Optimizing Dryland Processing Sweet Corn Production through Improved Nitrogen Management.

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Background and Justification:

Nitrogen (N) recommendations for non-irrigated processing sweet corn production in high organic matter soils have been established for many years. However, these recommendations are based on varieties that have since been replaced by the industry. These new varieties may have improved agronomic traits such as improved N use efficiency. The general management practice for sweet corn on dryland soils is to apply N fertilizer in the spring before planting. However, few studies that have evaluated sweet corn response to split applications or newer fertilizer products such as coated urea fertilizers. With increasing costs of N for crop production and its susceptibility to losses into the environment (leaching, runoff, atmospheric), improving N management practices will optimize both production and environmental stewardship. In addition to N, population density is an important factor to consider because of the need to optimize interplant competition that could drive yield recovery down. Interest in identifying varieties that tolerate, and even flourish, in high population densities are of high priority with a goal of maximizing production efficiencies. Because processing sweet corn is planted over a two-month window, planting date is yet another key factor to consider since N mineralization rate will increase as soil temperature increases. The overall goal of this research is to improve N fertilizer management practices for non-irrigated processing sweet corn on high organic matter, fine textured soils. The specific objective is to determine the effects of N rate/timing, hybrid, plant population density, and planting date on sweet corn yield, N uptake, and residual soil N. Compiled results from three years will be presented.

Materials and Methods

Experimental plots were established at the Southern Research and Outreach Center in Waseca in 2014, 2015, and 2016. The previous crop was soybean each year. Six N treatments were evaluated including 1) 0 (no N applied), 2) 60 lb N/A applied preplant as urea, 3) 120 lb N/A applied preplant as urea, 4) 180 lb N/A applied preplant as urea, 5) 120 lb N/A applied preplant as ESN, 6) 120 lb N/A as urea with 60 lb N/A applied preplant and 60 lb N/A applied at V6–V8. The three sweet corn hybrids evaluated were: GSS 1477, DMC 21-84, and GM Code 646. In 2014, planting was on 23 May and 24 June, in 2015 planting was on 1 May and 19 June, and in 2016 planting was 18 May and 14 June (21 June for GM C646). We seeded at 30,600 – 32,900 seeds per acre and thinned to target populations of 22,070 or 27,878 plants/A after emergence. For data analysis, we classified plant density treatments as ‘low’ (19,000 – 25,000/A) or ‘high’ (>25,000/A) because of uneven emergence in 2015 and 2016. For each planting date, preplant fertilizer was applied 1 to 7 days before planting. At planting, 6.5 gallons per A of 10-34-0 fertilizer (2014 & 2015) or 5 gallons per A of 7-23-5 (2016) was applied in furrow over the seed. The experiment was laid out as a split-split plot in a randomized complete block design with four replications. Each plot consisted of 4-row plots 30 ft. long with 2.5 feet between rows. Planting date and variety were main plots, while N rate was the sub-plot, and population density was the sub-sub-plot treatment. A total of 144 plots were evaluated for each planting date. Twenty feet

from the middle two rows was machined harvested 88 to 117 days after planting, targeting kernel moisture of 76%. At harvest, the following performance indicators were measured: unhusked and husked yield, ear length, ears usable as corn-on-the-cob sections, and cut corn yield. Nitrogen content of all aboveground plants parts was measured in 2014 and 2015 but has not been completed in 2016 at the time of this report. Soil samples were collected from within each N rate and planting date in October to determine residual nitrate-N in the top two feet of soil.

Results

Weather in 2014 was characterized by extremely heavy rainfall between the May and June planting, a relatively dry summer, and a relatively cool September. Heat unit accumulation rate in 2015 was average, and slightly higher than average in 2016. Precipitation was very regular from June through harvest in 2015, creating consistently wet conditions. Record precipitation fell in the 2016 season. A total of 25.4 inches from June through August 2016, including 3 rainfalls of greater than 3 inches each.

We found no consistent benefit in cut corn yield from using elevated populations or higher N rates (180 lb N/A) for any of the hybrids studied, though yield seems to increase slightly above 120 lb N/A. Planting in May vs. June revealed no differences in yield, and there were no interactions of other treatments with planting date. We found no yield benefit from using split application or slow-release nitrogen compared to pre-plant urea at 120 lb N/A, even though there was substantial precipitation in 2015 and 2016.

C646 yield and ear length were consistently higher than the other hybrids across all treatments, and the data suggest that elevated competition for N (0 N applied) at high plant populations generates shorter ears and less yield.

In only one of 4 planting dates (June 2014) did 180 lb N/A generate more cut corn yield than 120 lb N/A, and in 2 of 4 planting dates (May and June 2015), 60 lb N/A generated yield indistinguishable from 120 lb N/A. Overall yields were highest in May 2015 (5 T cut corn / A) and lowest in May 2014 (3.6 T/A). Specific N and population effects within May and June were not analyzed in 2016 because flooding and poor stands reduced the number of usable plots from 288 to 190. However, these 190 plots were included in mixed model analyses across all 3 years. Our results indicate that for the hybrids we studied in our soils, N management does not need to change throughout the planting season and for sweet corn following soybeans, approximately 120 lb N/A, or perhaps slightly more, as pre-plant urea can reasonably be used for achieving high yield goals without split-applications or ESN (slow-release) urea.

Residual soil N at the end of the 2014 and 2015 season was highest for 180 lb N/A urea (13.6 ppm), but this was not statistically different from any application of urea at 120 lb N/A. . Corn fertilized with 120–180 lb N/A averaged 40 lb N removed by kernels, but 73–77 lb N/A remained in stover after harvest. As sweet corn is harvested with substantial amounts of N remaining in the stover and soil, future research focusing on managing N in sweet corn, including the use of cover crops, and management effects on following-year crops, should be undertaken to optimize sustainable use of N inputs.