Corn response to nitrogen and foliar inputs, Carrington, 2013.
(Greg Endres and Mike Ostlie)

Trial objective was to determine the combination of soil nitrogen (N) levels and foliar inputs to economically increase corn yield. The dryland field trial was established at the NDSU Carrington Research Extension Center on a conventionally-tilled Heimdal-Emrick loam soil. Experimental design was a RCB with split plot arrangement [main plot=N (3 treatments targeted at 50, 100, 150 lb soil N/acre) and subplots=foliar treatments] with four replications. Spring soil analysis indicated 30 lb nitrate-N/A, 9 ppm phosphorus, 295 ppm potassium, 0.62 ppm zinc, 3.5% organic matter, and 6.7 pH. Urea (46-0-0) was applied on May 16 to reach targeted N rates, and was incorporated with 0.4 inches of rain on May 16 plus twice mechanically with a field cultivator plus harrow on May 17. DeKalb Roundup Ready 'DKC31-10' (81-day relative maturity) was planted at 37,000 seeds/A in 30-inch row spacing on May 17 with band applied 10-34-0 fertilizer at 3 gal/A plus chelated zinc at 1 qt/A. POST foliar inputs were applied on July 5 to V6-stage corn with 8001 flat fan nozzles delivering 12 gal/A at 30 psi: 1) chelated zinc [9.5% N, 10% Zn, and 4% S (NW Chemical) at 1 qt/A]; 2) zinc + fungicide [Headline (BASF) at 6 fl oz/A + NIS at 0.25% v/v]; 3) zinc + fungicide + growth regulator [Ascend (Winfield) at 4.5 fl oz/A]. The trial was harvested with a plot combine on October 25.

Soil N at 100 lb/A improved grain yield 8.6 bu/A (9%) compared to yield at 50 lb/A (Table 1). The high N rate did not improve yield compared to 100 lb/A, likely due to plant stress from deficient soil moisture during reproductive stages. Seed moisture tended to increase with increasing N levels. Foliar zinc tended to improve yield compared to the untreated check, while additional foliar products mixed with zinc did not improve yield. Yield was not statistically significant with the interaction of soil N and foliar inputs (Table 2). Highest numerical yield (106.6 bu/A) was obtained with N at 100 lb/A plus foliar zinc, and provided the highest net gain ($44/A) among treatments compared to yield (84.1 bu/A) and income with N at 50 lb/A and no foliar inputs. Prices used for costs and income: N fertilizer=$0.60/lb; zinc=$3.25/A; Headline=$12.70/A; Ascend=$10.50/A; field application cost=$6/A; and corn market price=$3.70/bu.

Table 1. Corn response main factors: soil N and foliar inputs, Carrington, 2013.

Treatment	Plant		Seed		
Factor	Height (July 19)	Silk date	Yield	Test weight	Moisture
	cm	Jday	bu/A	lb/bu	%
Soil N level (lb/A)					
50	113	217	89.0	52.0	18.6
100	114	216	97.6	51.9	19.0
150	112	217	97.8	51.6	20.2
LSD (0.05)	NS	1	7.5	NS	1.4
Foliar inputs[1]					
untreated check	111	217	89.2	51.8	19.5
zinc	117	216	96.4	51.8	19.6
zinc + fungicide	111	216	97.1	51.8	18.7
zinc + fungicide + growth regulator	113	216	96.4	51.9	19.4
LSD (0.05)	NS	NS	NS	NS	NS
mean	113	216	94.8	51.8	19.3
CV (%)	7.7	0.3	11.5	1.5	9.9

[1]Zinc=9.5% N, 10% Zn, and 4% S (NW Chemical) at 1 qt/A; fungicide=Headline (BASF) at 6 fl oz/A; growth regulator=Ascend (Winfield) at 4.5 fl oz/A. Applied at V6 stage.

Table 2. Corn grain yield among soil N levels and foliar inputs, Carrington, 2013.

	Corn yield (bu/acre)			
	Soil N (lb/acre)			Average across soil N
Foliar inputs[a]	50	100	150	
untreated check	84.1	87.2	96.4	89.2
Zinc	86.7	106.6	96.0	96.4
Zinc + fungicide	97.4	96.2	97.7	97.1
Zinc + fungicide + growth regulator	87.6	100.4	101.2	96.4
Average across foliar inputs	89.0	97.6	97.8	

[a]Zinc=9.5% N, 10% Zn, and 4% S (NW Chemical) at 1 qt/A; fungicide=Headline (BASF) at 6 fl oz/A; growth regulator=Ascend (Winfield) at 4.5 fl oz/A. Applied at V6 stage.