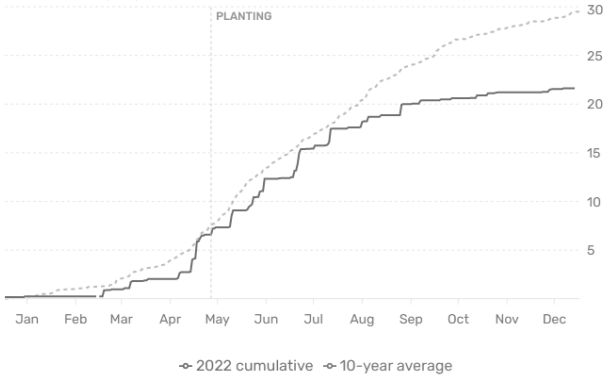
Determining Economically Optimum Nitrogen Rate on Irrigated Corn

Study ID: 1111185202201
County: Hamilton
Soil Type: Hord silt loam 1-3% slope; Hord silt loam rarely flooded; Hastings silty clay loam 3-7% slopes; Hastings silty clay loam 7-11% slopes
Planting Date: 5/11/22
Harvest Date: 10/17/22
Seeding Rate: 29,000
Row Spacing (in): 36
Hybrid: Pioneer® P1572
Reps: 3
Previous Crop: Soybean
Tillage: No-till
Herbicides: ***Pre:*** 2 qt/ac Lexar® EZ, 22 oz/ac Roundup®, and AGpHRx™ on 5/16/22 ***Post:*** 1 qt/ac Resicore®, 1 qt/ac atrazine, 22 oz/ac Roundup®, and AGpHRx™ on 6/14/22
Seed Treatment: Maxim® Quattro, Lumiflex™, Lumiante™, L-20012R, and Lumivia™ 250
Foliar Insecticides: None
Foliar Fungicides: None
Fertilizer: Treatments were applied in the form of anhydrous in November 2021; all treatments had 50 lb N/ac applied as 32% UAN at V8
Note: This field had 25% hail damage on 6/14/2022 when the corn was at V6
Irrigation: Pivot, Total: 8.5"
Rainfall (in):



Introduction: The goal of this study was to determine the economic optimum nitrogen (N) rate for corn. Treatments were established as anhydrous ammonia with rates of 0, 50, 100, 150, and 200 lb N/ac in November 2021. All treatments also received a sidedress of 50 lb N/ac as 32% UAN at V8. The sidedress treatment was surface applied and did not get incorporated until a rain 10 days later. Harvest stand counts, yield, net return, and residual nitrate were evaluated.

Results:

Total N Rate (lb/ac)	Harvest Stand Count (plants/ac)	Yield (bu/ac)†	Marginal Net Return‡ ($/ac)
50 lb N/ac	25,167 A*	211 C	1,329 AB
100 lb N/ac	22,667 A	222 B	1,354 A
150 lb N/ac	22,833 A	231 A	1,375 A
200 lb N/ac	22,167 A	232 A	1,339 AB
250 lb N/ac	24,500 A	230 A	1,288 B
P-Value	0.121	0.0002	0.012

*Values with the same letter are not significantly different at a 90% confidence level.
†Bushels per acre corrected to 15.5% moisture.
‡Marginal net return based on $6.57/bu corn, $0.85/lb N as anhydrous, and $1.10/lb N as 32% UAN.

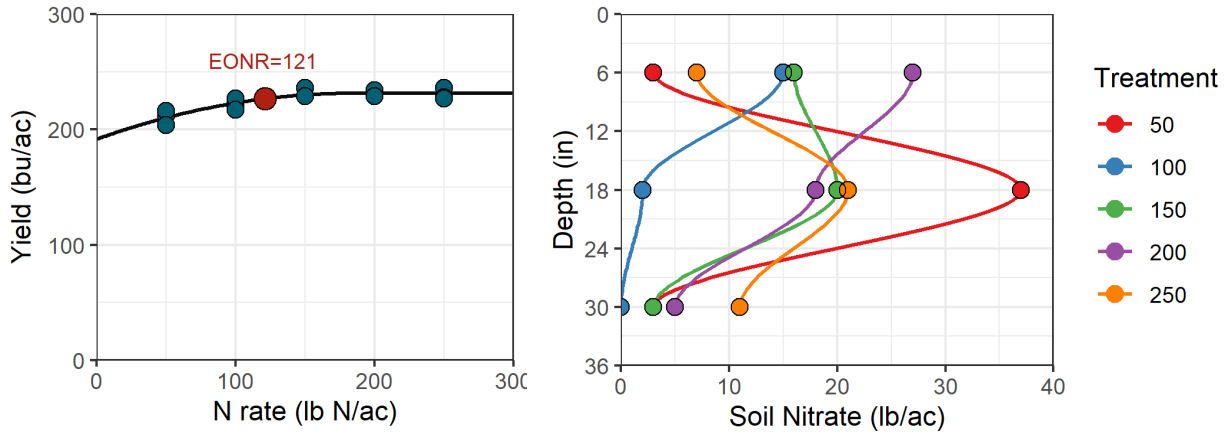


Figure 1. (left) Economic optimum nitrogen rate (lb/ac) at a corn price of $6.57/bu and nitrogen fertilizer price of $0.98/lb. **(right)** Residual soil nitrate (lb/ac) for five nitrogen rates at depths of 0-12", 12-24", and 24-36".

Summary:

- There was no difference in harvest stand counts between the N rates evaluated.
- Residual nitrate varied greatly both by depth and by treatment.
- The economic optimum N rate was 121 lb N/ac and resulted in a yield of 226 bu/ac. At this N rate, the nitrogen use efficiency is 0.54 lb N/bu grain.
- As always, individual expenses are unique for each grower and need to be considered. The economic optimum N rate was calculated using the standard grain price of $6.57/bu and the nitrogen fertilizer prices paid by the farmer ($0.85/lb N as anhydrous and $1.10/lb N as UAN 32%). However, the grower noted he has additional grain drying, storage, and hauling expenses that total $0.35/bu and an additional N expense of $0.05/lb of N from interest on an operating loan for N fertilizer.