Influence of Late Nitrogen Applications on Corn Yield on a Mississippi River Alluvial Silt Loam in Northeast Louisiana

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Introduction

Nitrogen (N) fertilization is a critical cultural practice required for producing maximum corn yield. Many factors, including soil type and crop management systems, determine optimum N rates. Nitrogen is typically knifed-in soon after the crop has emerged and an adequate stand established. After fertilization, 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 this trial was to evaluated late N applications on a Mississippi River alluvial silt loam.

Procedures

A field experiment was conducted in 2007 on Commerce silt loam 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). Early-season N (ESN) rates were injected at about the two-leaf growth stage as 32% URAN solution at N rates of 0, 120, 150, 180, 210, and 240 lb/acre. Late-season N (LSN) was broadcast at early tassel as ammonium nitrate at rates of 0 and 60 lb/acre for each ESN rate, resulting in a total of 12 treatments. Late N at tassel emergence was applied on May 31, 2007. Pioneer brand (PB) 33R81 was planted on March 16 at a seeding rate of approximately 30,000 seed/acre. Cultural practices as recommended by the LSU AgCenter were followed.

The experimental design was a randomized complete block with four replications. Grain yield, leaf N, kernel-N concentration, kernel-N uptake, and NFUE were measured. Grain yield was determined by machine harvest from the two middle rows of four-row plots and reported at 15.5% moisture. Yield components, ears/acre, kernel weight (g/100 kernels), and ear size (kernels/ear) were also determined from the two middle rows. Twelve ear-leave samples were collected from the two center rows at tassel emergence (May 31). Total N was determined in the ear leaves and kernels by the LSU AgCenter's Soil and Plant Testing Lab. Kernel N uptake (lb N/acre) was calculated by multiplying kernel-N concentration by grain yield. NFUE was calculated using the following formula: (kernel-N uptake for a given N rate – kernel-N uptake for the no-N control) / N rate. Calculations for kernel-N uptake and NFUE are based on dry weight. Statistical analyses were performed using the GLM procedure of SAS at probability level of 0.10.

Results and Discussion

Rainfall was below normal for March through June (Table 1). Rainfall was very low in June totaling only 0.53 inches for the month. June is a critical month for corn, since much of the pollination and early grain fill occurs during this month. Rainfall in July was excessive, totaling over 16.0 inches.

Grain yields in this trial were extremely low, averaging only 112.6 bu/acre (Table 2). Optimum ESN rate was about 120 lb/acre. There were no significant grain yield responses to the late N applications at tassel. This was partly due to the low yield potential. Additionally, there was no rainfall for two to three weeks after late N application, which limited the plant availability of the N fertilizer. Kernel weights ranged from 25.8 to 35.2 g/100 kernels and ear size (kernels/ear) ranged from 95 to 365 kernels/ear across the ESN rates.

The leaf N, kernel N, kernel-N uptake, and NFUE are reported in Table 3. There were trends for the lower ESN rates, 0, 120, and 150 lb/acre, to produce higher kernel N and kernel-N uptake with supplemental N applied at tassel emergence. Kernel-N uptake across ESN rates ranged from 13.3 to 88.7 lb/acre. NFUE averaged 31.7% and ranged from 26.9 to 36.4% across the ESN rates.

The findings for this study are inconclusive. The lack of rainfall after the late-N application probably minimized any advantage of applying supplemental N late in the season.

Table 1. Rainfall received at the Northeast Research Station, 2007

Month	Rainfall
	inches
March	1.30
April	3.33
May	1.80
June	0.53
July	16.03
August	3.55

Table 2. Influence of early-season and late-season N rates on grain yield and yield components on Commerce silt loam at St. Joseph, 2007.

Early N	Late N	Total N applied	Grain yield	Ears	Kernel weight	Kernels
----------lb/acre----------			bu/acre	no/acre	g/100	no/ear
0	-	-	26.4	30,900	25.5	86
0	60	60	32.3	30,250	26.1	105
120	0	120	123.1	27,250	32.7	368
120	60	180	129.7	27,800	32.8	363
150	0	150	128.6	29,430	33.1	340
150	60	210	133.9	28,940	34.4	350
180	0	180	133.9	28,940	33.9	357
180	60	240	123.6	28,780	34.7	289
210	0	210	123.2	26,160	35.2	346
210	60	270	127.7	27,300	35.4	335
240	0	240	121.8	27,470	35.6	318
240	60	300	136.7	26,980	34.9	372
Averages:			112.6	28,690	32.6	305
LSD (0.10):			**NS**	**NS**	**NS**	**NS**
Early N averages:						
0			29.4	30,580	25.8	95
120			126.4	27,560	32.8	365
150			131.2	29,190	33.8	345
180			129.5	28,860	34.3	323
210			125.4	26,730	35.3	340
240			129.2	27,220	35.2	345
LSD (0.10):			**11.0**	**NS**	**1.1**	**46**
Late N averages:						
0			114.8	28,780	32.4	303
60			110.5	28,610	32.8	308
LSD (0.10):			**NS**	**NS**	**NS**	**NS**

Table 3. Influence of early-season and late-season N rates on leaf N, kernel-N concentration, kernel-N uptake, and N fertilizer use efficiency (NFUE) on Commerce silt loam at St. Joseph, 2007.

Early N	Late N	Total N applied	Leaf N	Kernel N	Kernel-N uptake	NFUE
----------lb/acre----------			%	%	lb/acre	%
0	-	-	1.44	1.19	13.3	-
0	60	60	-	1.29	18.9	9.2
120	0	120	2.84	1.11	62.1	40.6
120	60	180	-	1.22	71.3	32.2
150	0	150	2.9	1.23	71.7	38.9
150	60	210	-	1.30	78.9	31.2
180	0	180	2.96	1.36	83.2	38.8
180	60	240	-	1.41	72.2	24.5
210	0	210	3.09	1.42	79.5	31.5
210	60	270	-	1.43	81.6	25.3
240	0	240	3.08	1.49	81.9	28.6
240	60	300	-	1.44	88.7	25.1
Averages:			2.72	1.33	67.0	31.7
LSD (0.10):			**-**	**NS**	**NS**	**NS**
Early N averages:						
0			1.44	1.24	16.1	-
120			2.84	1.17	66.7	36.4
150			2.9	1.27	75.3	35.1
180			2.96	1.39	77.7	31.7
210			3.09	1.43	80.6	28.4
240			3.08	1.47	85.3	26.9
LSD (0.10):			**0.15**	**0.06**	**7.1**	**4.1**
Late N averages:						
0			-	1.30	65.3	35.7
60			-	1.35	68.6	27.7
LSD (0.10):			**-**	**0.03**	**3.5**	**2.0**