EXPLORING TOOLS TO MONITOR IN-SEASON CROP NITROGEN STATUS

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Nitrogen management on sandy soils is challenging by limited nutrient capacity coupled with rain events exceeding the water storage capacity of the crop root zone, which can quickly change plant available nitrogen. The findings presented here are from the first two years of a three-year study with two objectives: firstly, to compare in-season plant tissue samples, petiole, whole leaf and whole vine NO_3-N and total nitrogen for determining plant nitrogen status and correlation with final yield; secondly, to compare optimum applied nitrogen rates of developing varieties to varieties widely grown in Wisconsin.

The trial uses four varieties, Snowden, Hodag, Silverton, and W9433-1rus; five rates applied nitrogen (40, 180, 240, 300 and 360 pounds of nitrogen per acre over) were replicated four times for each variety-rate combination. W9433-1rus is compared with Silverton; Hodag with Snowden.

As this study is continuing, some data sets are incomplete at this writing, presented data is preliminary. In both 2018 and 2019, observed petiole NO_3-N concentrations are lower than the optimum concentrations outlined by Univ. of Wisconsin Extension (UWEX) recommendations. The rate, timing, and nitrogen source made in the study are comparable to the recommendations outlined UWEX guidelines for potato. The reason for this discrepancy is unclear. Comparisons of tissue sample types indicate petiole NO3-N concentrations were the most responsive to changes in plant available nitrogen. Petiole NO_3-N increased following nitrogen application and decreased following leaching events. Whole leaf and whole vine samples show a similar trend but lower in magnitude. Trends in total nitrogen content were similar in trend and comparable to observed changes to concentration of NO_3-N for each of the tissue times. In terms effort and time to collect samples, petiole and whole leaf samples collection required less resources than whole vine sampling. It is not apparent from two years of data that whole vine samples provide data greater value in than petiole or whole leaf, and it is difficult to justify the additional time and effort required for sample collection.

Trends between tissue nitrogen content and final yield were mixed. Total marketable yield of Silverton and W9433-1rus show a strong correlation between marketable yield with petiole nitrate content at 25 and 35 days after emergence (DAE) in 2018; there is weak or no correlation between yield and petioles nitrogen concentration for later

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collection dates during 2018 or 2019. The general correlation between marketable yield and applied nitrogen is positive, although weak. Total marketable yield for all varieties and treatments was lower in 2019 than 2018; cumulative growing degree days were also lower in 2019 than 2018. The yield response curve to applied nitrogen is not the expected smooth curve. While the correlation between applied nitrogen and total marketable yield was positive, yield from the 240-unit rate was the same or less than yield of the 180-unit rate in 2018 and 2019. This provides the evidence for splitting side-dress application if there is a chance rain capable of causing a leaching event within a week of the application, but more data is required.

The properties of sandy soils provide challenges to nitrogen management of irrigated crops. Sandy soils have high infiltration and fast draining, and low nutrient holding capacity and low water holding capacity. Weather is likely the most significant confounding variable in nitrogen response studies on sandy soils. Future nitrogen management tools may benefit from tools that incorporate probabilities of future rainfall event totals when determining application amount and timing.