

Corn Sidedress Nitrogen Response Trials on Clay Soils

Purpose:

This project was initiated to evaluate the appropriateness of side dress nitrogen application systems for use on heavy textured unimproved soils.

Methods:

A 15 foot wide, skip row liquid fertilizer applicator was built utilizing an old six row corn planter frame (Figure 1.). Three fertilizer application coulters were mounted to the frame and plumbed to an added fertilizer tank. The system was operated with a used ground drive piston pump donated by the University of Guelph/OMAFRA.

The applicator was calibrated to deliver 50, 100 and 150 lbs/ac of actual nitrogen from 28% Urea Ammonium Nitrogen (UAN). Eight sites across Peel Region were selected based on cooperators interest and soil type. Two to three replicates of four treatments were applied post emergently to corn which was in the 4-7 leaf stage during the middle of June 2008. Treatments were randomly assigned to plots. Plots were 12 rows wide and ranged in length from 500 to 2000 feet.

Figure 1. Custom Build Six Row Nitrogen Applicator with Three Fertilizer Coulters Adapted from a Used Corn Planter.



Results:

Table 1. Yield Results from Side Dress N Rate Applications to Corn – All Sites Combined

		Across Sites			
Trt	Rate	Yield		H2O	
1	0	117.0	D	30.5	A
2	50	139.0	C	29.9	B
3	100	144.0	B	29.8	B
4	150	148.0	A	30.0	B
Sign.		*		*	
cv		4.8		2.2	

Table 2. Yield Results from Side Dress N Rate Applications to Corn – Individual Sites

		pnr09_bs			pnr09_dj			pnr09_ga*			pnr09_hj1			pnr09_hj2			pnr09_pa			pnr09_ta					
prev crop		wheat			wheat			soybean			soybean			wheat			soybean			corn					
starter N		38.3			3.3			24.0			19.0			19.0			32.7			7.0					
till sys		conv			notill			conv			notill			conv			conv			conv					
Trt	Rate	Yield		H2O	Yield		H2O	Yield		H2O	Yield		H2O	Yield		H2O	Yield		H2O	Yield		H2O			
1	0	173.0		33.1	81.2	C	30.6	A	84.0	C	32.0	98.0	B	31.8	125.5	B	24.0	149.0		29.9	B	107.7	B	32.3	A
2	50	176.0		32.8	127.4	B	29.1	B	110.0	B	30.9	134.0	A	30.6	158.4	A	22.9	142.0		31.0	A	121.2	A	31.8	A
3	100	177.0		33.3	135.6	AB	28.9	B	129.0	A	31.0	133.0	A	30.4	155.6	A	23.6	149.0		31.7	A	128.0	A	30.1	B
4	150	182.0		33.3	152.3	A	28.5	B	121.0	AB	30.6	137.0	A	31.0	164.4	A	23.2	153.0		31.4	A	128.2	A	31.7	A
Sign.		nsd		nsd	*		*		*		nsd	*		nsd	*		nsd	nsd		*		*		*	
cv		2.0		2.7	6.6		1.1		6.0		1.4	4.0		2.1	3.5		3.1	6.1		1.1		2.5		1.5	

Table 1 summarizes the harvest moisture and yield data associated with the side dress nitrogen treatments averaged across all trials. Additional nitrogen to no more than 30 lbs of actual N was applied either with the planter or pre plant. No differences in harvest moisture were detected. Corn yield increased significantly as nitrogen rate increased over all rates tested.

Table 2 presents the results on an individual site basis. Five of the seven sites showed significant increases in crop yield as N rate increased. Seldom was there a significant increase in crop yield between the 50 and 100 lbs/ac rates of N. In no case was there a significant increase in yield between the 100 and 150 lbs/ac N rates. The main difference in yields occurred between the 0 and 50 lb/ac rates. In the highest yielding site, no rate response to applied N was observed (pnr09-bs).

It is important to point out the implications of applying N fertilizer. In the case of site pnr09_dj, a 3.3 lb/ac rate of starter N resulted in an 81.2 bu/ac yield of corn. This points out that the addition of large rates of N does not result in large gains in corn yield. The addition of applied N makes incremental increases in corn yield. The addition of 50 additional pounds of N added 46.2 bu/ac (127.4 – 81.2) while the addition of another 50 lbs of N added only 8.2 bu/ac more to yield (135.6-127.4). This is why accounting for corn price and N cost is critical to choosing a rate that approaches the economic maximum for N application.

Table 3 presents the economic results for the individual sites included in the project. Two scenarios were considered reflecting 2008 and 2009 prices for corn and fertilizer N. In two cases, there was no MERN suggesting no response to nitrogen (pnr09_bs and pnr09_pa). Note the differences in values between the MERNs for the two different price scenarios. While the MERN changed with these prices, there was always an economic advantage to targeting the MERN rate compared to the rate of N that would result in maximum yield. The difference in dollars between MERN and maximum N response as reflected in corn yield varied between sites and has to be considered in terms of the sites natural N reserves, previous crop, tillage system etc. The differences are more compelling at high prices but can be gained regardless of the price.

Summary:

The target rate for nitrogen should be based on targeting the economic rate of nitrogen, not the rate that maximizes corn yield. This is because the cost of nitrogen required to maximize yield is usually higher than the added grain harvest achieved with the higher nitrogen rate.

Next Steps:

More plots should be conducted to build the database of corn response to nitrogen on the clay soils of Peel Region. This is the 2nd of four years of a project which should create a database of clay soil based N rates for this geography that will assist growers in better targeting their N rates.

Table 3: An Economic Analysis of N Application Rates Targeting MERN

	Corn and N Prices:	\$4.60 & \$0.84			\$3.60 & \$0.39		
		MERN	MAX	Diff.	MERN	MAX	Diff.
PNR09_TA	Nitrogen Rate (lb-N/ac)	64	127		89	127	
	Yield (bu/ac)	123	128		126	128	
	Gross Return (\$/ac)	510.33	483.65	26.68	419.85	412.50	7.35
PNR09_HJ1	Nitrogen Rate (lb-N/ac)	69	77		72	77	
	Yield (bu/ac)	134	135		134	135	
	Gross Return (\$/ac)	557.28	553.68	3.60	454.99	454.00	0.99
PNR09_HJ2	Nitrogen Rate (lb-N/ac)	72	83		76	83	
	Yield (bu/ac)	159	160		159	160	
	Gross Return (\$/ac)	671.04	666.53	4.51	545.00	543.75	1.25
PNR09_PA	Nitrogen Rate (lb-N/ac)	0			0		
	Yield (bu/ac)	148			148		
	Gross Return (\$/ac)	681.57			533.40		
PNR09_BS	Nitrogen Rate (lb-N/ac)	0			0		
	Yield (bu/ac)	177			177		
	Gross Return (\$/ac)	814.00			637.00		
PNR09_DJ	Nitrogen Rate (lb-N/ac)	123	154		135	154	
	Yield (bu/ac)	147	150		149	150	
	Gross Return (\$/ac)	574.00	560.83	13.17	483.60	480.00	3.60
PNR09_GA	Nitrogen Rate (lb-N/ac)	107	134		118	134	
	Yield (bu/ac)	122	125		124	125	
	Gross Return (\$/ac)	472.67	461.43	11.24	400.45	396.96	3.49

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Location of Project Final Report:

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