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

Carrie Laboski and Todd Andraski, Dep. Soil Science
Joe Lauer, Dep. Agronomy

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
- Plano silt loam
  - pH = 7.1
  - OM = 4.1%
  - Bray P = 107 ppm (excessively high)
  - Bray K = 347 ppm (excessively high)
  - Preplant nitrate (0-3 ft) = 69 lb N/a
    - 19 lb N/a credit
- Spring chisel & soil finisher

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 day after planting
- 8 Hybrids

Hybrids

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

Hybrids

Hybrid	Hybrid i.d.	Brand	Hybrid	CRM	Traits
1	Bt-CR 1	Pioneer	P35F44	105	Herculex Xtra, Roundup Ready 2, Liberty Link
2	Isoline 1	Pioneer	P35F37	105	Roundup Ready 2
3	Bt-CR 2	DeKalb	DKC52-59	102	Yield Guard VT Triple, Roundup Ready
4	Isoline 2	DeKalb	DKC52-62	102	Roundup Ready 2
5	Standard Bt-CB	Northrup King	N58-D1	107	Yield Guard Corn Borer
6	Standard nontransgenic	Pioneer	35A30	106	None
7	Bt-CR (Mon863) 1	Renk	R698RRYGRW	104	Roundup Ready, CRW
8	Bt-CR (Mon863) 2	Dairyland	ST400	106	Roundup Ready, CRW

Plot details

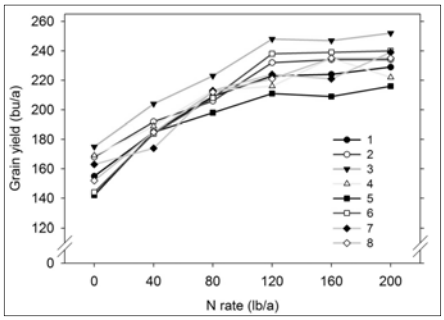
- Planting
  - May 5
  - 33,600 seeds/a
    - Thinned to 30,500 at V4-V5
  - 3 gal/a 10-34-0 in furrow
  - 4.4 lb/a insecticide in T-band (Force 3G)
    - To all plots
    - Border area - no insecticide
- Weather
  - Wet June, cool all-season,

Plot details continued

- Root injury rating
  - In border area on July 24
  - Average rating 1.12 using the 0-3 node-injury scale
    - Significant damage
- Harvest
  - Silage – Sept. 29 & 30
  - Grain – Nov. 11

Results

Effect of N rate and corn hybrid on grain yield at Arlington, 2008



Effect of corn hybrid on EONR and MRTN

Hybrid	Agronomic Opt. (max yield)	
	N rate	Yield
	lb/a	bu/a
1	164	227
2	131	234
3	128	250
4	175	227
5	130	212
6	119	239
7	130	230
8	185	234
Mean	177	233

Effect of corn hybrid on EONR and MRTN

Hybrid	Agronomic Opt.		N:Corn price ratio					
	(max yield)		0.05		0.10		0.15	
	N rate	Yield	EONR	Yield	EONR	Yield	EONR	Yield
	lb/a	bu/a	lb/a	bu/a	lb/a	bu/a	lb/a	bu/a
1	164	227	155	227	146	226	137	225
2	131	234	131	234	131	234	131	234
3	128	250	128	250	128	250	128	250
4	175	227	163	227	150	226	138	225
5	130	212	124	211	118	211	112	210
6	119	239	119	239	119	239	119	239
7	130	230	130	230	130	230	130	230
8	185	234	175	234	165	233	155	232
Mean	177	233	167	233	157	232	147	231

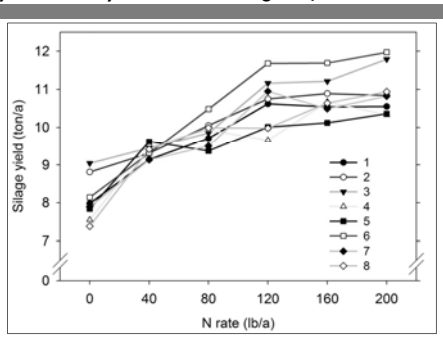
Effect of corn hybrid on EONR and MRTN

Hybrid	Agronomic Opt.		N:Corn price ratio					
	(max yield)		0.05		0.10		0.15	
	N rate	Yield	EONR	Yield	EONR	Yield	EONR	Yield
	lb/a	bu/a	lb/a	bu/a	lb/a	bu/a	lb/a	bu/a
1	164	227	155	227	146	226	137	225
2	131	234	131	234	131	234	131	234
3	128	250	128	250	128	250	128	250
4	175	227	163	227	150	226	138	225
5	130	212	124	211	118	211	112	210
6	119	239	119	239	119	239	119	239
7	130	230	130	230	130	230	130	230
8	185	234	175	234	165	233	155	232
Mean	177	233	167	233	157	232	147	231
Hybrid MRTN, lb/a			154		141		137	
Range ≤ $1/a, lb/a			143 - 165		134 - 148		130 - 143	

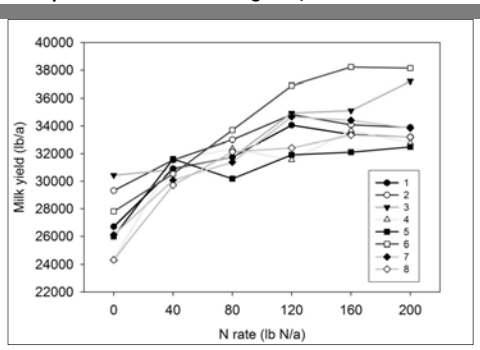
Effect of corn hybrid on EONR and MRTN

Hybrid	Agronomic Opt.		N:Corn price ratio					
	(max yield)		0.05		0.10		0.15	
	N rate	Yield	EONR	Yield	EONR	Yield	EONR	Yield
	lb/a	bu/a	lb/a	bu/a	lb/a	bu/a	lb/a	bu/a
1	164	227	155	227	146	226	137	225
2	131	234	131	234	131	234	131	234
3	128	250	128	250	128	250	128	250
4	175	227	163	227	150	226	138	225
5	130	212	124	211	118	211	112	210
6	119	239	119	239	119	239	119	239
7	130	230	130	230	130	230	130	230
8	185	234	175	234	165	233	155	232
Mean	177	233	167	233	157	232	147	231
Hybrid MRTN, lb/a			154		141		137	
Range ≤ $1/a, lb/a			143 - 165		134 - 148		130 - 143	
A2809 MRTN, lb/a			165 (135 – 190)		135 (120 – 155)		120 (100 – 135)	

Effect of N rate and corn hybrid on silage dry matter yield at Arlington, 2008



Effect of N rate and corn hybrid on milk yield per acre at Arlington, 2008



NUE definitions

- Fertilizer N recovery efficiency (FNRE)
  - (Δ Total N uptake ÷ N rate) x 100
- Relative total N uptake at 0 N
  - (Total N uptake at 0 lb/a ÷ Total N uptake at 200 lb/a) x 100
- Relative yield
  - (Yield at 0 lb/a ÷ Yield at 200 lb/a) x 100
- Δ Yield
  - Yield at agronomic opt. N rate (AONR) – Yield at 0 lb/a
- Fertilizer N use efficiency (FNUE)
  - N rate at AONR ÷ AONR

Effect of corn hybrid on NUE

	Hybrid i.d.	Mean FNRE
		%
1	Bt-CR 1	63
2	Isoline 1	42
3	Bt-CR 2	54
4	Isoline 2	57
5	Standard Bt-CB	62
6	Standard nontransgenic	83
7	Bt-CR (Mon863) 1	61
8	Bt-CR (Mon863) 2	78
	Mean	**74**

Note: Statistics have not yet been run on these data.

Effect of corn hybrid on NUE

	Hybrid i.d.	Mean FNRE	Relative total N uptake at 0 N
		%	
1	Bt-CR 1	63	55
2	Isoline 1	42	64
3	Bt-CR 2	54	60
4	Isoline 2	57	60
5	Standard Bt-CB	62	56
6	Standard nontransgenic	83	48
7	Bt-CR (Mon863) 1	61	54
8	Bt-CR (Mon863) 2	78	48
	Mean	**74**	**57**

Note: Statistics have not yet been run on these data.

Effect of corn hybrid on NUE

	Hybrid i.d.	Mean FNRE	Relative total N uptake at 0 N	Relative yield at 0 N	
				Silage	Grain
		%			
1	Bt-CR 1	63	55	76	67
2	Isoline 1	42	64	80	71
3	Bt-CR 2	54	60	77	68
4	Isoline 2	57	60	77	73
5	Standard Bt-CB	62	56	78	66
6	Standard nontransgenic	83	48	68	60
7	Bt-CR (Mon863) 1	61	54	74	69
8	Bt-CR (Mon863) 2	78	48	70	64
	Mean	**74**	**57**	**75**	**67**

Note: Statistics have not yet been run on these data.

Effect of corn hybrid on NUE

	Hybrid i.d.	Mean FNRE	Relative total N uptake at 0 N	Relative yield at 0 N		Δ Grain Yield
				Silage	Grain	
		%				bu/a
1	Bt-CR 1	63	55	76	67	72
2	Isoline 1	42	64	80	71	66
3	Bt-CR 2	54	60	77	68	75
4	Isoline 2	57	60	77	73	58
5	Standard Bt-CB	62	56	78	66	68
6	Standard nontransgenic	83	48	68	60	95
7	Bt-CR (Mon863) 1	61	54	74	69	67
8	Bt-CR (Mon863) 2	78	48	70	64	82
	Mean	**74**	**57**	**75**	**67**	**75**

Note: Statistics have not yet been run on these data.

Effect of corn hybrid on NUE

	Hybrid i.d.	Mean FNRE	Relative total N uptake at 0 N	Relative yield at 0 N		Δ Grain Yield	FNUE at AONR
				Silage	Grain		
		%				bu/a	lb N/bu
1	Bt-CR 1	63	55	76	67	72	0.72
2	Isoline 1	42	64	80	71	66	0.56
3	Bt-CR 2	54	60	77	68	75	0.51
4	Isoline 2	57	60	77	73	58	0.77
5	Standard Bt-CB	62	56	78	66	68	0.61
6	Standard nontransgenic	83	48	68	60	95	0.50
7	Bt-CR (Mon863) 1	61	54	74	69	67	0.57
8	Bt-CR (Mon863) 2	78	48	70	64	82	0.79
	Mean	**74**	**57**	**75**	**67**	**75**	**0.63**

Note: Statistics have not yet been run on these data.

Summary

- Based on 1st year can't say CRW hybrids require a different amount of N
  - When insecticides are used on non-CRW hybrids
- Various measures on NUE appear to vary somewhat with hybrid
- MRTN provides a conservative N recommendation
- Caveat – only one year of data; stats not complete

Questions?

Thanks to:

- Wisconsin Fertilizer Research Program
- Fluid Fertilizer Foundation
  - Waters Lab
  - Brookside Lab

Contact Info:

- Carrie Laboski
- laboski@wisc.edu
- 608-263-2795
- www.soils.wisc.edu/extension/