# Nitrogen for Manitoba Corn: Rates and Splits

**John Heard**[1] CCA

[1]Manitoba Agriculture, Carman, MB, Canada

## Findings

1. Most Economic Rate of Nitrogen (MERN) was:

150 lb N/ac – soil N for medium yielding sites and 182 lb N/ac – soil N for high yielding sites.

2. Much N was provided by in-season mineralization, often exceeding150 lb N/ac and was unrelated to soil OM levels.

3. There were no significant yield differences between N applied at seeding or at V4-V8 stages.

## Method

- Ten 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 Super U (46-0-0).
- 2 additional treatments were applied to the 40 lb N/ac broadcast rate 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).
- A number of N rate decision tools and concepts were evaluated (not shown here)
- Yield response was graphed and the most economic return to N (MERN) was determined (using $4/bu corn and $0.40/lb N).
- Soil mineralization of OM obviously 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 only done at Winkler, Carman and Letellier in 2017

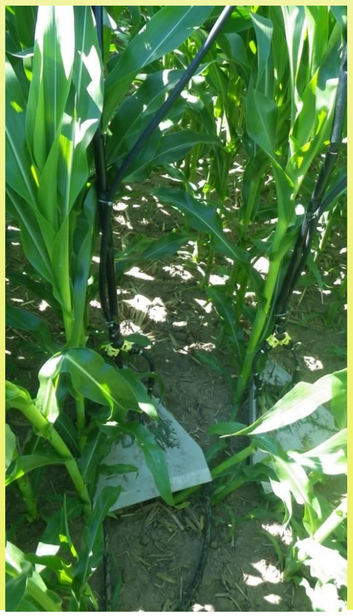

Figure 1. Y-Drop application of UAN solution in corn.

## Results – Nitrogen Rates

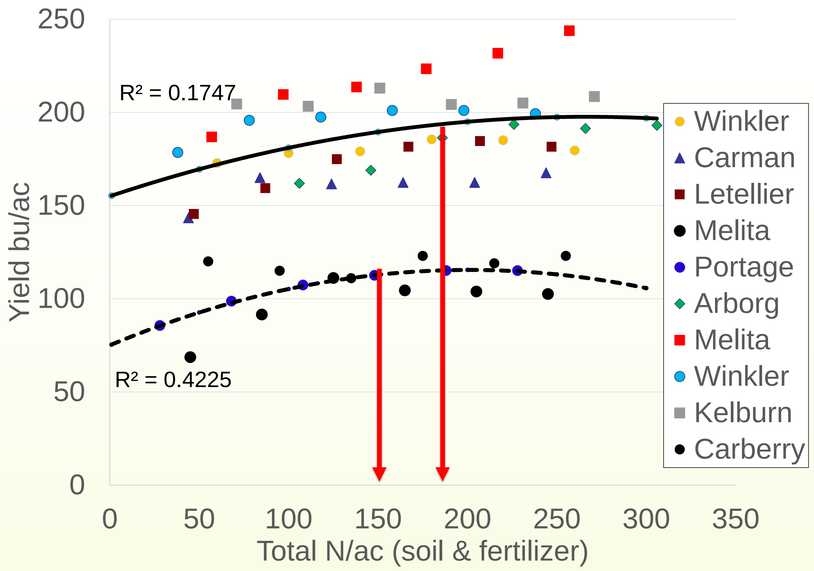


Figure 2. Corn yield response to nitrogen at 10 sites. Lines are average quadratic function of modest (100-150 bu/ac) yielding sites (dotted) and high yielding (50-200 bu/ac) sites (solid lines). Red lines indicate MERN.

•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 N/ac and was achieved with about 0.95 lb N/bu.
•But MERN of individual sites ranged widely (for example 0 -200 lb applied 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, whereas 50 is closer to traditional estimates.
Soil OM was poorly related to mineralized N (Figure 3).

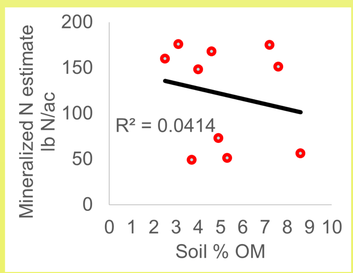


Figure 3. Mineralized N relationship to soil OM.

## Results – Nitrogen Splits

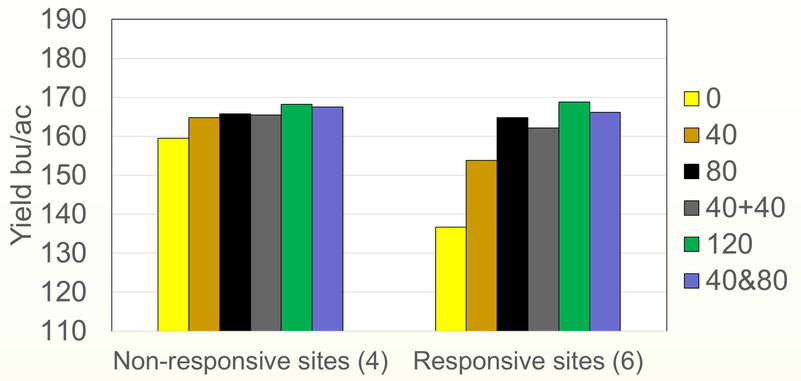


Figure 4. Corn yield response to nitrogen split applications across all 10 sites grouped by site response to applied N.

•At non-responsive sites, effective in-season decision guides could have eliminated need for the split application.
•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 was similar among N application at planting application and V4 and V8 stages
•but when N was delayed to V8 stage yield was consistently less than earlier applications.
•It appears that mid season applications provide an opportunity to assess season, soil and crop N status before committing the final N application.

## References

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

## Acknowledgements

Manitoba Corn Growers Association
AgVise Laboratories, KOCH Fertilizers
Manitoba Agriculture Crop Diversification Centres and research staff (C. Linde, S. Chalmers, R. Burak), AAFC Portage
Kelburn Farm, Southern Potato Farms, Russell Farms, Fontain Farms