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EFFECT OF NITROGEN RATE ON NO-TILL CORN YIELD

Flanary, W., Agronomy Specialist, University of Missouri Extension
Crawford, J.J.W., Superintendent of Graves Chapple Research Center, University of Missouri Extension

ABSTRACT

The optimum corn nitrogen application rate varies from year to year as environmental conditions such as soil moisture impact corn yield. The objective of these experiments was to demonstrate to growers that the optimum nitrogen rates vary from year to year and may need to be managed during the growing season. Nitrogen fertilizer was applied as ammonium nitrate at a rate of 0, 60, 120, 180, 240 and 300 pounds of nitrogen per acre. The ammonium nitrate was surface applied at planting time on no-till corn following soybean. Seven years of data are summarized showing the optimum rate varied from year to year. One year, 2011, had the highest nitrogen efficiency producing over 200 bushels of corn with 120 pounds of nitrogen. The years of 2005 and 2006 produced approximately 200 bushels per acre of corn with 180 pounds of nitrogen applied. Years 2007 and 2008 required 240 pounds of nitrogen to grow approximately 200 bushels of corn. Years 2009 and 2010 required the highest nitrogen rate of 300 pounds to maximize yields. Corn yields were maximized within a range from 120 to 300 pounds of nitrogen per acre depending on the year.

Introduction

Nitrogen prices have increased along with corn yields over time. These changes have growers reconsidering their corn nitrogen fertilizer rates. Growers generally use the preplant method of nitrogen application to corn in north Missouri.

Scharf determined that the optimum nitrogen fertilizer rate differs among fields and also within fields. Yield goal has historically been used as a primary method for predicting nitrogen fertilizer rates. However, research from University of Missouri and other Midwest universities have helped develop other nitrogen management tools and recommendations to improve nitrogen management.

Wet weather during May and June can cause saturated soils leading to denitrification. Scharf indicates that if 12 inches of rain occurs during this time period, one should consider applying supplemental nitrogen. Several years in this study when April is included have had high amounts of precipitation.

The objective of these experiments was to demonstrate to growers that optimum nitrogen application rates vary from year to year and should be managed during the season.

Materials and Methods

The experiments were conducted from 2005 through 2011 on a Dockery silt loam soil located at the University of Missouri Graves Chapple Research Center, Corning, Missouri.

Ammonium nitrate was applied as a nitrogen source as different rates ranging in 60 pound increments from 0 to 240 pounds of nitrogen in the years of 2005 through 2008. In 2009 and on, an additional rate of 300 pounds was included as a treatment to test whether corn would respond to this higher nitrogen rate.

Plots were no-till planted and followed soybeans. Plots measured 10 feet by 35 feet in length and each experiment was conducted in a randomized complete block design with five replications. The center two rows of the four row plots were harvested.

Yield data was analyzed by Proc ANOVA using AGSTATS (Oregon State University, 2009).

Results and Discussion

Seven years of nitrogen rates on corn yield are shown in table 1. One year, 2011 had the highest nitrogen efficiency producing over 200 bushels of corn with only 120 pounds of nitrogen per acre. The years of 2005 and 2006 also produced approximately 200 bushels of corn per acre with 180 pounds of nitrogen applied. Years 2007 and 2008 required 240 pound nitrogen application rate to produce high yields. Next, the year of 2009 had the highest yield in the plots over the seven year period producing over 250 bushels that year but required 300 pounds of nitrogen be applied. Also, in 2010, 300 pounds of nitrogen were needed to maximize yields. Corn yields were maximized across years ranging from 120 to 300 pounds of nitrogen per year.

Table 1. The effect of nitrogen rate on corn yield.

Nitrogen rates	2005	2006	2007	2008	2009	2010	2011
	bushels/Acre						
0	163	135	150	102	87	78	104

60	186	189	168	129	144	138	167
120	199	197	186	149	185	163	216
180	206	199	192	192	196	188	216
240	205	194	197	199	231	191	212
300					256	206	218
LSD .05	26	31	31	33	36	37	22
CV%	7.1	8.7	8.9	11.3	14.6	12.5	8.8

Years 2005, 2007, 2008, 2009, 2010 and 2011 were considered wet years which resulted in denitrification. According to Scharf if May and June have over 12 inches of rainfall, there is a high probability that supplemental nitrogen applications will be needed. In table 2, if one includes April data with May and June, then Scharf recommendation of supplemental nitrogen would be met.

Table 2. Precipitation data from 2005 through 2011 from April through September.

	2005	2006	2007	2008	2009	2010	2011
Month	inches	inches	inches	inches	inches	inches	inches
April	6.43	3.47	2.94	3.3	4.19	2.83	3.61
May	3.97	1.95	8.32	5.44	1.74	3.71	3.6
June	4.12	2.38	1.29	4.66	5.75	4.96	5.63
July	5.03	2.07	2.46	2.73	1.95	4.87	5.83
August	6.02	5.59	10.66	0.68	3.59	4.8	4.94
September	0.5	3.47	1.37	4.39	0.88	3.23	0.29

Summary

The optimum nitrogen rate varied from year to year. The suggestion by Scharf to use other management strategies besides yield goal to determine nitrogen rates should be considered. Wet springs can result in loss of nitrogen through denitrification.

References

Scharf, P.C. and Lory, J.A. 2006. Best Management Practices for Nitrogen Fertilizer in Missouri. Ext. Pub. IPM 1027. University of Missouri, Columbia.
