Comparison of NUE and Nitrogen Needs of Corn Hybrids with and without Transgenic Corn Rootworm Resistance

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Objectives:

1. To determine if corn hybrids with a transgenic CRW resistant gene vary in their NUE and N need compared to non-resistant hybrids

2. Obtain additional N response info. for the Wisconsin database

Methods & Materials

Site background info.

- Previous crop = corn grain
- Spring chisel & soil finisher
- Plano silt loam

Soil Test	2008	2009
P, ppm	107 (EH)	33 (EH)
K, ppm	347 (EH)	163 (VH)
pH	7.1	6.9
OM, %	4.1	3.2
PPNT, lb N/a	69 (19 lb/a credit)	12

Experimental design

- N x hybrid in a full factorial – CRD
  - 4 replications
- 6 N rates
  - 0 – 200 lb/a in 40 lb/a increments
  - Applied 11 or 23 day after planting (early post)
- 8 Hybrids

Hybrids

Hybrid	Hybrid i.d.	Brand	Hybrid	CRM	Traits
1	Bt-CR 1	Pioneer	P35F44	105	(CB & CRW) Herculex Xtra, Roundup Ready 2, Liberty Link
2	Isoline 1	Pioneer	P35F37	105	Roundup Ready 2
3	Bt-CR 2	DeKalb	DKC52-59	102	(CB & CRW) Yield Guard VT3, Roundup Ready
4	Isoline 2	DeKalb	DKC52-62	102	Roundup Ready 2

Hybrids

Hybrid	Hybrid i.d.	Brand	Hybrid	CRM	Traits
5	Standard Bt-CB	Northrup King	N58-D1	107	(CB) Yield Guard
6	Standard nontransgenic	Pioneer	35A30	106	None
		Pioneer	35F38	105	None
7	Bt-CR (Mon863) 1	Renk	R698RRYGRW	104	(CRW) Yield Guard Roundup Ready
		DeKalb	DKC55-4 (VT3)	105	(CB & CRW) Yield Guard VT3, Roundup Ready
8	Bt-CR (Mon863) 2	Dairyland	ST400	106	Roundup Ready, CRW

Plot details

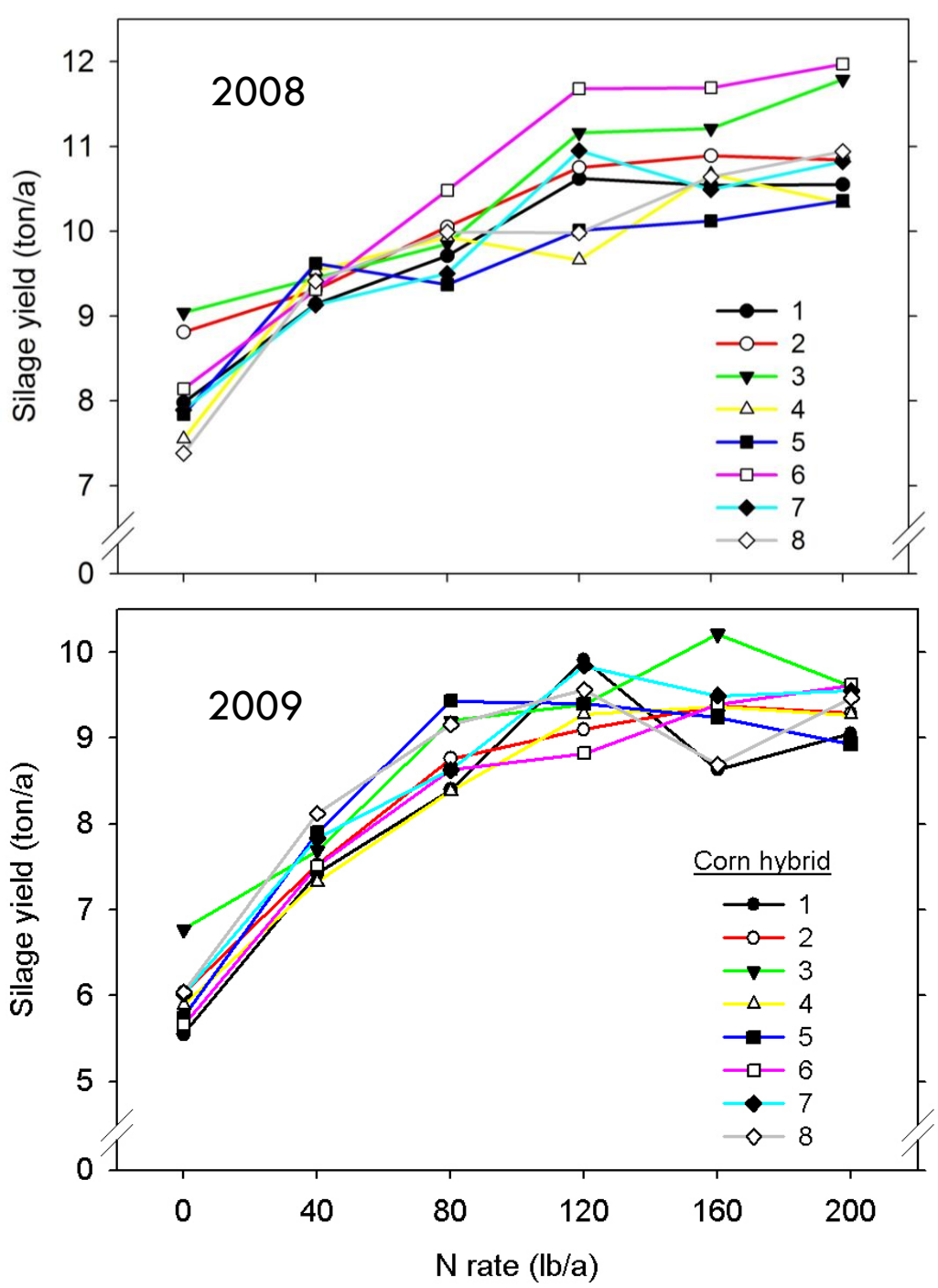
- Planting
  - May 5, 2008; May 12, 2009
  - 33,600 seeds/a
    - Thinned to 30,500 at V4-V5
  - 3 gal/a 10-34-0 in furrow in 2008; none in 2009
  - 4.4 lb/a insecticide in T-band (Force 3G)
    - To all plots
    - Border area - no insecticide
- Weather
  - 2008: Wet June, cool all-season
  - 2009: somewhat dry; cold

Plot details continued

- Root injury rating
  - In border area on July 24, 2008, July 27, 2009
  - Average rating using the 0-3 node-injury scale
    - 2008: 1.12
    - 2009: 0.19

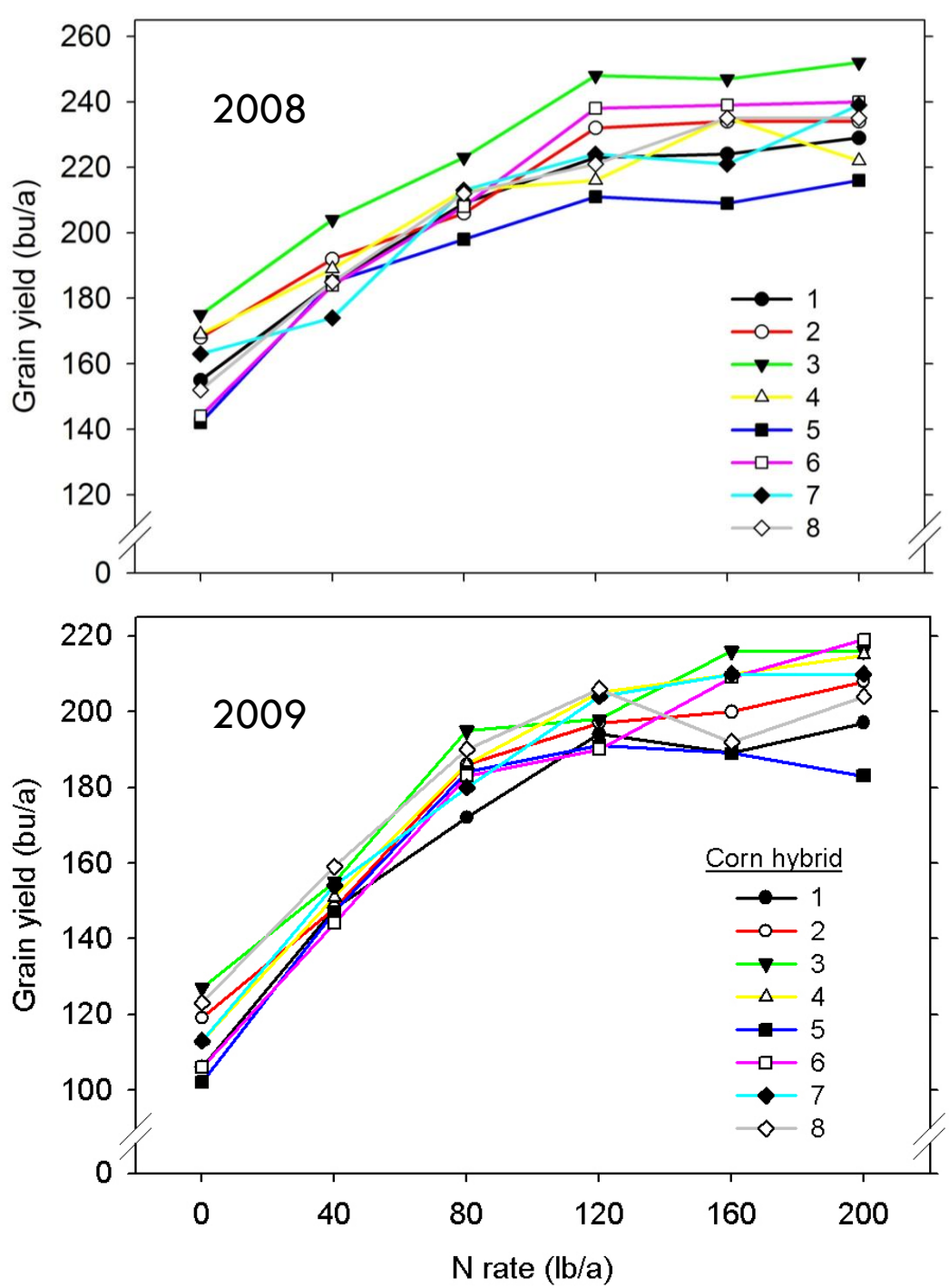
- Harvest
  - Silage – Sept. 29-30, 2008; Oct 5-9, 2009
  - Grain – Nov. 11, 2008; Nov. 3-4, 2009

Results



Silage yield

- ✓ Overall yield level lower in 2009
- ✓ Hybrid 3 yielded well both yr
- ✓ Optimum N rate greater in 2008



Grain yield

- ✓ Overall yield level lower in 2009
- ✓ Hybrid 3 yielded well both years
- ✓ Hybrid 5 low yield both years
- ✓ More responsive in 2009
- ✓ Optimum N rate greater in 2008

NUE definitions

- Relative yield (RY)
  - (Yield at 0 lb/a ÷ Yield at 200 lb/a) x 100
- Δ Yield (ΔY)
  - Yield at agronomic opt. N rate (AONR) – Yield at 0 lb/a
- Agronomic efficiency (AE)
  - Δ Yield at AONR ÷ ANOR

Effect of corn hybrid on NUE

Hybrid i.d.		Yield at 0 N, bu/a		AONR, lb N/a		Yield at AONR, bu/a		AE at AONR, Δ bu/lb N	
		2008	2009	2008	2009	2008	2009	2008	2009
1	CB-CRW 1	155	106	164	149	227	194	0.44	0.59
2	Isoline 1	168	117	131	168	234	205	0.50	0.52
3	CB-CRW 2	175	127	128	188	250	216	0.59	0.47
4	Isoline 2	169	113	175	172	227	213	0.33	0.58
5	Std CB	142	102	130	115	212	188	0.54	0.75
6	Std Std	144	106	119	200	239	217	0.80	0.56
7	CRW, CB-CRW	163	113	130	172	230	211	0.52	0.57
8	CB-CRW	152	123	185	131	234	201	0.44	0.60

Summary – isoline pairs

- Hybrids 1&2 (Pioneer)
  - CB-CRW hybrid needed more N in 2008 and less N in 2009 compared to isoline
  - CB-CRW hybrid yielded less than isoline both years
- Hybrids 3&4 (Dekalb)
  - CB-CRW hybrid needed less N in 2008 and more N in 2009 compared to isoline

Summary – comparison with 6 hybrids used both years

- Hybrids 1, 4 (no CRW), 5 (no CRW), & 8 had higher AE in 2009 than 2008
  - Lower AONR (15, 3, 15, and 54 lb N/a) even though soil N supply lower
- Hybrids 2 (no CRW), 3, had lowest AE in 2009
  - Higher AONR (37 and 60 lb N/a) in 2009 compared to 2008
- AE for same CB-CRW trait (DeKalb) were somewhat different
  - 0.47 for hybrid 3
  - 0.57 for hybrid 7

Summary – comparison of all CRW vs non-CRW hybrids

- On average, yield at 0 N was slightly greater for CRW hybrids compared to non-CRW hybrids
  - 2008: 161 vs 154
  - 2009: 115 vs 110
- On average, AE was slightly lower for CRW hybrids compared to non-CRW hybrids
  - 2008: 0.50 vs. 0.55
  - 2009: 0.56 vs 0.60

Questions?

Thanks to:

- Wisconsin Fertilizer Research Program
- Fluid Fertilizer Foundation

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