Nitrogen Application Method and Timing For Corn Production on Clay Soils

(OSCIA Golden Horseshoe SCIA Regional Partner Grant Project)

Purpose:

To evaluate the impact of applying UAN at various times after application using broadcast and injected methods.

Side dress N rates have been shown to be 20% less then preplant rates. This is likely because the N is being delievered to the crop just before it requires it as rapid stem elongation occurs and because the N is placed close to where corn roots can access it.

Growers and the fertilizer application industry have not adopted post emergent application of N across Ontario. While side dress applications are significant in south western and eastern Ontario, they are literally non existent elsewhere. Many reasons are given for the lack of adoption including timeliness, speed of application, damage to emerged crop, concern about weather preventing N application to occur in a timely manner.

Methods:

Seven field scale plots were initiated across different previous crops and tillage systems. Six of the seven sights were on unimproved clay soils. Plots were 12 rows wide by field length and were replicated 2 times. Two N application timings and 3 application methods were compared. Treatments tested included:

1. Early inject
2. Early broadcast (fan nozzle)
3. Late side dress
4. Late broadcast (streamer nozzle)

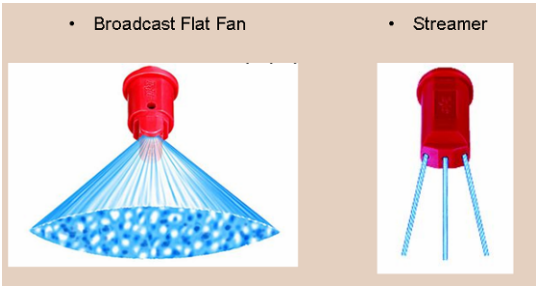
The target N rate was 85 lbs/ac of total N. Post emergence N rates were adjusted based on starter N rates so that 60 to 80 lbs/ac of N was applied.

Assessments included corn injury, yield, moisture, and NH4 losses.

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. A ground driven spray boom was mounted at the back of the unit and the nozzles were interchanged depending on the time of application. The nozzle spacing was 20”, to be analogous to standard setup on any normal spray equipment.

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

Figure 2: Post Emergent Broadcast Application of UAN to Standing Corn Using Streamer



Results:

Project results are reported in Table 1. Regardless of the timing or method of application, no differences in crop yield or harvest moisture were observed in 2009 while some difference in application method/timing were evident in 2010.In the 3 sites where significant effects were detected the injected applications were significantly better than the broadcast treatments only in the 1 trial. At the other two sites late injection appeared

to result in greater yield than streamer broadcast applications of N suggesting that losses from this application may be greater.

N losses were monitored using ammonium dosimeters which detect the evolution of ammonium vapor from the soil surface. Large amounts of data were collected but further analysis is required before the results can be reported.

Due to weather delays this spring, post emergent applications were late to occur, with the corn stage being at or beyond the 8 leaf stage at application. The applicator was adapted with drop pipes using bicycle tubes. This proved problematic since the tubes were so light that they bounced greatly when hitting the corn plants. N was sprayed wildly around the plot area and significant corn leaf burn was observed in many of the plots. However, the injury was soon overcome with the excellent growing season.

Although the late application of N broadcast using the streamer nozzles did cause some injury to the crop, especially on the sites where the corn was more advanced at application, no yield effects were observed.

Figure 3: Crop Injury from Post Broadcast Application of N Using Streamer Nozzles

In Figure 3, the initial injury can be seen on the corn approximately one week after application. based on the corn size it is obvious that the corn was well advanced at the time of application. The second picture shows the same field and treatment 3 weeks later and you will notice that all new growth is lush and green and no differences in the crop are observed looking across the various treatments.

Summary:

Post N applied with streamer nozzles may provide an alternative to the slow application of UAN using traditional side dress application equipment. If a wide boom field sprayer can be used with streamer nozzles to safely apply N at this stage, then producers may adopt this methodology.

Table 1. Corn Yield Response to Differing N Application Techniques at 85 lbs/ac (2009, 2010).

2010		All Sites	pnr10_bs	pnr10_dj	pnr10_ga	pnr10_hj	pnr10_ds	pnr10_pa	pnr10_ta
till system			conv	notill	conv	notill	conv	conv	conv
Trt	Timing	Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield
1	Early Broadcast	112.0	191.8	91.4	133.8 b	93.9 c	80.5 b	91.0	161.5 d
2	Early Inject	117.0	191.8	108.0	129.7 b	111.9 ab	79.3 b	110.1	175.2 a
3	Late Broadcast	121.2	194.8	107.2	136.7 b	104.9 bc	90.4 a	108.4	171.2 c
4	Late Inject	142.1	192.1	117.2	152.6 a	124.0 a	95.3 a	122.2	174.0 b
	Sign.	nsd	nsd	nsd	*	*	*	nsd	*
	cv	27.0	2.3	12.3	2.7	6.7	4.4	17.3	0.1

2009		All Sites	pnr09_bs	pnr09_dj	pnr09_ga	pnr09_hj1	pnr09_hj2	pnr09_pa	pnr09_ta
till system			conv	notill	conv	notill	conv	conv	conv
Trt	Timing	Yield	Yield	Yield	Yield	Yield	Yield	Yield	Yield
1	Early Broadcast	139.9	179.0	144.6	111.4	133.4	154.2	136.9	120.1
2	Early Inject	141.8	177.7	142.6	120.3	134.3	156.3	141.9	119.5
3	Late Broadcast	140.6	179.0	145.8	115.4	127.3	155.5	138.4	122.6
4	Late Inject	137.9	176.3	126.3	109.9	134.8	150.8	143.9	123.5
	Sign.	nsd	nsd	nsd	nsd	nsd	nsd	nsd	nsd
	cv	7.3	0.8	16.2	8.2	3.4	4.1	4.8	2.0

Next Steps:

This was the second of a 3 year study. More work is required to determine the crop stage at which it is safe to apply post N using streamer nozzles. The injury and recovery from burn injury associated with UAN application must be determined before recommendations are made for N to be applied in this manner. The data from N losses associated with ammonium volatilization must be studied to determine if losses from this application method are resulting in significant N losses which impact econmics and environmental aspects of production using this system.

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Project Contacts:

Ian McDonald, OMAFRA, Guelph, 519-824-4120 ext. 56707, ian.mcdonald@ontario.ca