

Station 3C: N Mineralization

4R Nutrient Stewardship Self-Guided Tour

The soil's ability to supply N to a crop is an important factor for developing agronomically and environmentally sound recommendations for N fertilizer rates:

$$\text{Rec. Rate of Fertilizer N} = \frac{\text{Crop Requirement} - \text{Soil Supply}}{\text{Fertilizer Use Efficiency}}$$


- ✦ Most soil tests measure only the immediately available N in soil (e.g., residual nitrate-N)
- ✦ However, the amount of N released from decomposition of soil organic matter (mineralization) during the growing season can be large
- ✦ The zero N “control” or “check” treatment can help us to estimate the amount of N mineralized from soil organic matter in a growing season, e.g.:
 - in John Heard’s corn fertilization trials in 2016 and 2017, estimated N mineralization exceeded 150 lb N/acre at several sites (200 bu/ac with 0N)
 - in Lanny Gardiner’s corn fertilization trials in 2018 and 2019, estimated N mineralization varied from 12 to 95 lb N/acre at 13 sites (see below)

Estimated N mineralization from soil organic matter in the 0 N treatment at Lanny Gardiner’s field experiments with N fertilization of corn in Manitoba				
Site-Year	Pre-plant NO ₃ -N to 24” as BD	Plant N uptake	Post-harvest NO ₃ -N to 24” as BD	Estimated N mineralization
lb/ac				
CarmanNorth19	31	65	13	47
CarmanSouth19	55	125	25	95
CarmanWest18 ^a	62	105	53	89
Clearwater19 ^a	124	143	30	43
Elgin19 ^a	45	83	30	59
Graysville18	75	104	29	58
Graysville19	51	96	22	67
Macgregor18 ^a	49	85	19	51
Morris19	97	82	32	17
Rosebank18 ^a	104	148	52	92
Rosebank19 ^a	140	137	30	22
StClaude19	25	40	17	32
Stephenfield18	38	40	10	12
Maximum	140	148	53	95
Median	55	96	29	51
Mean	69	96	28	53
Minimum	25	40	10	12

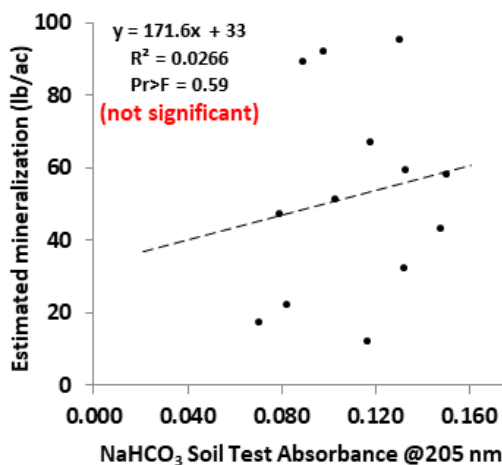
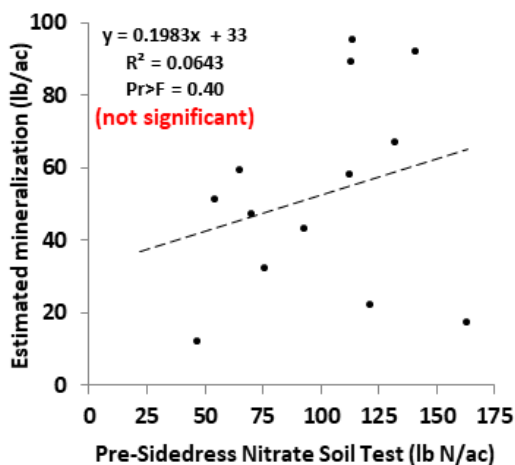
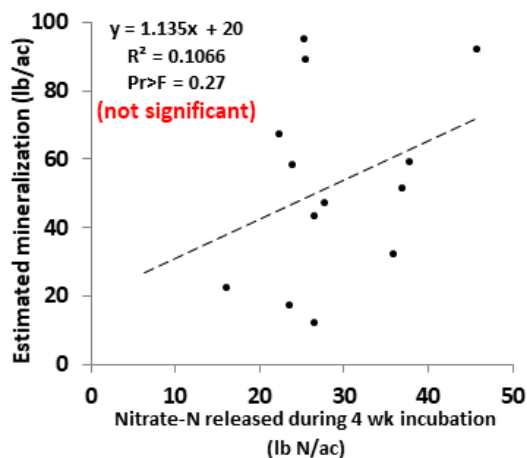
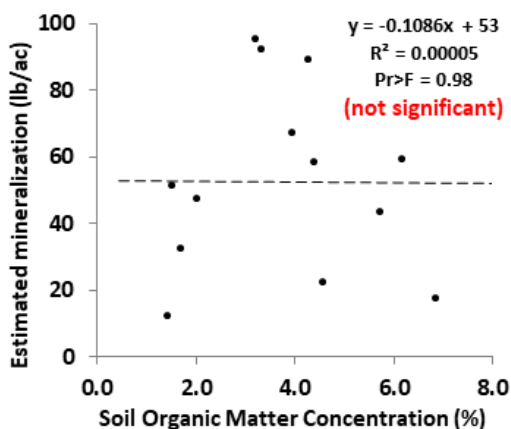
^aAdditional starter N applied at planting as a baseline application to all plots, was also accounted for in the calculation for mineralization

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Can we use soil tests to predict N mineralization in the field?

- ✦ In Lanny Gardiner's corn fertilization trials, none of the 10 soil test measurements in the lab were significantly related to estimated N mineralization in the field during the subsequent growing season (see examples below)



Conclusions

- ✦ The amount of N mineralized is virtually impossible to predict with a soil test, due to variation with a soil's nutrient & crop management history, plus effects of growing season weather on biological decomposition and release of organic N
- ✦ Eventually, we might use leaf colour/canopy reflectance measurements and other in-season tools to monitor for variation in N supply/demand and determine the need for supplemental midseason N applications
- ✦ In the meantime, use fall residual soil NO₃ tests every year on every field to monitor your N management and to avoid getting too far off track with your fertilizer rates