Influence Of Nitrogen Rate And Timing Of Application On Corn Yield On Mississippi River Alluvial Soils

Presented by Dr. H.J. "Rick" Mascagni, Jr.
Professor, LSU AgCenter, Northeast Research Station

Nitrogen (N) fertilization is a critical component of cultural practices required for producing maximum corn yield. Many factors, including soil type and tillage systems, determine optimum N rates. Nitrogen is typically knifed-in soon after the crop has emerged and an adequate stand established. After fertilization application, uncontrollable factors such as excessive or lack of rainfall, may produce soil conditions conducive to N fertilizer loss through denitrification and/or inefficient plant N uptake. Sometimes N applications are delayed or omitted due to inclement weather. While at other times, growers apply the recommended N rate for an expected yield potential; however, as the crop develops yield potential may be higher than expected and additional N may be required. In each of the above situations the question arises, can N applications as late as reproductive growth stages be effective? The objective of these trials was to evaluated late N applications on two Mississippi River alluvial soils.

Field experiments were initiated in 2006 and 2007 on Commerce silt loam and Sharkey silty clay at the Northeast Research Station near St. Joseph to evaluate the influence of N rate and timing on corn yield and N fertilizer use efficiency (NFUE). Irrigation was also evaluated in the clay trial. Early-season N (ESN) was injected at about the two-leaf growth stage as 32% URAN solution at N rates of 0, 150, 180, 210, 240, and 270 lb/a on silty clay and 0, 120, 150, 180, 210 and 240 lb/a on silt loam. Late-season N (LSN) was broadcast at early tassel as ammonium nitrate at rates of 0 and 60 lb/a. Rainfall was needed to activate the LSN treatments in both the non-irrigated clay trial (2006) and silt loam trials, while the LSN was watered-in soon after application in the irrigated clay trial. The late N application was also watered-in the day after application in the non-irrigated Sharkey trial in 2007. Unfortunately, rainfall did not occur for three to four weeks after LSN applications in both years, so, not unexpectedly, there was little affect of LSN when the late N was not activated. June rainfall was extremely low both years (2006 – 0.38 inches; 2007 – 0.53 inches), while July rainfall in 2007 was excessive (16 – inches).

On the silty clay, optimum ESN rate for both years was about 180 and 210 lb/a for the non-irrigated and irrigated trials, respectively (Table 1). In 2006, grain yields in the irrigated trials for the ESN rates at 150 and 180 lb/a were increased 21 and 9%, respectively, by LSN. In 2007, the largest increases due to late N occurred for the 0 and 150 lb/a N rates. Late N had much less affect at the higher ESN rates. Although late or supplemental N increased yield when N was limiting, there did not appear to be an advantage in splitting the N between early season and tassel emergence. For example, when a total of 210 lb N/a was applied, yields were similar regardless if N was applied in a single application in early season or split between early season and tassel emergence. The influence of treatments on seed N and NFUE in 2006 is shown in Table 2. The late N application increased total seed N, particularly when irrigation was used. When averaged across early-season N rates, seed N for no-late N was 102.9 lb N/acre and for seed N for late N application was 116.4 lb N/acre. Similar to yield response, there were little difference in NFUE when comparing equivalent rates, regardless if N was applied once early-season or split between early-season and tassel. Nitrogen analyses for the 2007 seed samples are being conducted and data will be presented.

Optimum ESN rate for silt loam was between 180 and 210 lb/a in 2006 and 120 lb/a in 2007. Late N did not significantly affect yield either year due, in part, to little rainfall and lack of late fertilizer N activation during the month of June. The influence of treatments on seed N and NFUE in 2006 is shown in Table 4. Nitrogen treatment influence on NFUE on the Commerce silt loam was similar to results on the Sharkey silty clay. Average NFUE was higher on the silt loam compared to the silty clay trial. Nitrogen analyses for the 2007 seed samples are being conducted and data will be presented.

These findings indicate that N fertilizer applications as late as tassel emergence may increase corn yield, if the plant is N deficient. However, splitting N fertilizer early season and at tassel emergence did not increase NFUE compared to applying a single N rate at the two-leaf growth stage. Plant monitoring, using remote sensing techniques (Greenseeker and SPAD meter), along with tissue analyses will also be discussed.

Table 1 . Influence of early- (two to three-leaf stage) and late-season N rates (tassel) on grain yield of non-irrigated and irrigated corn on Sharkey silty clay at St. Joseph, 2006 and 2007.

Early-N rate	Late -N rate	Total N applied	2006 Non-irrigated	2006 Irrigated	2007 Non-irrigated	2007 Irrigated
lb/a	lb/a	lb/a	bu/a		bu/a	
0	0	0	38.9	41.1	14.9	25.0
0	60	60	-	-	35.6	55.0
150	0	150	124.9	147.3	116.4	157.1
150	60	210	135.3	177.9	124.6	189.2
180	0	180	142.1	176.1	125.3	185.3
180	60	240	130.5	191.8	124.3	191.1
210	0	210	155.5	184.6	128.2	200.1
210	60	270	142.5	193.5	117.8	207.1
240	0	240	146.6	199.0	126.4	210.0
240	60	300	142.8	203.1	114.9	212.3
270	0	270	143.8	185.2	124.9	204.1
270	60	330	141.2	206.2	118.0	213.1
LSD (0.10):						
Early-season N			NS[1]	19.8	8.3	7.8
Late N			NS	7.2	NS	3.9
Early N x Late N			NS	NS	11.8	11.0

[1]NS=Non-significant at the 0.10 probability level.

Table 2. Influence of early- and late-season N rates on seed N concentration, seed N and N fertilizer use efficiency (NFUE) of non-irrigated and irrigated corn on Sharkey silty clay at St. Joseph, 2006.

Early N	Late N	Total N applied	Seed N conc Non-irr	Seed N conc Irr	Seed N Non-irr	Seed N Irr	NFUE[1] Non-irr	NFUE[1] Irr
lb/a	lb/a	lb/a	%		lb/a		%	
0	-	-	1.27	1.13	23.6	22.5	-	-
150	0	150	1.26	1.13	74.3	78.6	33.8	37.3
150	60	210	1.33	1.15	84.8	96.4	29.1	35.2
180	0	180	1.33	1.11	89.6	93.0	36.7	39.1
180	60	240	1.41	1.14	86.0	103.7	26.0	33.8
0	0	210	1.36	1.20	99.5	105.0	36.2	39.3
210	60	270	1.40	1.29	94.0	118.3	26.1	35.5
240	0	240	1.35	1.34	92.5	126.9	28.9	43.5
240	60	300	1.37	1.38	91.8	132.2	22.7	36.6
270	0	270	1.39	1.27	82.6	111.0	21.8	32.7
270	60	330	1.39	1.35	85.2	131.3	18.6	32.9
LSD (0.10):								
Early N			NS[2]	0.09	NS	18.8	NS	NS
Late N			0.03	0.05	NS	8.6	2.8	3.6
Early N x Late N			NS	NS	NS	NS	NS	NS

[1]NFUE=Nitrogen fertilizer uptake efficiency, [seed N for N rate – seed N for check/ N rate] x 100
[2]NS=Non-significant at the 0.10 probability level.

Table 3. Influence of early-season and late-season N rates on grain yield on Commerce silt loam at St. Joseph, 2006 and 2007.

Early - N rate	Late- N rate	Total N applied	2006	2007
lb/a	lb/a	lb/a	bu/a	
0	0	0	20.0	26.4
0	60	60	-	32.3
120	0	120	108.3	123.1
120	60	180	119.7	129.7
150	0	150	142.7	128.6
150	60	210	153.9	133.9
180	0	180	164.0	133.9
180	60	240	164.5	118.8
210	0	210	175.8	123.2
210	60	270	170.3	127.7
240	0	240	171.9	121.8
240	60	300	176.2	136.7
LSD (0.10):				
Early N			13.9	11.4
Late N			NS[1]	NS
Early x Late			NS	NS

[1]NS=Non-significant at the 0.10 probability level.

Table 4. Influence of early-season and late-season N rates on grain yield, seed N concentration, seed N and N fertilizer use efficiency (NFUE) on Commerce silt loam at St. Joseph, 2006.

Early N	Late N	Total N applied	Seed N conc	Seed N	NFUE[1]
lb/a	lb/a	lb/a	%	lb/a	%
0	-	-	1.05	9.9	-
120	0	120	1.07	55.0	37.5
120	60	180	1.15	66.0	31.1
150	0	150	1.22	82.2	48.2
150	60	210	1.26	91.5	38.8
180	0	180	1.25	97.4	48.6
180	60	240	1.31	102.2	38.5
210	0	210	1.34	111.9	48.5
210	60	270	1.39	111.5	37.6
240	0	240	1.35	109.4	41.4
240	60	300	1.38	115.2	35.1
LSD (0.10):					
Early N			0.06	10.3	5.8
Late N			0.02	3.4	1.8
Early x Late			NS[2]	NS	NS

[1]NFUE=Nitrogen fertilizer uptake efficiency, [seed N for N rate – seed N for check/ N rate] x 100

[2]NS=Non-significant at the 0.10 probability level.

The Basics Of Getting A Good Corn Stand

Presented by Dr. Emerson Nafziger

Professor of Crop Sciences, University of Illinois

First Question: How many seeds do we drop?

Before we talk about how to get a "perfect" stand of corn, it helps to know what stand, in terms of plant number, we are trying to establish. This has been a moving target for corn, but mostly, and appropriately, the direction of that movement is up. The average plant stand recorded in Illinois by the Agricultural Statistics Reporting Service in 2006 was 28,000 plants per acre, up about 10% since 2002 (NASS). Many producers have increased their targeted plant population in corn in recent years, yet still wonder, after a year with good weather and good yields, if thy should have set the planter for higher populations than they did. We know that yield response to plant population will vary depending on conditions. Figure 1 shows, as an example, the population responses from several