NITROGEN RATE AND TIMING CONSIDERATIONS FOR SWEET CORN

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Introduction

Sweet corn production represents over 80,000 acres of Wisconsin cropland and is grown for processing and fresh market production. In addition, sweet corn is grown on irrigated sandy soils as well as rain-fed fine-textured soils. Our current nitrogen (N) fertilizer recommendations were developed several decades ago and may not fully represent N need of new varieties, seeding densities, use of multiple split applications to improve nitrogen use efficiency and implications toward groundwater quality. The objectives of this research were to: (1) re-evaluate our current N recommendations for sweet corn and (2) evaluate sweet corn response to N rate, N timing, variety, and seeding density.

Materials and Methods

Two projects were conducted: (1) N rate study conducted on-farm and (2) N rate, timing, variety and seeding density conducted at Hancock Agricultural Experiment Stations (HARS). The first project was conducted on four grower fields in 2009 and 2010. Six N fertilizer rates were applied: 105, 130, 155, 180, 205 and 230 lb ac^{-1}. The grower applied 105 lb ac^{-1} through starter fertilizer, two early in-season applications and fertigation. The grower skipped their main N fertilizer application in our study area and we applied additional N (0 to 125 lb N ac^{-1} in 25 lb ac^{-1} increments). Each site represents a different planting/harvest timing. The second project was conducted at HARS in 2009 and 2010. Two studies were conducted. The first study compared seven N fertilizer rates across two sweet corn varieties and the second study evaluated two fertilizer rates across four seeding densities across two varieties (Table 1). Nitrogen was applied by hand and split-applied when rates were above 50 lb ac^{-1}. When N was applied across three applications, 50 lb ac^{-1} was applied at V5 and 30 lb ac^{-1} was applied at tasseling, with the remainder applied at V8 (Table 1). At each site, corn was hand harvested for yield as fresh weight of whole ear (including husk).

Results and Discussion

On-farm Research

In 2009, there was not a significant yield increase above 155 lb ac^{-1}. In 2010, N fertilization rated did not affect yields at two sites and one site showed a significant increase in yield up to 205 lb ac^{-1}. Overall, yields in 2010 were much lower compared to 2009. Based on these eight site-years of data, there appears to be two main factors that will need to be considered if new N recommendations need to be developed. The first is the timing of fertilizer applications. It is clear that high yields can be obtained with 155 lb ac^{-1} (near the UW guideline of 150 lb ac^{-1})

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Table 1. Experimental treatments for the 2009 and 2010 sweet corn experiments at Hancock, WI.

Study	Nitrogen rate	Variety	Seeding density
	---------- lb ac^{-1} ----------		----- seed ac^{-1} -----
1	None	Overland	
	50 (applied at V5)	Experimental	
	100 (applied at V5 and V8)		
	150 (applied at V5 and V8)		
	150 (applied at V5, V8 and tasseling)		
	200 (applied at V5, V8 and tasseling)		
	250 (applied at V5, V8 and tasseling)		
2	130 (applied at V5, V8 and tasseling)	Overland	18,000
	200 (applied at V5, V8 and tasseling)	Experimental	24,000
			30,000
			36,000

when fertilizer is applied over five or six times during the growing season. Applying extra fertilizer as "insurance" has little value in production systems designed for efficient N use. The other factor is the plot-to-plot variability in small plot sweet corn studies. Standard errors were large, causing yield differences of 0.7 ton ac^{-1} to be indistinguishable. Yield gains of this magnitude (0.5 to 1 ton ac^{-1}) would be considerable for a grower and investment in an extra 30 to 50 lb ac^{-1} of N to achieve that yield increase would be an economic risk growers would take. These results suggest that plot size variability, even with 80 ft of harvest row collected, can be large. Additional site years will be required to determine if UW guidelines should be modified.

Variety and Planting Density Research

Research conducted at the Hancock ARS also suggests yields are maximized with 150 lb ac^{-1} of N. This was evident in both 2009 and 2010, as well as in a conventional variety (Overland) and the higher yielding experimental variety. This preliminary research shows that new varieties of sweet corn, while higher yielding, may not require additional inputs of N fertilizer. At N rates of 150 lb ac^{-1} or greater, N was applied over three application timings, further suggesting that multiple applications reduce the perceived need for "insurance" N. In 2009 and in 2010, there was no significant effect of planting density on yield, but again the experimental variety had greater yields compared to Overland. In effort to evaluate claims of greater nitrogen use efficiency, a lower than recommended rate of 130 lb ac^{-1} was used. The lower N rate of 130 lb ac^{-1} had significantly lower yields compared to the 200 lb ac^{-1} rate in 2009 and in 2010. Thus, improvements in nitrogen use efficiency with new varieties will likely come from increased N uptake at current N application rates rather than maintaining yields with lower N rates.

Future Research

Future research will continue to evaluate N response in experimental sweet corn varieties, as well as explore other agronomic components of sweet corn production, such as ears per acre, ear weight and kernel yield. Additional nutrient management parameters are also being evaluated, such as nitrogen uptake efficiency, nitrogen removal efficiency and nitrogen harvest index.

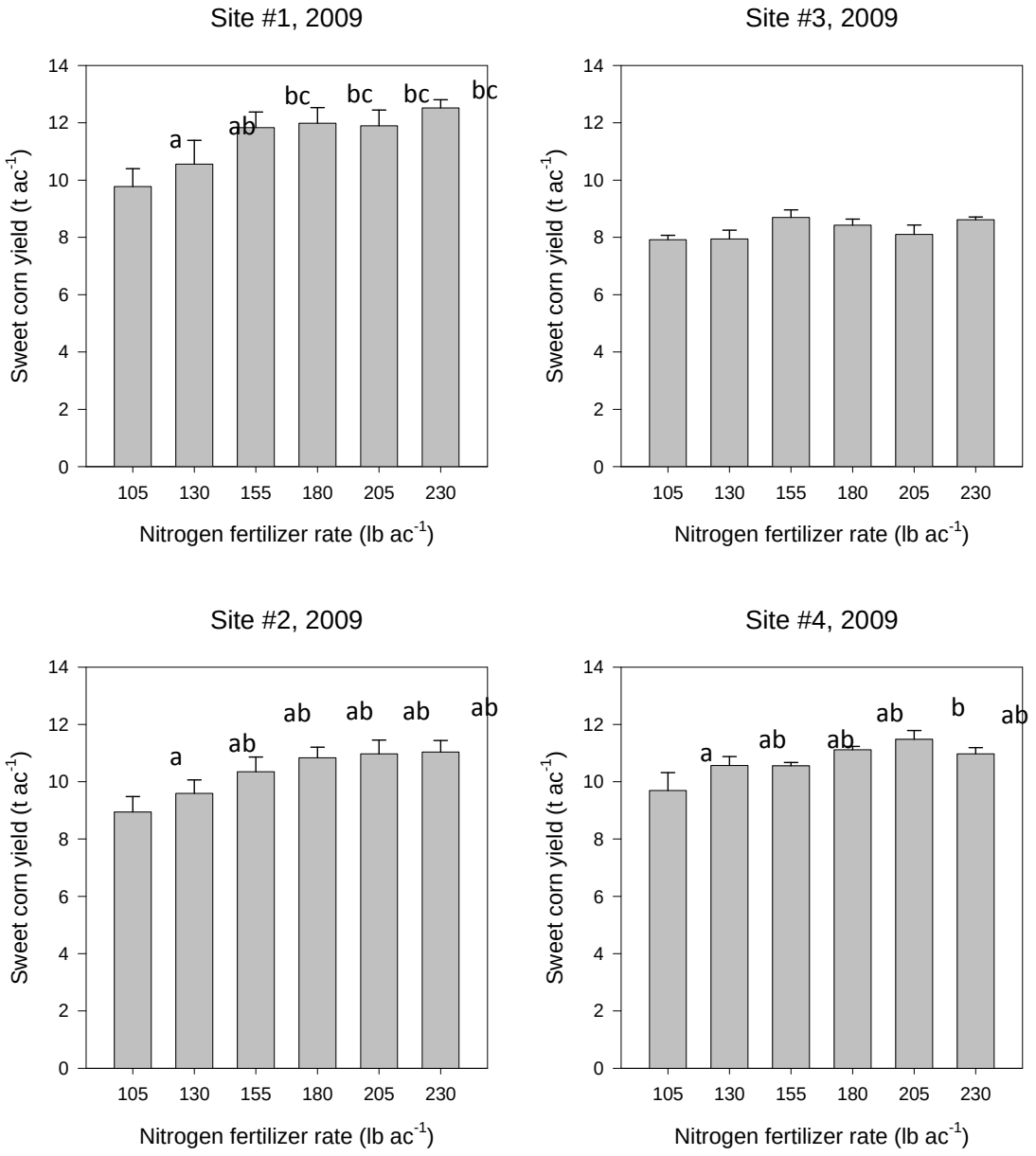

Figure 1. Sweet corn yield response in 2009 to nitrogen (N) fertilizer rates at four grower sites on irrigated sandy soils. Error bars are standard error.

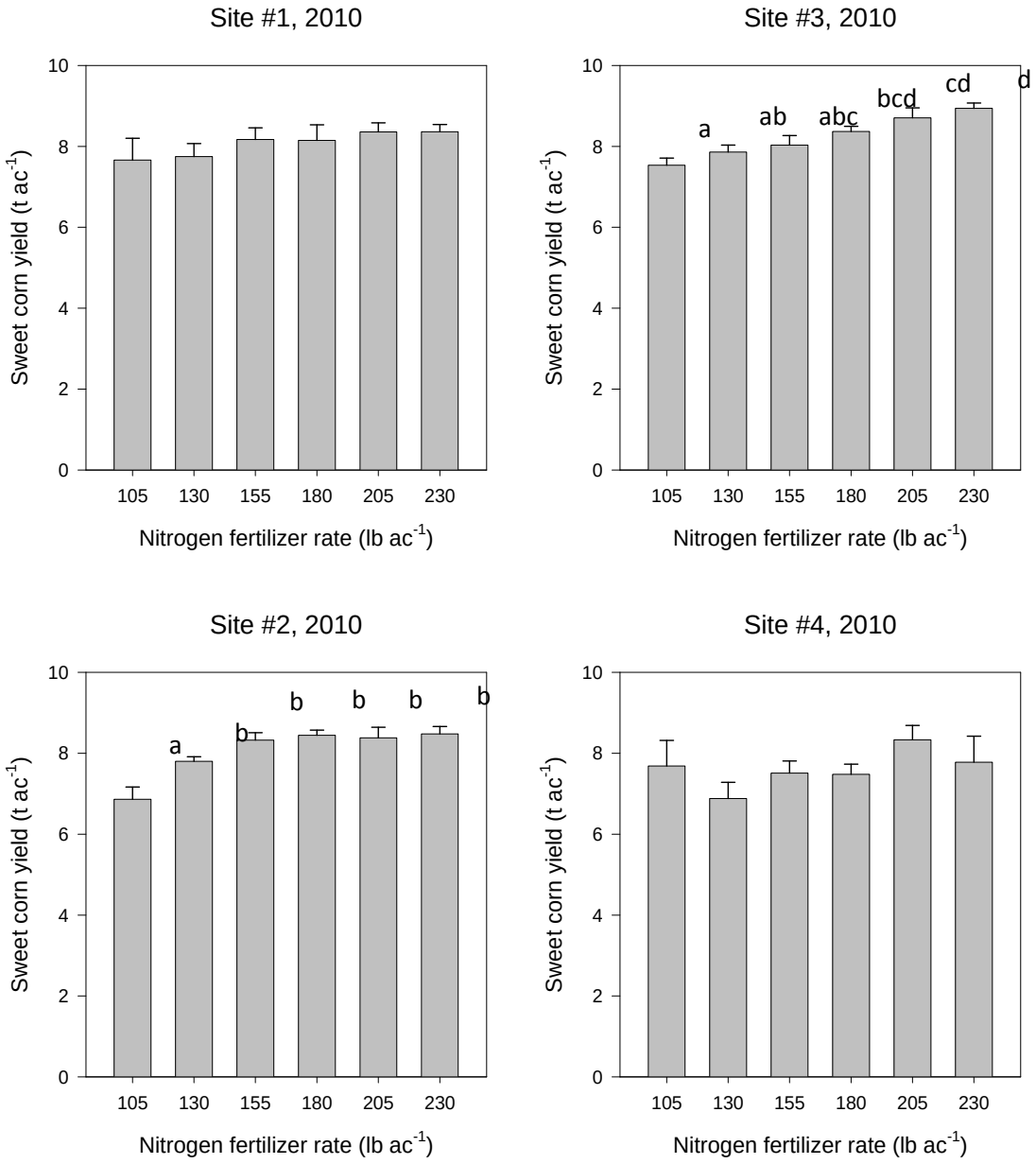

Figure 2. Sweet corn yield response in 2010 to nitrogen (N) fertilizer rates at four grower sites on irrigated sandy soils. Error bars are standard error.

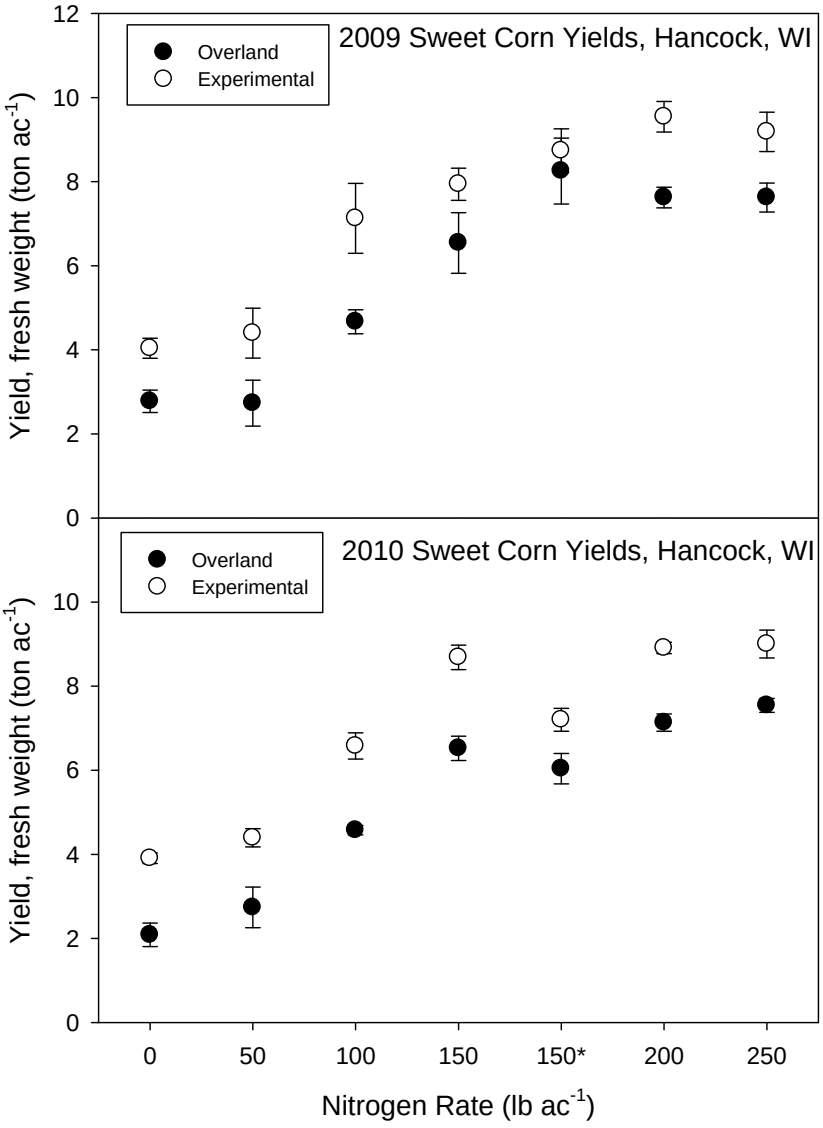

Figure 3. Sweet corn yields from two varieties across different nitrogen rates. Error bars are standard error. * indicates that the 150 lb of N was applied in only two applications.

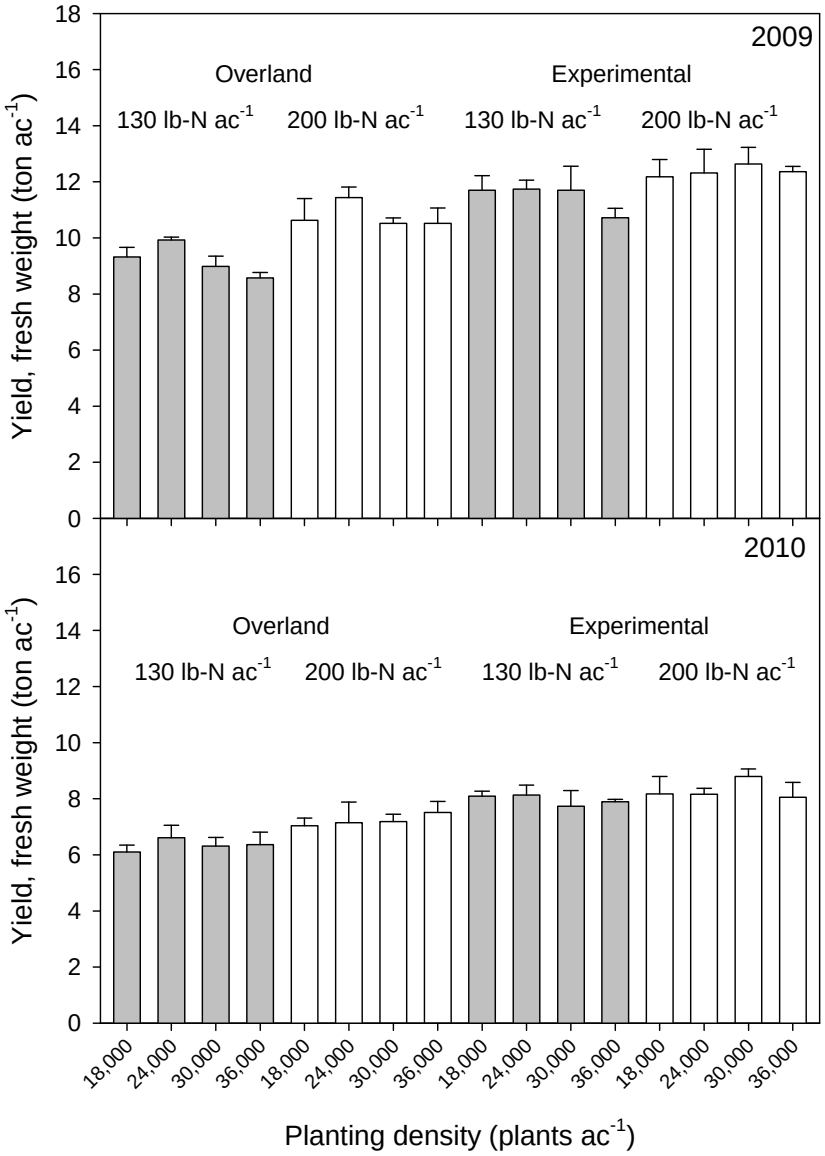

Figure 4. Sweet corn yields of two varieties at two fertilizer N rates across four planting densities. Error bars are standard error.