



Nitrogen Management for Corn on Fine Textured Soils

Purpose:

This project concentrated on the Nitrogen requirements for corn production on fine textured soils which are slower to dry out and warm up in the spring and thought to be slower to release available nitrogen. The resulting trials were used to highlight the economic importance of targeting the correct N rate.

Methods:

A number of cooperators within the Golden Horseshoe Soil and Crop Improvement Association region and beyond participated in the project. A site was selected at each location where 2-4 replicates of full field length N rate strips could be established. The N fertilizers used by cooperators included urea and uan, applied preplant, with the planter or side dress. Tillage systems varied from full conventional to straight notill.

Rates of N were chosen that bracketed the cooperators normal practice or based on PSNT N rate predictions from the sites. In general rates targeted 0, 0.5, 1.0, 1.5 times the normal fertilizer rate for the farm. Starter rates were in addition to the supplemental N values and were not to exceed 40 lb/ac (45 kg/ha).

Plots were harvested at maturity and data was recorded for yield, moisture and test weight. The data was statistically analyzed and then the individual field sites MERN's and gross economic returns were calculated.

Results:

The yield data from the sites in the Golden Horseshoe Region are presented in Table 1. Significant differences in yield between treatments were detected in the majority of sites. In most cases there was a difference between the "starter only" rate and the lowest supplemental rate, but not always. Rarely were there big significant differences between the cooperators normal full rate and the lowest supplemental rate even though statistically the resulting yields were significantly different at the 10% level.

The real test of the value of this type of trial is to determine the field MERN which is the N rate at which the greatest gross return is realized. This information is presented in table 2. The difference between the MERN and the cooperators normal N rate indicates how much economic loss was experienced at the individual location, this year.

The determination of MERN is a mathematical exercise in which you need to estimate or know the selling price of the corn and the cost of the nitrogen used. As these values change, the MERN will vary. In these 2005 sites the Gross Return at MERN always was greater than the maximum yield N rate, with the exception of the Milton site where there was no response to nitrogen, all rates gave a similar yield. There were some bigger than expected MERN's in this data set because of the phenomenal yields achieved in some sites during the 2005 growing season.

Table 1. Yield Response to N Rates at Golden Horseshoe SCIA Sites

| Vinemount_Side Dress | | | | | Milton_Side Dress | | | | | Wainfleet_PrePlant | | | | | Dunnville_PrePlant | | | | |
|----------------------|-------|-------|------|-------|-------------------|-------|-------|------|-------|--------------------|-------|-------|------|-------|--------------------|-------|-------|------|-------|
| Total N | | Yield | | Sign* | Total N | | Yield | | Sign* | Total N | | Yield | | Sign* | Total N | | Yield | | Sign* |
| lb/ac | kg/ha | bu/ac | t/ha | | lb/ac | kg/ha | bu/ac | t/ha | | lb/ac | kg/ha | bu/ac | t/ha | | lb/ac | kg/ha | bu/ac | t/ha | |
| 15 | 17 | 145 | 9.1 | b | 31 | 35 | 124 | 7.8 | nsd | 17 | 19 | 132 | 8.3 | c | 19 | 21 | 154 | 9.7 | c |
| 65 | 73 | 160 | 10.0 | a | 71 | 80 | 127 | 8.0 | | 92 | 103 | 171 | 10.7 | b | 91 | 102 | 176 | 11.0 | b |
| 115 | 129 | 164 | 10.3 | a | 91 | 102 | 128 | 8.0 | | 147 | 165 | 184 | 11.5 | ab | 146 | 164 | 193 | 12.1 | a |
| 165 | 185 | 163 | 10.2 | a | 111 | 124 | 131 | 8.2 | | 167 | 187 | 181 | 11.4 | ab | 166 | 186 | 194 | 12.2 | a |
| 120 | 134 | 148 | 9.3 | b | | | | | | 242 | 271 | 193 | 12.1 | a | 241 | 270 | 201 | 12.6 | a |

* Yields followed by the same letter within an individual site are not significantly different at the 10% level. The 120 lb/ac rate of N at Vinemount above was applied with the planter while the remaining N rates were applied Side Dress.

| Binbrook_At Plant | | | | | Binbrook_Side Dress | | | | | St. George_At Plant | | | | |
|-------------------|-------|-------|------|-------|---------------------|-------|-------|------|-------|---------------------|-------|-------|------|-------|
| Total N | | Yield | | Sign* | Total N | | Yield | | Sign* | Total N | | Yield | | Sign* |
| lb/ac | kg/ha | bu/ac | t/ha | | lb/ac | kg/ha | bu/ac | t/ha | | lb/ac | kg/ha | bu/ac | t/ha | |
| 40 | 45 | 103 | 6.5 | c | 40 | 45 | 103 | 6.5 | c | 6 | 7 | 160 | 10.0 | c |
| 85 | 95 | 115 | 7.2 | abc | 85 | 95 | 119 | 7.5 | bc | 86 | 97 | 190 | 11.9 | b |
| 130 | 146 | 122 | 7.7 | abc | 130 | 146 | 126 | 7.9 | ab | 127 | 142 | 205 | 12.9 | a |
| 175 | 196 | 122 | 7.7 | abc | 175 | 196 | 128 | 8.0 | a | 164 | 183 | 200 | 12.5 | ab |

Table 2. Determination of Site MERN and Gross Return

| 2005 Nitrogen Response Trials in Golden Horseshoe Soil and Crop Assoc. Region | | | | | | | | | | | | | | |
|-------------------------------------------------------------------------------|---------------|-----------|---------------|----------|---------------|------------|---------------|------------|---------------|------------|---------------|------------|---------------|------------|
| Site | Vinemount | | Milton | | Binbrook | | Binbrook | | Wainfleet | | Dunnville | | St. George | |
| | imp | metr | imp | metr | imp | metr | imp | metr | imp | metr | imp | metr | imp | metr |
| Soil Type | Clay | | Clay | | Clay | | Clay | | Clay Loam | | Loam | | Clay Loam | |
| N_Timing | Side Dress | | Side Dress | | At Plant | | Side Dress | | Preplant | | Preplant | | At Plant | |
| StarterOnlyNrate (lb/ac kg/ha) | 15 | 16.8 | 31 | 35 | 40 | 45 | 40 | 45 | 17 | 19 | 16 | 18 | 6 | 7 |
| StarterOnlyYield (bu/ac t/ha) | 145 | 9.1 | 127 | 8.0 | 103 | 6.5 | 103 | 6.5 | 133 | 8.4 | 122 | 7.6 | 159 | 10.0 |
| Starter_GrReturn \$/ac | 399.14 | | 341.76 | | 272.00 | | 272.00 | | 365.97 | | 334.51 | | 443.27 | |
| MERN_Nrate (lb/ac or kg/ha) | 72 | 81 | 0 | 0 | 103 | 115 | 115 | 129 | 170 | 190 | 155 | 174 | 116 | 130 |
| MERN_Yield (bu/ac or t/ha) | 162 | 10.1 | 128 | 8.0 | 119 | 7.5 | 125 | 7.8 | 187 | 11.7 | 196 | 12.3 | 199 | 12.5 |
| MERN_GrReturn \$/ac | 420.21 | | 355.54 | | 287.36 | | 298.80 | | 449.51 | | 480.41 | | 506.92 | |
| MaxYield_Nrate (lb/ac or kg/ha) | 100 | 112 | 0 | 0 | 152 | 170 | 157 | 176 | 228 | 255 | 183 | 205 | 155 | 174 |
| MaxYield (bu/ac or t/ha) | 164 | 10.3 | 128 | 8.0 | 123 | 7.7 | 128 | 8.0 | 191 | 12.0 | 198 | 12.4 | 202 | 12.7 |
| MaxYield GrReturn \$/ac | 414.17 | | 355.54 | | 277.21 | | 290.00 | | 437.98 | | 474.60 | | 498.78 | |

GrReturn = gross return based on corn selling price of \$2.80/bu and an N price of 0.42/lb actual N

Table 3. Impact of Yield Performance on Seasonal MERN

| Seasonal MERN Differences Based on Yield Response | | | | | |
|-----------------------------------------------------------------------------------------------------|-------------------|--------------------|------------------|-------------------|--------------------|
| Imperial | | | Metric | | |
| N Rate (lb/ac) | 2005 Actual Yield | Avg Seasonal Yield | N Rate (lb/ac) | 2005 Actual Yield | Avg Seasonal Yield |
| 16 | 154 | 110 | 18 | 9.7 | 6.9 |
| 91 | 176 | 125 | 102 | 11.0 | 7.8 |
| 146 | 193 | 150 | 164 | 12.1 | 9.4 |
| 166 | 194 | 155 | 186 | 12.2 | 9.7 |
| 241 | 201 | 160 | 270 | 12.6 | 10.0 |
| | | | | | |
| MERN (lb/ac) | 168 | 117 | MERN (kg/ha) | 188 | 131 |
| MERN Yld (bu/ac) | 195 | 140 | MERN Yld (t/ha) | 12.2 | 8.8 |
| GrReturn (\$/ac) | 472.21 | 340.28 | GrReturn (\$/ac) | 472.21 | 340.28 |
| GrReturn = gross return based on corn selling price of \$2.80/bu and an N price of 0.42/lb actual N | | | | | |

Table 3 highlights one of the dilemmas of trying to target MERN. The yield potential can have a significant impact on the MERN. In the table, the actual 2005 data is presented next to a fictional yield response but one that is realistic for the area. Note that in 2005 the MERN based on a phenomenal overall yield response was 168 lb/ac (188 kg/ha) vs. the normal year MERN of 117 lb/ac (131 kg/ha).

Summary:

Conducting N response trials on grower's farms is an effective way to judge if normal N rates being used are on target. Considerable yield is derived from background N levels which this work allows farmers to identify. The MERN can be an elusive target in years with above normal yield response, but in general provides farmers with an understanding of the N rates they should be targeting for maximum economic gain and to minimize environmental losses.

Next Steps:

This work will be continued in 2006 due to the enthusiastic response from the cooperators.

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