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 cooperator 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 summarizes the yield response to the N rates applied and cmpares the results between 2009 and 2010. In 2010, 3 of the 6 sites did not have a significant yield response to increasing N rates across the 4 rates tested. Where significant responses were recorded, two sites had a significant increase in yield between the 50 and 100 lb/ac N rates at side dress time, while only a single site showed a significant increase in yield by going to the highest rate of 150 lbs/ac N tested.

In 2009 similar trends were observed.

Figure 1 displays the yield response data graphically showing the large increase in yield from starter only to the 50 lbs/ac N rate at side dress. Again, the graphs point out that the added N applied to corn fields increases yield above some base point. In these cases, no site had a starter N rate that didn't return at least 50 bu/ac of corn even with as low as 3 lbs/ac of starter N. The additional N applied to corn fields has to be recognized for the amount of additional yield it results in compared to no or low rates of N. The MERN calculations take into account the additional yield response provided by added N over and above low or no N levels.

Table 2 presents the MERN's for each site and the economic response and return achieved by targeting the MERN rate of N. Observe the wide swing in MERN's and economic returns associated with the different sites. The differences result from yield response differences to added N and are a function of field yield potential based on soil, previous crop, and other factors. MERN's vary between sites, and within sites over years so yield response trials need to be conducted over time to get a feel for the rates of N needed in particular fields.

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 then 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.

Acknowledgements:

The project team would like to thank the members of Peel SCIA who contributed their time and effort to building, calibrating and applying the nitrogen treatments on the 8 sites offered by Peel SCIA members. We would like to thank Maple Farm Supply for their contribution in Nitrogen and other services.

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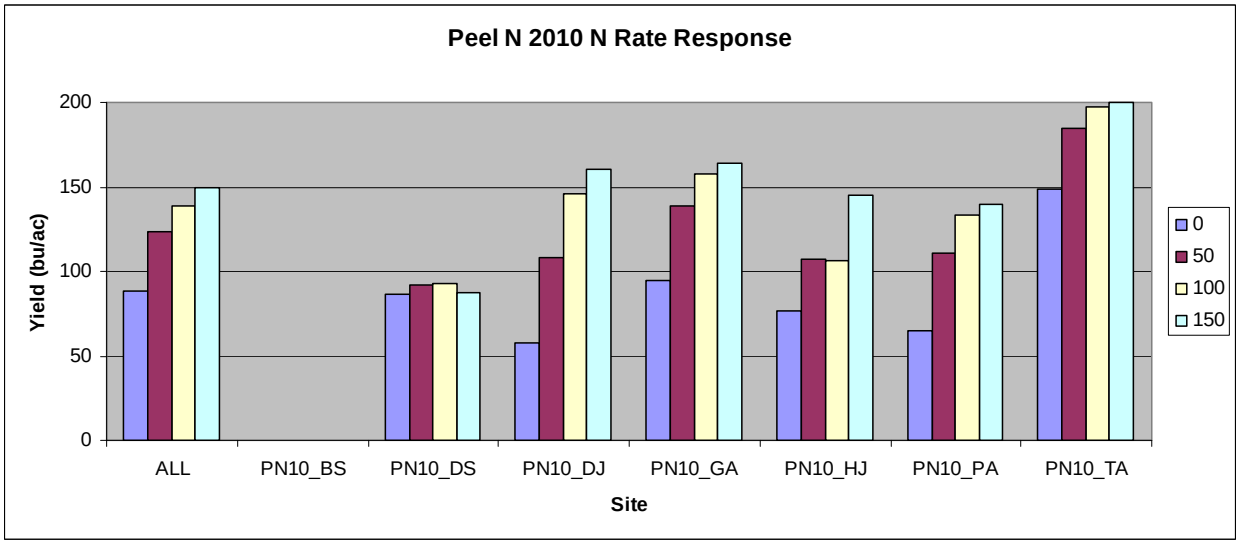
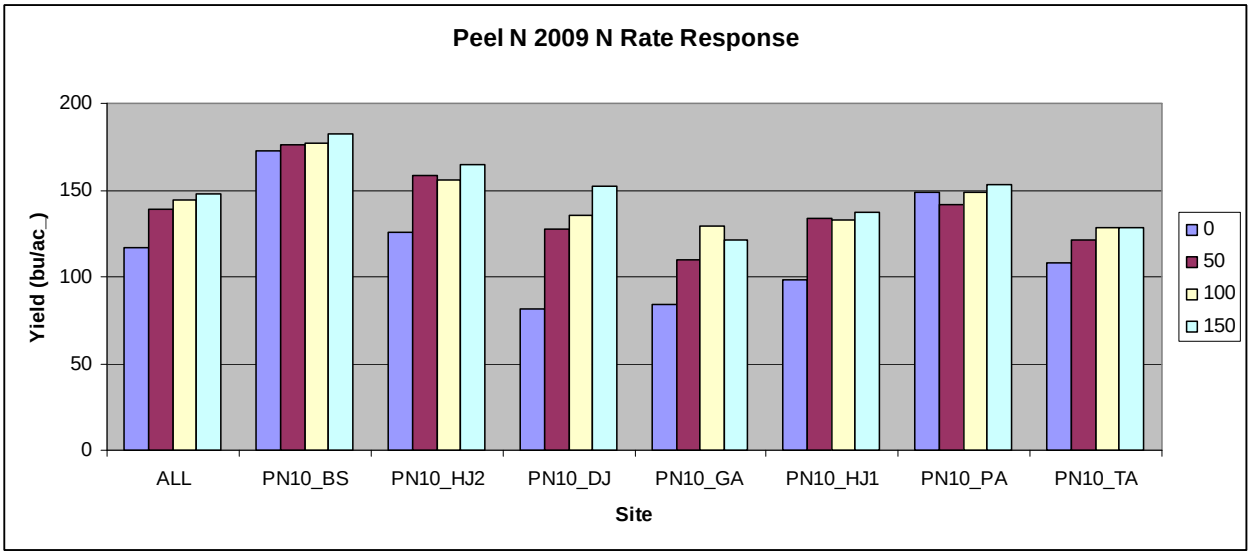
Table 1. Yield Results from Side Dress N Rate Applications to Corn – All Sites Combined (2009-2010)

2010		Across Sites		pnr09_bs	pnr09_dj		pnr09_ga		pnr09_hj	pnr09_ds	pnr09_pa		pnr09_ta	
prev crop					wwheat				soybean				corn	
starter N					3.3		32.0		19.0	32.0	32.7		7.0	
till system				conv	notill		conv		notill	conv	conv		conv	
Trt	NRate (lbs/ac)	Yield		Yield	Yield		Yield		Yield	Yield	Yield		Yield	
1	0	88.2	D		57.6	D	95.0	C	76.6	86.7	64.5	B	146.6	C
2	50	123.6	C		108.2	C	138.5	B	107.1	92.3	111.0	A	184.6	B
3	100	139.0	B		146.3	B	158.1	AB	106.0	92.6	133.6	A	197.7	A
4	150	149.4	A		160.7	A	164.0	A	144.8	87.1	139.4	A	200.3	A
Sign.		*			*		*		nsd	nsd	nsd		*	
cv		9.7		2.3	4.9		6.3		21.0	19.2	10.0		2.1	

2009		Across 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 system				conv	notill		conv		notill		conv		conv	conv	
Trt	NRate (lbs/ac)	Yield		Yield	Yield		Yield		Yield		Yield		Yield	Yield	
1	0	117.0	D	173.0	81.2	C	84.0	C	98.0	B	125.5	B	149.0	107.7	B
2	50	139.0	C	176.0	127.4	B	110.0	B	134.0	A	158.4	A	142.0	121.2	A
3	100	144.0	B	177.0	135.6	AB	129.0	A	133.0	A	155.6	A	149.0	128.0	A
4	150	148.0	A	182.0	152.3	A	121.0	AB	137.0	A	164.4	A	153.0	128.2	A
Sign.		*		nsd	*		*		*		*		nsd	*	
cv		4.8		2.0	6.6		6.0		4.0		3.5		6.1	2.5	

Figure 1. Graphical Representation of N Rate Response of Corn Yield (2009,2010)





Tale 2. MERN Estimation and Returns to N Rate 2010

Site	Crop Year	cv	LowRate (lbs/ac N)	MERN (lbs/ac N)	Yield at MERN (bu/ac)	Economic Yield Response (bu/ac)	Net Return ($/ac)
PNR10_DS	2010	1.5	35.8	131	96.8	23.3	52.25
PNR10_DJ	2010	4.9	3.7	157	161.7	104.7	410.00
PNR10_GA	2010	6.3	35.8	147	162.3	67.0	252.40
PNR10_HJ	2010	38.3	21.4	19	108.6	0.0	0.00
PNR10_PA	2010	44.7	36.6	33	104.9	0.0	0.00
PNR10_TA	2010	2.1	7.8	103	198.4	49.7	181.00