Nitrogen for Manitoba Corn: Rates and Splits

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Findings

1. Most Economic Rate of Nitrogen (MERN) was:
   - 150 lb N/ac (fert & soil) at medium yielding sites
   - 182 lb N/ac (fert & soil) at high yielding sites.
2. Much N was provided by in-season mineralization, often exceeding150 lb N/ac and was unrelated to soil OM levels. Perhaps some prairie soils now react as summer fallow under corn production.
3. There were no significant yield differences between N applied at seeding or at V4-V8 stages.

Method

- Ten, generally well-drained sites were selected and soil sampled prior to N application.
- 6 Nitrogen (N) rates (0, 40, 80, 120, 160 and 200 lb N/ac) were surface broadcast after seeding as SuperU (46-0-0).
- 2 additional treatments were applied to the seeding time broadcast rate (PRE)) as surface UAN dribble to simulate the Y-drop application at approx. the V6 stage in 2016 and at V4 and V8 stages in 2017 (Figure 1).

Figure 1. Y-Drop application of UAN solution in corn.

- A number of N rate decision tools and concepts were evaluated (not shown here).
- Average yield response was graphed and the most economic return to N (MERN) was determined (using $4/bu corn and $0.40/lb N).
- Growing conditions in 2016 were 108% and 112% of normal CHU and precipitation, respectively. In 2017, CHU were near normal but rainfall was only 60% of normal.
- Soil mineralization of OM appeared to contributed greatly to the high check yields. A very crude calculation of N was made by multiplying check yields by 1.12 lb whole plant N uptake/bu[1] less soil nitrate, less starter fertilizer N. Post harvest residual soil N measurements were determined only at Winkler, Carman and Letellier in 2017

Results – Nitrogen Rates

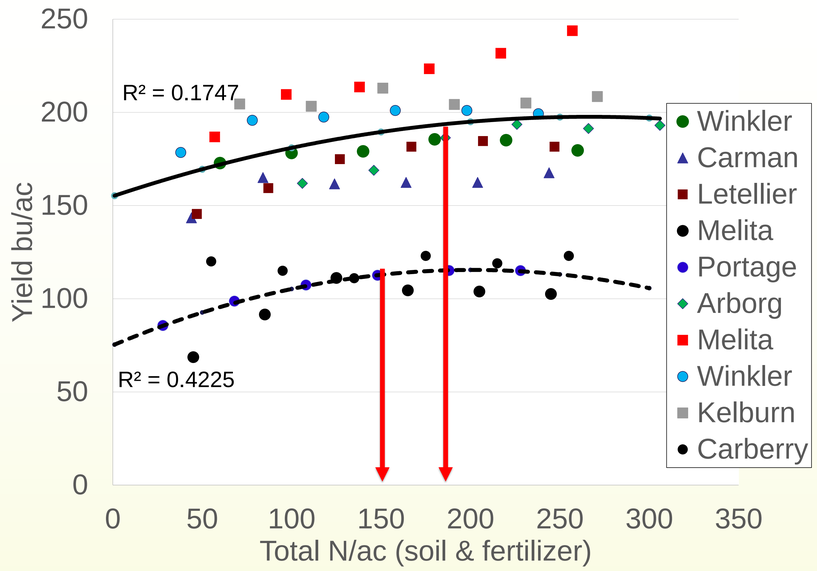

Figure 2. Corn yield response to nitrogen at 10 sites. Lines are average quadratic function of medium (100-150 bu/ac) yielding sites (dotted) and high yielding (50-200 bu/ac) sites (solid lines). Red lines indicate MERN.

•MERN for 3 medium yielding sites was 150 lb total N (soil & fertilizer)/ac and was achieved with about 1.2 lb total N/bu.
•MERN of 7 high yielding sites was 182 lb total N/ac and was achieved with about 0.95 lb N/bu.
•But MERN of individual sites ranged widely (for example from 0 to 200 lb fertilizer N/ac at Kelburn and Melita, respectively).
•Very high check yields were achieved at many sites without applied N presumably due to mineralization from soil organic matter (OM).

Table 1. Estimates of mineralized nitrogen.

Site	Check Yield	Est .N uptake[1]	Soil nitrate 0-2'	Starter fertilizer N	Mineralized N est.
	Bu/ac	lb N/ac			
Kelburn	202	226	71	4	151
Carberry	120	134	55	6	73
Arborg	154	172	106	10	56
Morden	178	199	35	4	160
Melita	187	209	57	4	148
Winkler	173	194	18**	-	176
Carman	143	160	-8**	-	168
Letellier	146	164	-11**	-	175
Melita	69	77	28	-	49
Portage	86	96	45	-	51

** the difference between preplant soil N and post harvest residual N.

- Estimated mineralized N was 150 lb/ac or greater at 6/10 sites, about 3 times greater than traditional estimates.
- Soil OM was poorly related to mineralized N (Figure 3).

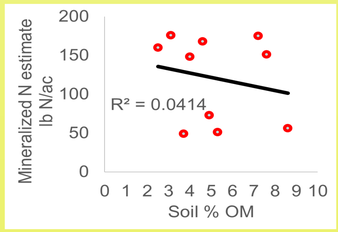

Figure 3. Mineralized N relationship to soil OM

Results – Nitrogen Splits

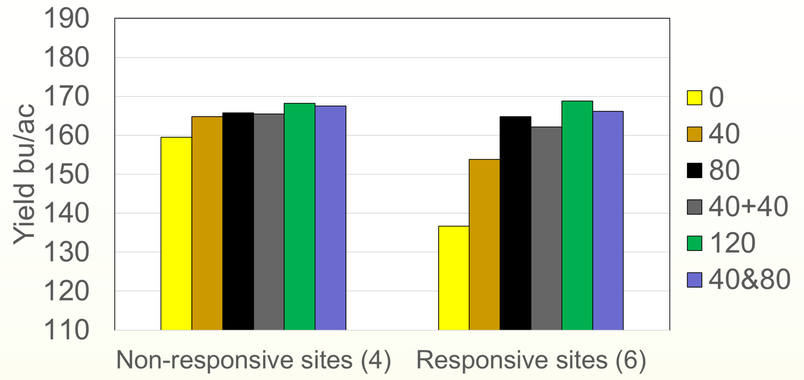

Figure 4. Corn yield response to nitrogen split applications across all 10 sites grouped by site response to applied N.

•At non-responsive sites, effective in-season decision tools could have eliminated need for additional N application. Such tools are under development.
•At responsive sites the in-season Y-drop applications produced similar yield to at planting N.

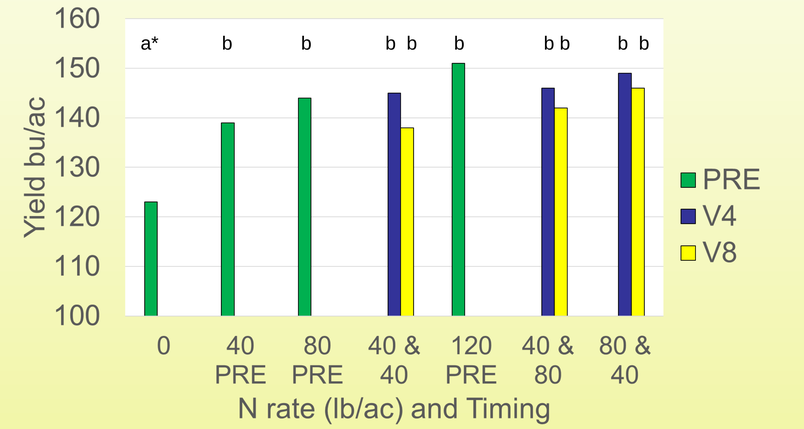

Figure 5. Response to nitrogen split applications at V4 and V8 stages in 2017. * bars under letters with the same letter are not significantly different at the 5% probability level.

•Corn yield increased with >40 lb fertilizer N/ac and was similar among N application at planting (PRE) and V4 and V8 stages
•however when N was delayed to V8 stage, yield tended to be less than earlier applications.
•It appears that in-season applications provide an opportunity to assess early season conditions influencing soil and crop N status before committing the final N application. Early season N losses due to excess rainfall were not observed in 2016-17.

References

[1]Bender et al. 2013. Better Crops. Vol.97 No. 1 p7-10.

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