

Assessing Nitrogen Requirements in Corn Using the Quadratic Plateau Model (Interim Report)

Purpose:

To develop a method that will allow a farmer to assess the profitability of current rates of nitrogen (N) application on a field and the potential for variable N application. The Quadratic Plateau model of statistical analysis will be compared to the Quadratic model for predicting the maximum economic rate of nitrogen (MERN) for a field.

Methods:

The project was setup on a field scale basis in a corn crop on cooperator's fields. A representative area in the field was chosen for the treatments. Field length strips consisting of several nitrogen rates with the full rate in between (in most cases) were established. The treatments consisted of several rates of nitrogen, 3 or 4 nitrogen rates below the field's full or normal rate of nitrogen, and one rate above. If the full rate was 120 lbs N/ac or less, or if equipment settings were limiting, fewer rates were used. The check strips (zero nitrogen strip) were to have up to 30 lbs N/ac in a starter and no sidedress N.

One-foot soil nitrate samples were taken from the plots in June. The plots were monitored throughout the season to identify any potential problems that might affect yield. The strips were harvested and weigh wagon weights for each strip were recorded. The yield data was analyzed using the quadratic and quadratic plateau statistical models.

Results:

See Table 1. below.

Summary:

The weather had an impact on the results of this project, particularly in 2001 and 2002. This method of determining the nitrogen rate for a field appears to be a good one. Yield monitor data was not collected so it is difficult to determine if there were opportunities for variable N application.

Five of the cooperators identified the potential to reduce their nitrogen rate. Several could reduce rates by 20-30 lbs. N /acre while some had potential reductions of 70-80 lbs. N/acre. Some of these cooperators made adjustments to their N rates based on the results of this project. One cooperator who had cattle manure and red clover in a good crop rotation consistently did not get a response to sidedress nitrogen. They apply about 60-70 lbs of N on corn which seems reasonable as this would compensate for uneven manure application or areas of reduced stands of red clover. Others were able to confirm that the rate they were using was correct for the field. Amherstburg H (Essex SCIA demo farm) had the plot in the same area for 2 years. The first year showed they were over applying by about 30 lbs. and the reduced rate was the correct rate the second year.

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Table 1. Comparison of Nitrogen Recommendations – 2000-2003

Cooperator	Normal N ¹		Pre Sidedress N Test		Quadratic MERN	Q. Plateau MERN	Potential N Rate Change
	(kg/ha)	(lbs/ac)	(kg/ha)	(lbs/ac)	(lbs/ac)	(lbs/ac)	(lbs/ac)
Wallaceburg 2002	145	130	69 ²	61 ²	89	75	-50
Wallaceburg 2003	175	156	22	20	120	118	-35
Bothwell 2000	157	140	149	133	138	126	-15
Bothwell 2000	157	140	138	123	141	118	-20
Bothwell 2001	170	150	32	28	113	97	-50
Bothwell 2003	170	150	84 ²	75 ²	148	147	0
Watford 2001	170	150	107	95	117	66	-80
Watford 2002	140	125	53 ²	47 ²	102	91	-35
Amherstburg D 2003	200	180	11	10	0	0	-180
Dresden 2000	135	120	0	0	73	---	-60
Dresden 2002	124	110	NA	NA	70	70	-40
Dresden 2003	74	66	41 ²	36 ²	30	30	-35
Tilbury 2000	202	180	161 ²	143 ²	214	---	0
Tilbury 2003	202	180	107 ²	95 ²	146	102	-80
Amherstburg H 2002	170	150	36 ²	32 ²	119	118	-30
Amherstburg H 2003	139	124	101	90	126	122	0
Thamesville 2003	200	180	84	75	0	0	-180
Mooretown 2003	180	160	29 ²	26 ²	70	55	105
Dresden R 2003	170	150	145	130	154	155	0
Wallaceburg S 2000	202	180	112	97	146	107	-70
Wallaceburg S 2001	170	150	60	53	134	---	-15
Wallaceburg S 2002	170	150	90 ²	80 ²	114	109	-40
Corunna 2003	165	147	67 ²	60 ²	0	0	-145

Notes:

1. Normal N is the usual rate of nitrogen the cooperator applies to that field.
2. The nitrate samples were taken after the ideal pre-sidedress nitrogen test (PSNT) timing

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The Amherstburg D plot had 10 tons per acre of turkey manure applied the previous fall so no response to nitrogen would be expected. The Corunna plot has had regular applications of hog manure so no response would be expected there. Both cooperators could reduce their nitrogen rates significantly.

The soil nitrate test was taken every year on the plots. Samples were taken along some of the treatments and slope position was noted. Some of the plots were sampled later than the ideal time period for the pre-sidedress nitrogen test. There were 10 plots where the PSNT could be related to a yield determined nitrogen recommendation. In only 3 of the sites did the PSNT come close to recommending the correct amount of nitrogen. In 4 sites it under recommended by 25 to 100 lbs. N/acre and in 3 it over recommended by 30 to 75 lbs. N/acre. There tended to be a wider range of soil nitrate levels in the sites where the PSNT over or under recommended nitrogen. There was not a consistent trend in nitrate levels between the slope positions. This could be partly due to the fact that the samples were taken along nitrogen rate strips and may not represent the lowest or highest point in the topography.

The quadratic plateau model was a good method for calculating the maximum economic rate of nitrogen. It tended to give a lower nitrogen recommendation than the quadratic model but seemed to fit the response curve better.

Next Steps:

The project will continue for one more year. The data will be included in other nitrogen databases. A database of the 5 years of data will be put together and further analyzed. The response curves from this year and next year will be tested in the nitrogen recommendation spreadsheet the Greg Stewart is working on.

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Location of Project Final Report:

See Project Contacts above.