▸ On-Farm Evaluation Of Canopy Sensor And Soil Conductivity Driven Variable Rate Nitrogen Fertilization Of Cotton

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Early season detection of corn and cotton N status as an in-field indicator of spatial N availability and fertilizer N demand has been difficult with proximal sensors. A variable rate application of fertilizer N should be strongly linked to available N supply and demand. Excess use of purchased N fertilizers can lower profitability as well as result in environmental consequences due to leaching of nitrates into groundwater or transport to surface waters as well as potential gaseous losses. Fields containing significant variability in soil properties which can influence soil N availability are prime candidates for spatial optimization of fertilizer N rates to conserve resources. Our objective was to evaluate the utility of canopy reflectance and soil conductivity to drive variable N fertilization. Two study areas were established in a producer's field north of Greenwood, MS. For what will be referred to as the 'North' experiment, four fertilizer N rates of 30, 60, 90, and 120 lb/a were applied on 13 June, 2013 with intended variable rate side dress treatments receiving a base rate of 30 lb/a. In a second area or 'South' experiment, a base rate of 70 lb/a was applied on 12 April 2013 including intended side dress variable rate treatments. On 27, June 2013, side dress N rates of 25, 50, and 75 were applied to the South experiment resulting in total N rate treatments of 70, 95, 120, and 145 lb N/a. Strategic acquisition of canopy reflectance was performed on 28 June 2013 with a YARA N Sensor mounted on a 3-point tractor hitch and set at a height sufficient to collect canopy reflectance data from rows 2 thru 4 and 9 thru 11 at an off-nadir viewing angle. Variable rate fertilization was carried out on 1 July 2013 to both experimental areas. Variable rate 1 treatment was derived solely from sensor data and variable rate treatment 2 was based on sensor data and adjusted downward 30 lb/a where soil conductivity was characterized as low for the field and upward 30 lb/a when soil conductivity was characterized as high. No adjustment was made for areas characterized as having a medium soil conductivity. A urea ammonium nitrate solution (UAN 28-0-0-5S) was banded using a liquid applicator equipped with coulters and attached liquid knives set at 9" from the row and 3" deep for all fertilizations except for the 70 lb/a pre-plant application that was broadcast and incorporated. Field plots were 12 rows wide at a spacing of 38" with a length of from

1000 to 1500 ft. Four replicates were utilized and the experimental design was a randomized complete block. Leaf samples were collected at early flowering on 15 July from experimental sites and analyzed for total N. An automated dry combustion analyzer was used to determine total N content on duplicate samples per plot following oven drying at 65 °C and grinding through a 40-mesh sieve (0.425 mm) in a Wiley mill. Cotton was harvested with a 6-row spindle-type picker and round bales from each plot were weighed and samples were ginned to calculate lint yield. Leaf N values at corresponding N rates for the North experiment were 4.23 % (120 lb N/a), 4.06 % for variable rate 1 treatment (92 lb N/a), and 4.12 % for variable rate 2 treatment (107 lb N/a) and for the South experiment they were 4.59 % (120 lb/a), 4.58 % for variable rate 1 treatment (130 lb/a), and 4.41 % for variable rate 2 treatment (132 lb/a). The grower applied N rate of 120 lb N/a yielded 1579 lb lint/a in the North experiment and 1701 lb lint/a in the South experiment. The variable rate 1 treatment yielded 1558 lb/a at an average N rate of 92 lb/a in the North experiment and 1793 lb/a at an average N rate of 130 lb/a in the South experiment. For the variable rate 2 treatment, lint yield was 1531 lb/a at a N rate of 107 lb/a in the North experiment and 1736 lb/a at a N rate of 132 lb/a in the South experiment. These results indicate that sensor based fertilization is capable of either reducing fertilizer N rate, while maintaining yield or increasing yield with slightly more fertilizer N.