EFFECT OF N SOURCE SELECTION ON HIGH PROTEIN CORN RESPONSE

Kelly Nelson
Research Agronomist

Peter Motavalli
Associate Professor

Clint Meinhardt
Research Specialist

Identity preserved corn hybrids have been marketed by farmers to the pet food industry. Corn hybrids have been evaluated over the past several years to determine high yielding hybrids with high protein levels. We hypothesized that a slow release fertilizer source (ESN) may increase protein levels of such hybrids. The objective of this research was to determine the effect of N source on high protein corn yield and protein concentration.

A field trial with three replications was established at the Greenley Research Center in 10 by 20 ft plots in 2006, 2007, and 2008. This research was arranged as a split-plot design with N source (non-treated, anhydrous ammonia, urea, and ESN) as the main plot and hybrid (Asgrow 715, NK N65-M7, NK N71-Z3, Pioneer 33Y45, and DK 60-18, a high yield standard) as the sub-plot. All N sources were applied at 150 lbs N/acre. Seeds were no-till planted at 28,000 seeds/acre on 19 May 2006 and 23 April 2007. Dry fertilizer was applied with a Gandy Orbit-Air (Owatonna, MN) applicator. Grain yield was determined and samples collected from each plot. Grain yield was adjusted to 15% prior to analysis. The concentration of protein, oil, starch and extractable starch was determined with a Foss Infratec1241 near-infrared reflectance grain analyzer.

Grain yield differed by hybrid for 2006 and 2007 (Table 1), but there was no interaction between hybrid and N source. Wet conditions followed planting in both years. Final corn population was lower with urea compared with the other treatments (Table 2). Grain yield was ranked ESN = anhydrous ammonia $\geq$ urea > non-treated control which may be a result of the combined effects of stand and N loss.

Grain quality was affected by hybrid and N source (Table 3). All N sources increased protein concentration over the non-treated control. Grain protein concentration was ranked AA = ESN $\geq$ urea for Asgrow 715, DK 60-18, and NK N7-Z3 while protein concentration was ranked AA > ESN = urea for NK N65-M7. No difference in protein concentration among N-sources was observed for Pioneer 33Y45. Since protein concentration was lower for urea compared to ESN and anhydrous in some instances, there was probably N loss.

The effect of N source on oil concentration was hybrid dependent; however, there was no oil concentration difference between anhydrous ammonia, ESN, and urea for an individual hybrid. The Asgrow 715 non-treated control had a higher oil concentration than all N sources while there was no difference between the non-treated control and N sources with Pioneer 33Y45.

The non-treated control starch concentration was greater than N sources, but starch concentration was similar among N sources for DK 60-18, NK N65-M7, NK N7-Z3, and Pioneer 33Y45. However, starch concentration was ranked UTC = ESN $\geq$ urea > AA for Asgrow 715. There was no effect of N source on extractable starch concentration in Asgrow 715. Extractable starch concentration was greatest in the non-treated control when compared to the N sources for all of

the other hybrids. ESN did not affect extractable starch concentration when compared to urea or anhydrous ammonia for the hybrids evaluated in this experiment.

Grain yield was similar with ESN and anhydrous ammonia. Protein concentration was similar for anhydrous and ESN with four hybrids, but protein concentration was greater with anhydrous ammonia when applied to NK N65-M7. Grain yield response to N sources was more stable than grain quality. Increased management is needed for some hybrids to match the right N source with a specific hybrid for specialty, value-added hybrids in order to maximize grain quality.

Table 1. The effect of corn hybrid on grain yield in 2006 and 2007.

	2006	2007
Hybrid	Yield	
	Bu/acre	
Asgrow 715	141	147
NK N65-M7	135	131
NK N7-Z3	105	131
Pioneer 33Y45	134	114
DK 60-18	168	140
LSD (P = 0.05)	16	15

Table 2. The effect of nitrogen source on plant population and grain yield. Data were averaged over corn hybrids and years.

N source	Rate	Population	Yield
	lbs/acre	No./acre	Bu/acre
Non-treated	0	20,380	114
Anhydrous ammonia	150	19,600	140
Urea	150	17,870	137
ESN	150	21,770	147
LSD (P = 0.05)		2,100	10

Table 3. Corn hybrid selection and N source affect grain oil, protein, starch and extractable starch concentration of high protein corn hybrids. Data were combined over 2006 and 2007.

	Oil				Protein				Starch				Extractable starch			
Hybrid	NTC	AA	ESN	Urea	NTC	AA	ESN	Urea	NTC	AA	ESN	Urea	NTC	AA	ESN	Urea
	---------- % ----------				---------- % ----------				---------- % ----------				---------- % ----------			
Asgrow 715	4.30	3.97	3.73	3.95	6.73	9.18	8.83	8.73	72.75	71.77	72.32	71.83	68.15	64.63	65.03	65.35
DK 60-18	3.63	3.49	3.33	3.59	6.68	8.67	8.33	8.18	73.38	72.15	72.37	72.20	70.22	68.00	69.23	68.75
NK N65-M7	4.20	3.84	4.00	3.87	6.78	9.27	8.83	8.68	72.35	70.98	71.07	71.37	68.90	65.85	66.38	66.67
NK N7-Z3	4.30	4.04	4.19	4.17	7.10	9.73	9.61	9.16	72.57	70.77	70.50	70.97	67.97	63.73	63.98	64.55
Pioneer 33Y45	3.81	3.95	3.88	3.80	7.42	8.95	8.98	8.72	72.77	71.68	71.60	72.07	67.38	64.60	64.82	64.78
LSD (P=0.05)	---------- 0.24 ----------				---------- 0.37 ----------				---------- 0.51 ----------				---------- 0.80 ----------			

[a]Abbreviations: AA, anhydrous ammonia; ESN, polymer-coated urea; LSD, least significant difference; NTC, non-treated control.