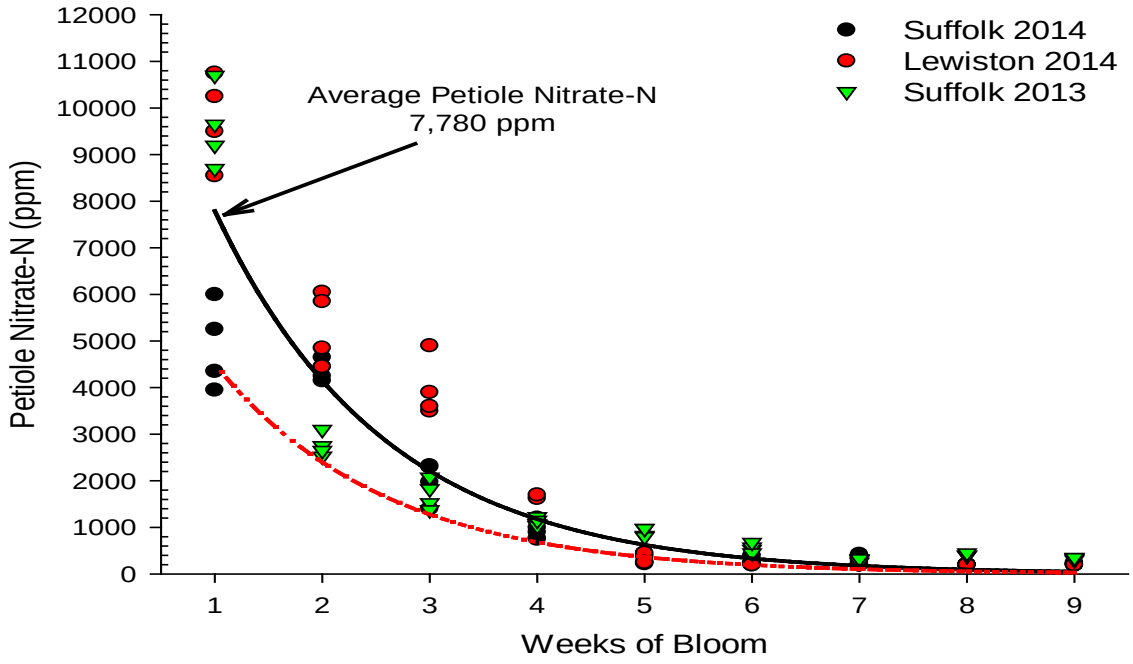

Figure 1: Petiole nitrate-N (ppm) concentrations during the first nine weeks of bloom. The red shaded area indicates petiole nitrate levels that may limit yield (< 4,500 ppm during the 1st week of bloom) and the green shaded area indicates sufficient petiole nitrate-N concentrations. All sites received 80 lbs. N per acre at 1st square stage of development.

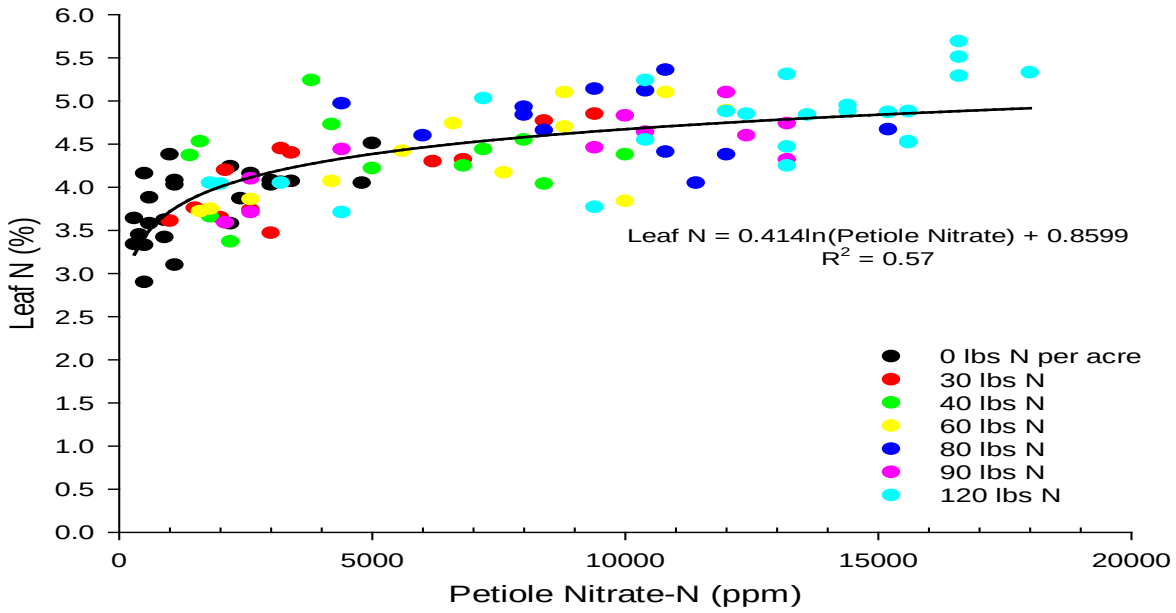

Fig. 2: Correlation between leaf nitrogen (%) and petiole nitrate-N (ppm) during the first week of bloom. Blue shaded area indicates leaf nitrogen sufficiency range and pink shaded area indicates petiole nitrate sufficiency range. Nitrogen rates were applied at first square stage of development.

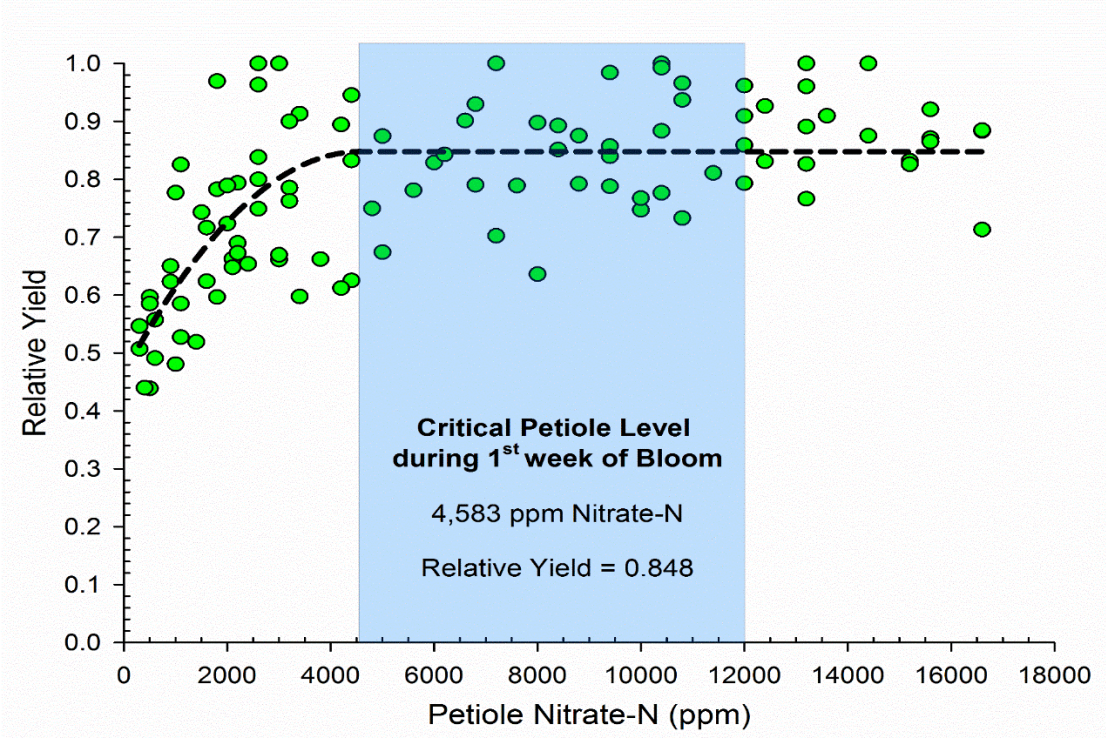

Figure 3: Petiole nitrate-N concentrations and relative yield of cotton in Virginia. Blue shaded area indicates sufficiency range of petiole nitrate-N in order to maximize lint yields.

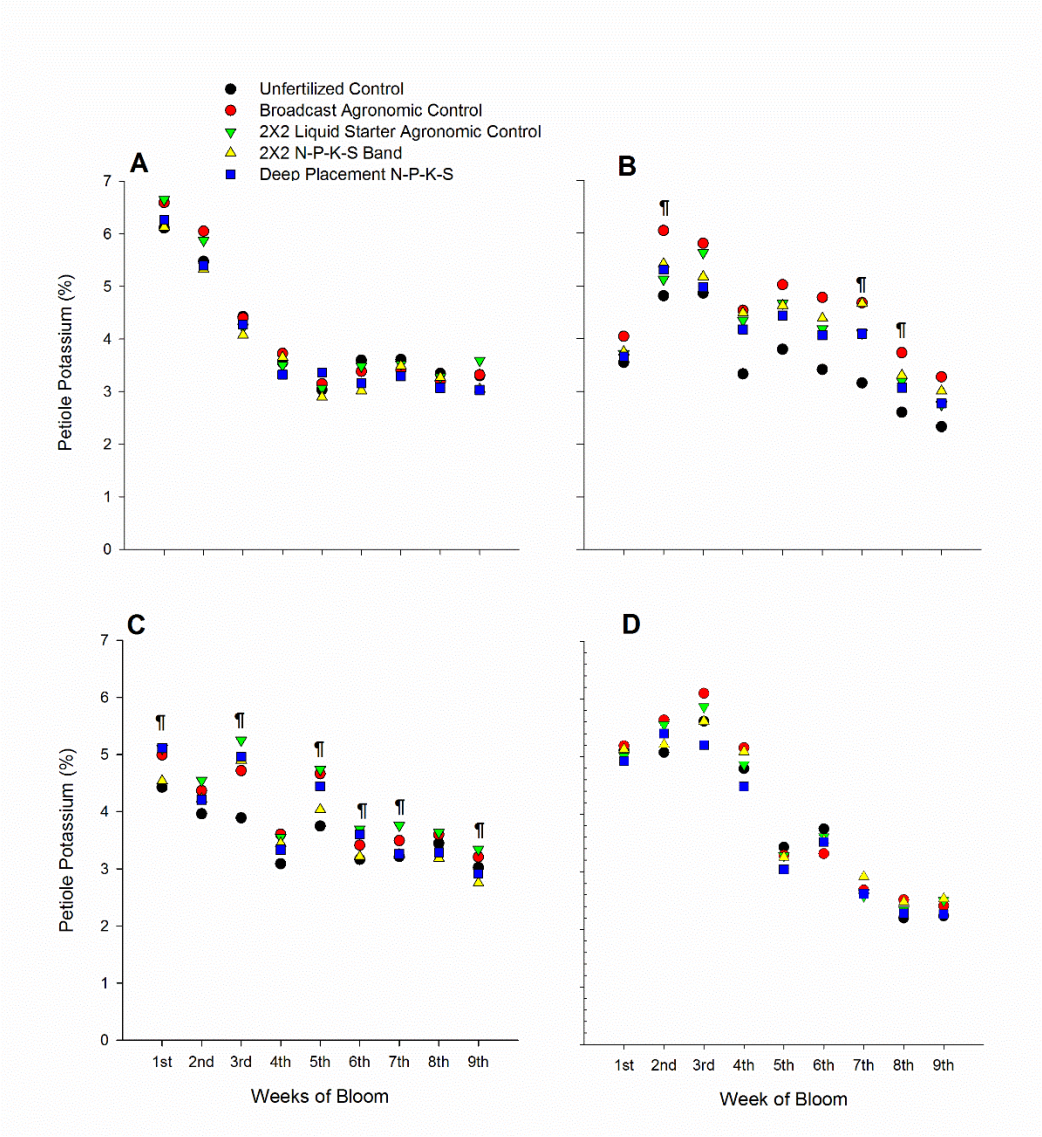

Fig. 4: Petiole potassium concentrations during bloom for four locations in Virginia. Different color symbols represent different nutrient management strategies. Data present is for information purposes and does not indicate any sufficiency ranges for petiole potassium.