2007 Purdue Nitrogen Rate Trial Update

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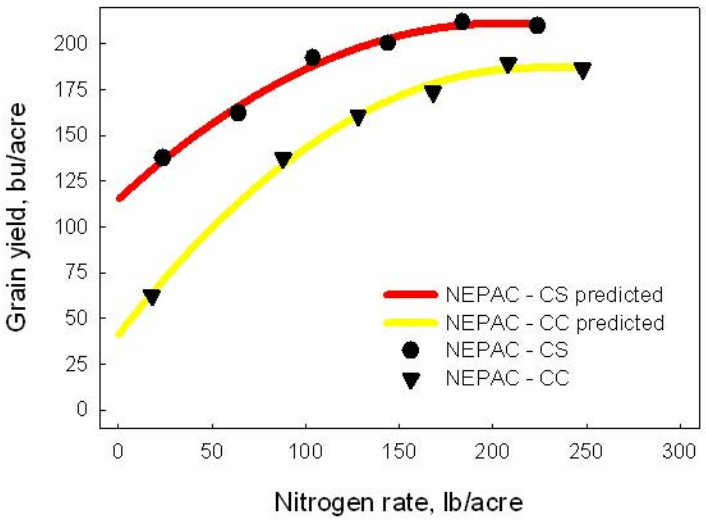
Corn nitrogen (N) rate trials were conducted on 7 Purdue Agricultural Centers in 2007. The N response of corn following soybeans (CS) was examined at all of the sites. The N response of second year corn (CC) was examined at 5 of the 7 locations in fields adjacent to the CS fields. Locations were: ACRE-West Lafayette, TPAC-Lafayette, PPAC-Wanatah, NEPAC-Columbia City, DPAC-Farmland, SEPAC-Butlerville, and SWPAC-Vincennes.

All fields were sidedressed with 28% urea-ammonium-nitrate liquid fertilizer between the corn rows at V4 to V6 growth stages. Similar N results would be expected from late pre-plant or sidedress anhydrous, but not necessarily from early pre-plant or anhydrous or 28% or fall anhydrous. Nitrogen rates ranged from near zero to more than 250 lb N/acre in 40 to 50 lb N/acre increments. Most trials were field scale with each plot having a row length greater than 300 ft. long and 12 rows wide and 4 to 6 replications of each treatment in each field. Most of the trials were conducted on fine-textured soils: silt loams, silty clay loams, and the like.

Corn Yield Response to Fertilizer Nitrogen

A typical N response curve is illustrated at the right with the N response of CC and CS at NEPAC. The grain yield response to added N is large at low rates of N but tapers off as the rate of N is increased. Often the highest rates do not increase yield further. For CC, the yield with starter alone (18 lb N/acre) was only 63 bu/acre and increased substantially with 70 lb N/acre sidedress. The maximum yield of 187 bu/acre was attained with 221 lb N/acre (starter and sidedress) for CC at NEPAC. The soil supplied more N in the CS rotation, in comparison to CC, achieving 138 bu/acre with starter only. Maximum yield for the CS rotation, 211 bu/acre, was achieved with 204 lb N/acre. Economic optimum N rates for CC and CS were about 30 lb N/acre less than those for maximum yield.

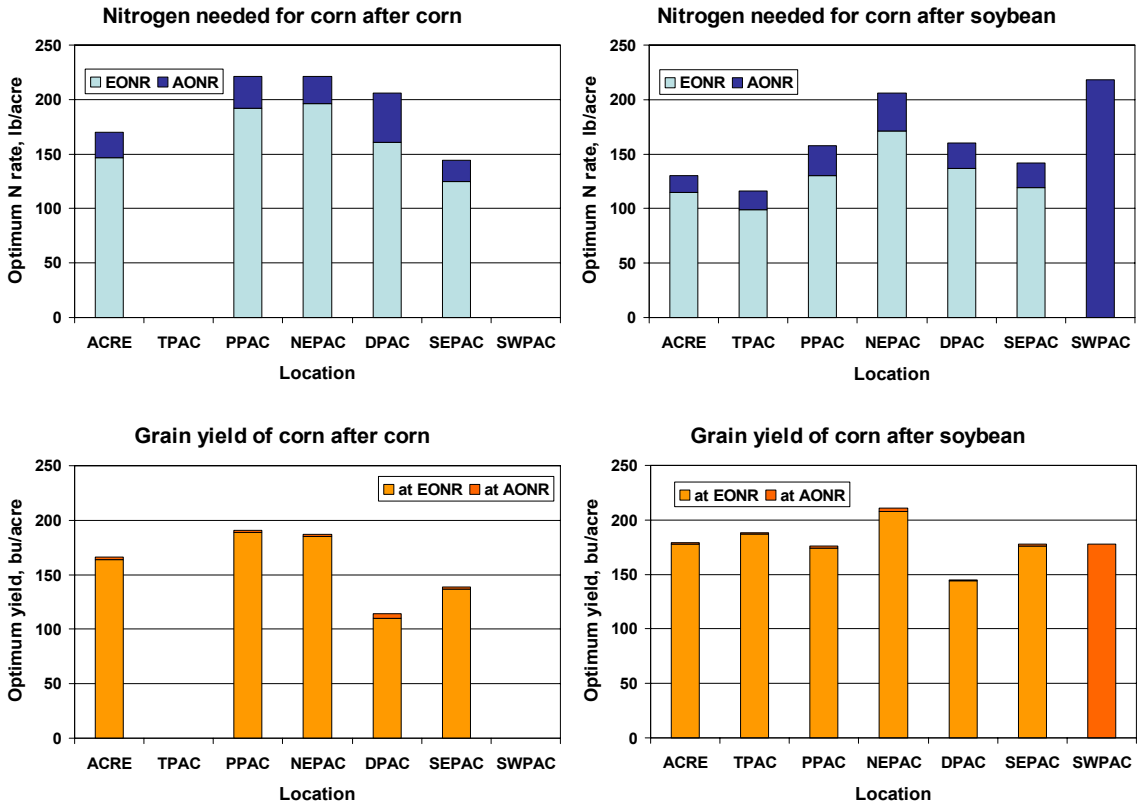


[1] Summary current as of 12/3/07. For more information, contact Jim Camberato (jcambera@purdue.edu) or Bob Nielsen (rnielsen@purdue.edu)

Nitrogen Needed for Maximum Yield: Agronomic Optimum Nitrogen Rate (AONR)

The N rate needed to maximize corn yield, the agronomic optimum N rate (AONR), varied substantially from location to location, from less than 120 lb N/acre to more than 220 lb N/acre. The AONR is represented by the entire height of the blue bar in the charts below (both the light and dark blue portions). The SWPAC bar is entirely dark because the AONR was greater than the highest N rate used in our study, so yield may have increased with even higher N rates and we could not determine the optimum rate.

Grain yield at AONR also varied substantially, from 110 to 211 bu/acre (see the second set of charts with orange bars). The level of grain yield was not correlated with the amount of N needed to maximize grain yield. For example, maximum yield at DPAC for CC was only 110 bu/acre, but it required over 200 lb N/acre to achieve this yield. In contrast, 115 lb N/acre was enough at TPAC to produce CS near 190 bu/acre. This type of result is why N fertilizer recommendations will no longer be directly tied to yield potential.



The Cost of Fertilizer Nitrogen and Grain Prices Determine Economic Optimum Nitrogen Rate (EONR)

Fertilizing for maximum yield is usually a money losing proposition. Considering corn grain at $3.25/bu grain and $0.50/lb N the economic optimum N rate (EONR-see the light blue portion of the bar in the charts above) averaged about 25 lb N/acre less than AONR. Yield at EONR averaged about 2 bu/acre less than the AONR yield (compare the height of the light colored orange bar to the total height of the orange bar for each location except SWPAC). EONR is dependent on the cost of N and grain price, as well as the N rate response curve. The EONR decreases with more expensive N and/or less valuable grain and increases with high grain prices and/or cheap N.

Nitrogen Fertilizer Rates for Corn after Soybean (based on 2006 & 2007 trials)

Thirtythree N rate trials for corn following soybean were conducted in 2006 and 2007. Twelve trials were conducted on Purdue farms and the remaining trials were conducted on farmer fields or at Beck's Hybrids research farms. **The N rate needed for maximum yield (AONR) averaged 167 lb/acre N across all sites.** Yield at the AONR averaged 188 bu/acre. **The average economic optimum N rate (EONR) was 140 lb/acre N** (at $3.25/bu grain and $0.50/lb N) and produced an average yield of 186 bu/acre.

Unfortunately, the EONR varied across locations, ranging approximately 31 lb/acre N from the overall average or from about 110 to 170 lb N/acre. This is not unexpected since the optimum N rate for any given field in any given year is dependent on many factors, particularly soil N supply and fertilizer N loss. Considering fine-textured soils only (silt loams, etc.), fields in northeast Indiana required N on the higher side of the range, while sites in northwest and west central Indiana tended to have N requirements on the lower side of the range. Hopefully, additional N trials will help us to more clearly separate out responses based on region, soil type, drainage class, tillage system, and/or other soil and cropping system factors.

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