

200 Bu/ac Corn with No Nitrogen Fertilizer?

John Heard¹ and Magda Rogalsky²

¹Manitoba Agriculture, Carman, MB, Canada, ² Soil Science Dept, University of Manitoba

Background

Corn acreage and yields continue to increase in Manitoba (Figure 1) yet traditional provincial nitrogen (N) rate recommendations were not developed under such high yields.

Additionally there is interest in the in-season application of N, especially using Y-drop applicators to deliver UAN beside the corn row (Figure 2).

Method

•6 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

•A number of N rate decision tools and concepts were employed and compared to the actual yield responses, including:

1. Standard 0-2' soil nitrate soil test with recommendations from Manitoba Agriculture¹, NDSU² and AgVise Laboratories (Yield goal x 1.2 – soil test N)
2. In-season measurements at V6 stage using the:
 - SPAD chlorophyll meter, where 95 index is considered sufficient
 - pre-sidedress nitrate test to 12" (PSNT) with AgVise Laboratories guidelines
 - NDVI using the GreenSeeker optical sensor and Minnesota corn algorithm³
3. End of season stalk nitrate test with AgVise Laboratories guidelines
- Yield response was graphed and the most economic return to N (MERN) was determined (using \$5/bu corn and \$0.50/lb N).
- Estimates of N needs were plotted on response graphs for comparison

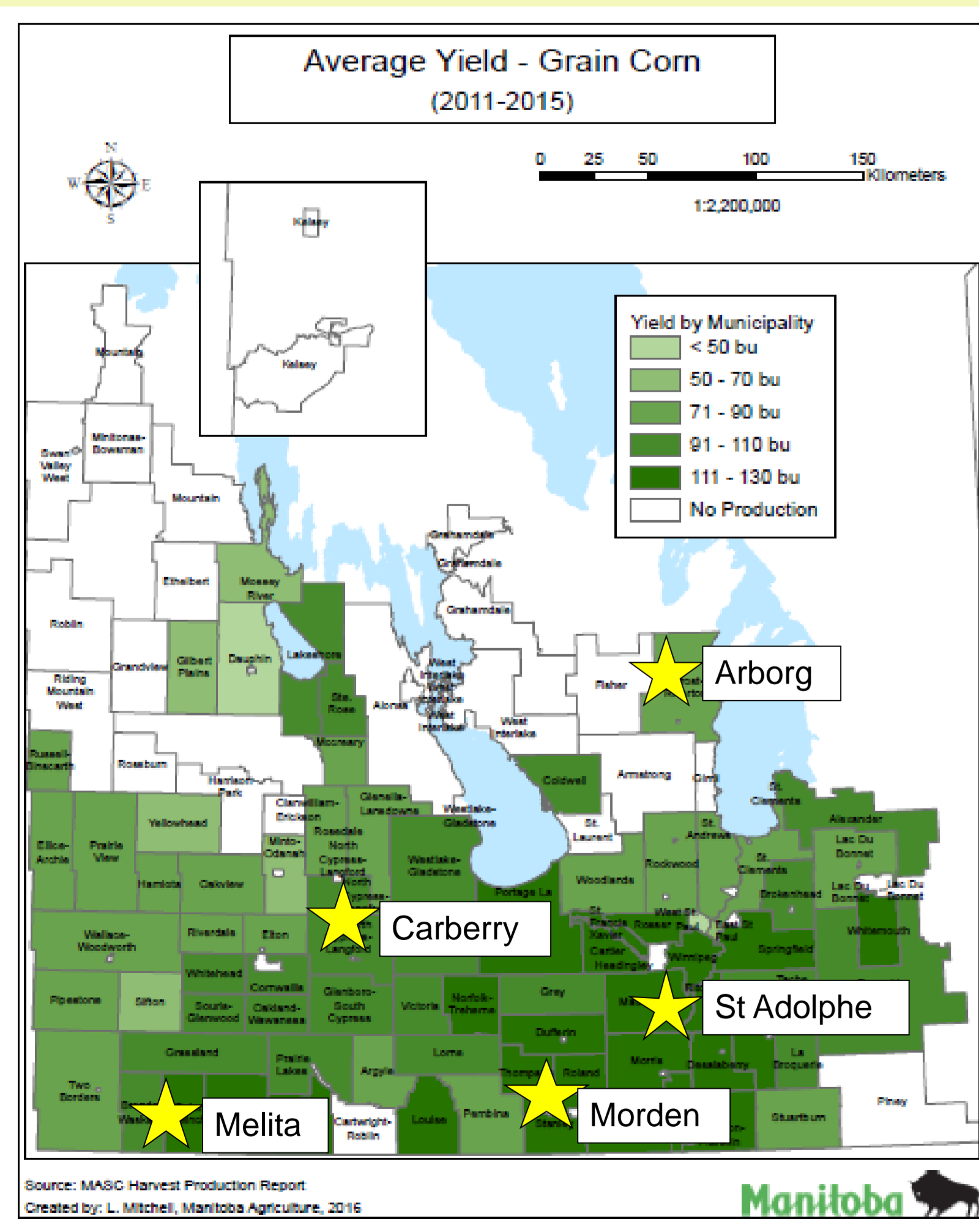


Figure 1. Average grain corn yields in Manitoba and locations of 2016 trials.



Figure 2. Y-Drop application of UAN solution in corn.

Non-responsive sites

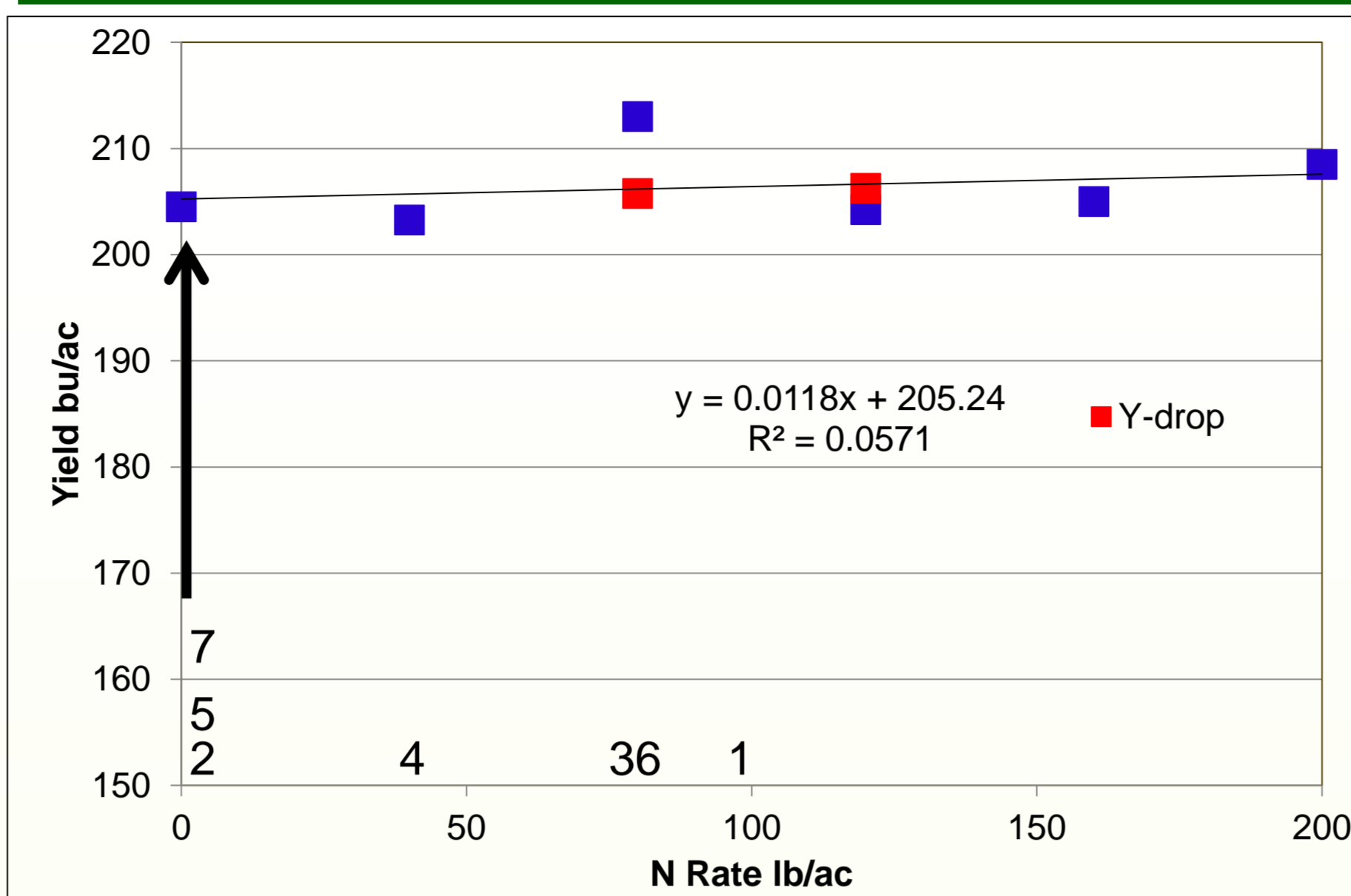


Figure 3. N response at St Adolphe.

St Adolphe
Yield goal = 125 bu/ac
Scatterbury clay
Previous crop = soybeans
CHU = 112% of normal
Precip = 122 % of normal
Soil nitrate = 71 lb N/ac
OM = 7.6%
1. MB Ag rec = 95 lb N/ac
2. NDSU rec = 0 lb N/ac
3. AgVise rec = 79 lb N/ac
4. PSNT = 50 lb N/ac
5. GreenSeeker = 0 lb N/ac
6. Stalk nitrate = 80 lb N/ac
7. MERN = 0 lb N/ac (arrow)

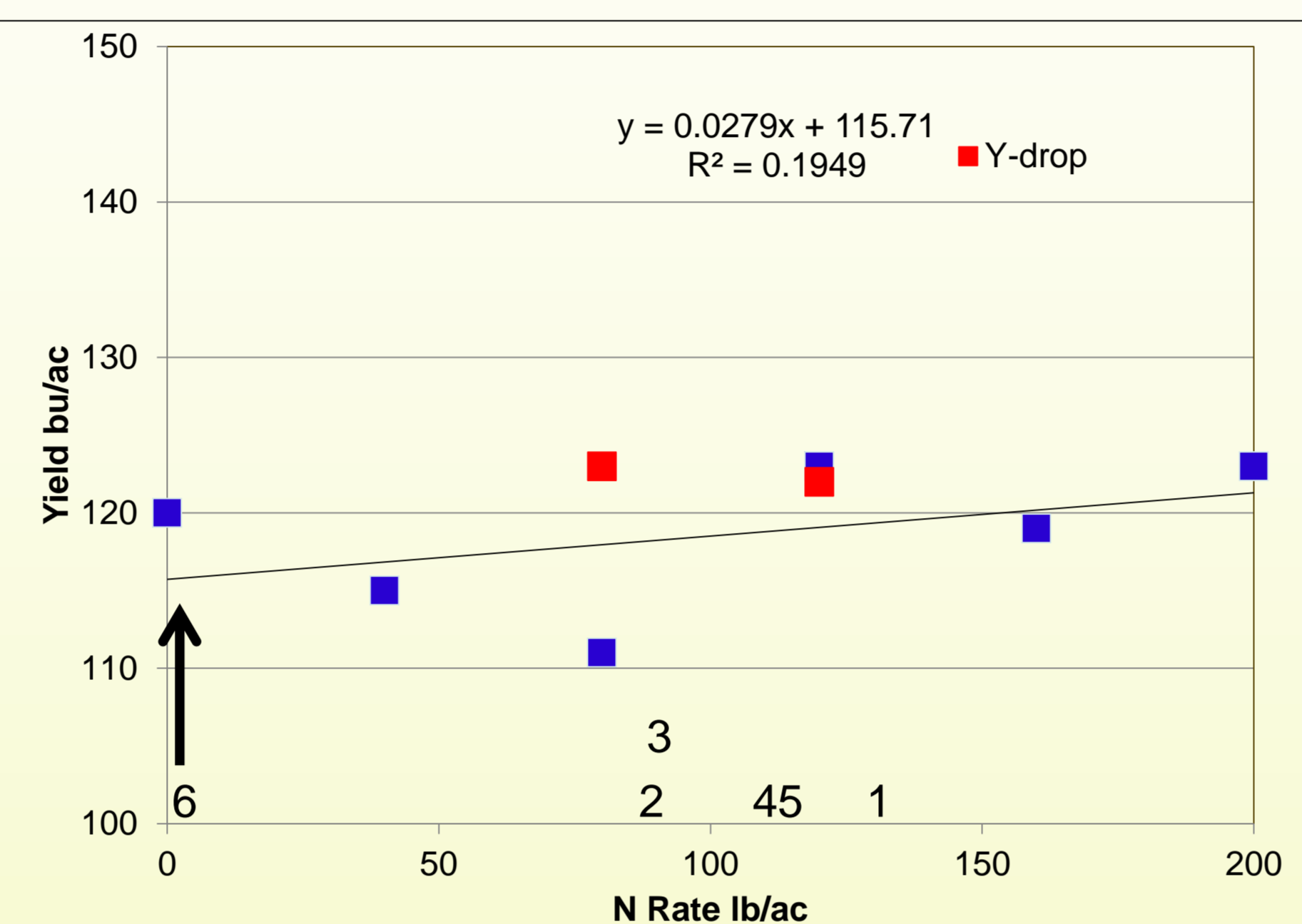


Figure 4. N response at Carberry.

Carberry
Yield goal = 125 bu/ac
Ramada clay loam
Previous crop = canola
CHU = 109% of normal
Precip = 101 % of normal
Soil nitrate = 55 lb N/ac
OM = 4.9%
1. MB Ag rec = 130 lb N/ac
2. NDSU rec = 95 lb N/ac
3. AgVise rec = 95 lb N/ac
4. PSNT = 115 lb N/ac
5. GreenSeeker = 120 lb N/ac
6. MERN = 0 lb N/ac (arrow)

Responsive sites

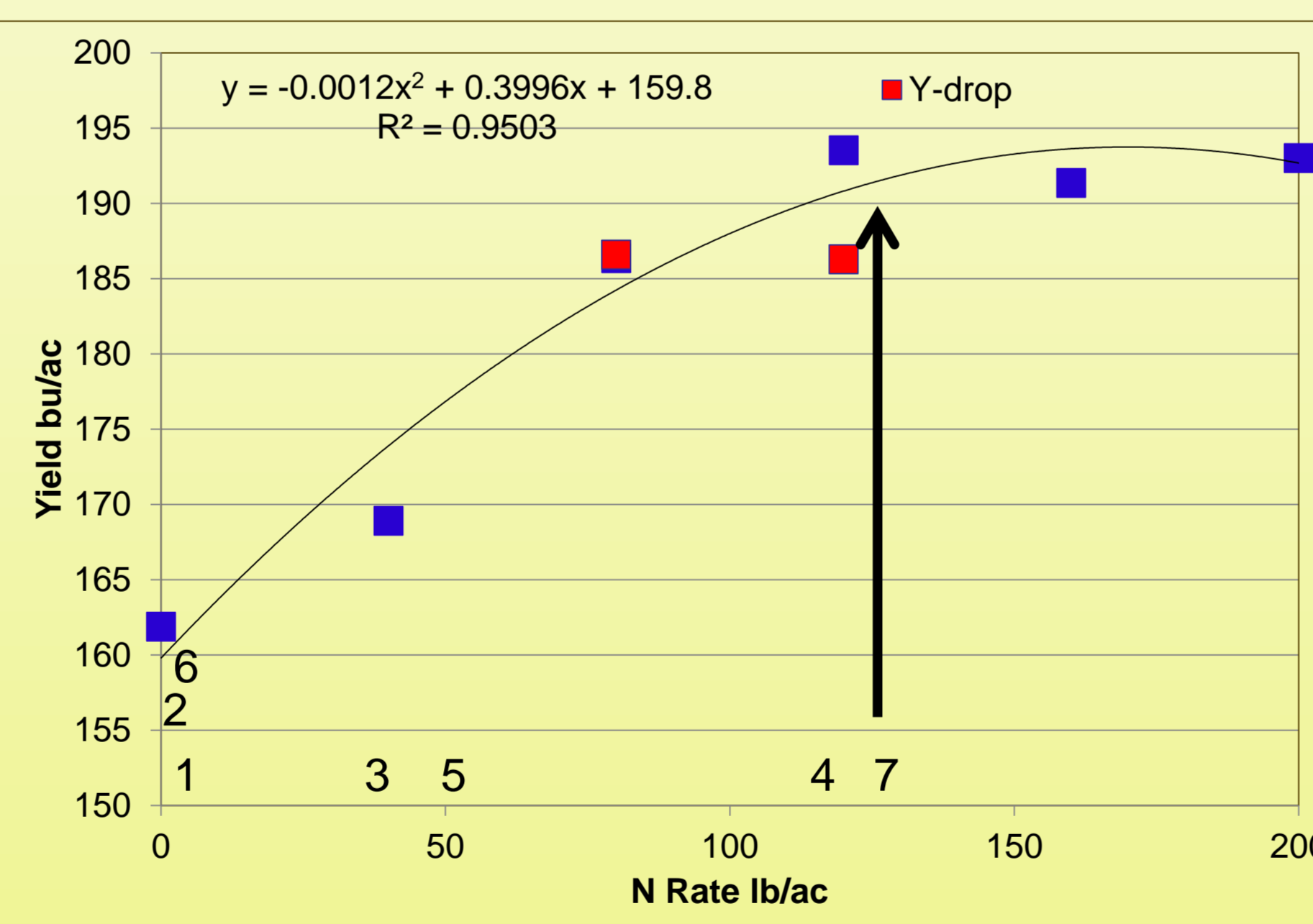


Figure 5. N response at Arborg.

Arborg
Yield goal = 125 bu/ac
Peguis clay
Previous crop =wheat
CHU = 106% of normal
Precip = 93 % of normal
Soil nitrate = 106 lb N/ac
OM = 8.6%
1. MB Ag rec = 0 lb N/ac
2. NDSU rec = 0 lb N/ac
3. AgVise rec = 44 lb N/ac
4. SPAD = 120 lb N/ac
5. PSNT = 50 lb N/ac
6. GreenSeeker = 0 lb N/ac
7. MERN = 125 lb N/ac (arrow)

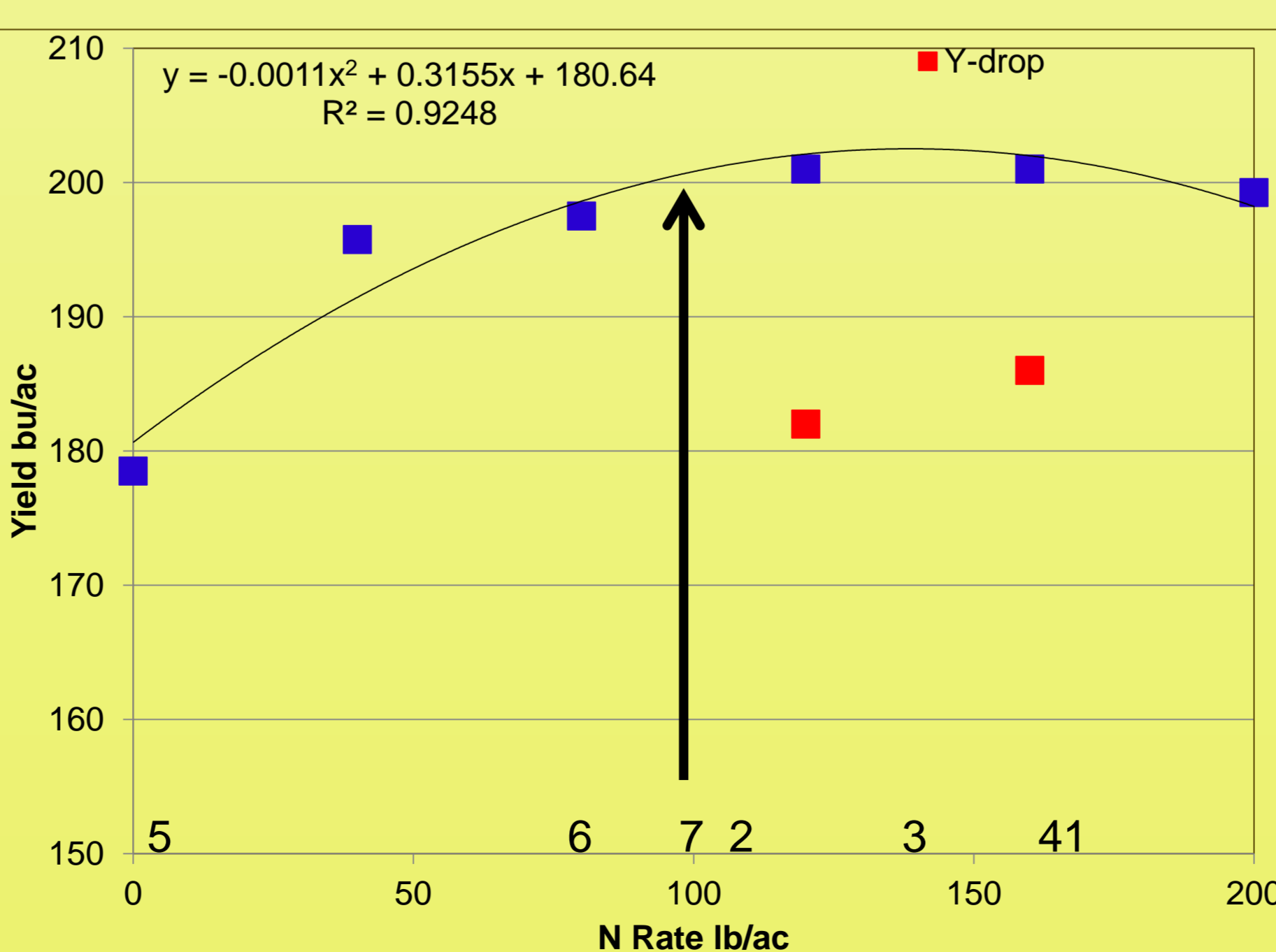


Figure 6. N response at Morden.

Morden
Yield goal = 150 bu/ac
Neuenburg sandy loam
Previous crop = potatoes, rye cover crop
CHU = 106% of normal
Precip = 139% of normal
Soil nitrate = 38 lb N/ac
OM = 2.5%
1. MB Ag rec = 170 lb N/ac
2. NDSU rec = 112 lb N/ac
3. AgVise rec = 144 lb N/ac
4. PSNT = 168 lb N/ac
5. GreenSeeker = 0 lb N/ac
6. Stalk nitrate = 80 lb N/ac
7. MERN = 98 lb N/ac (arrow)

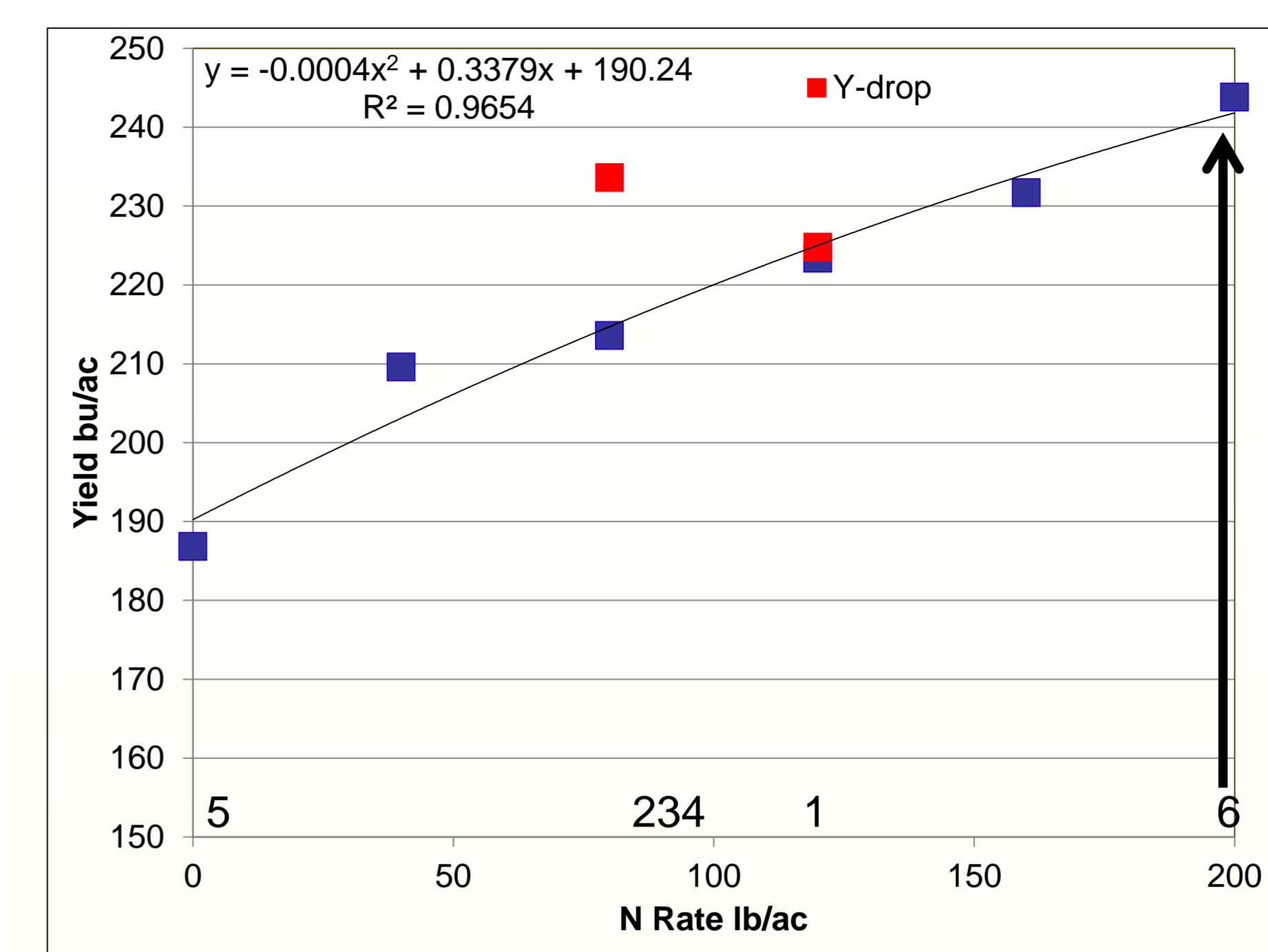


Figure 7. N response at Melita.

Melita
Yield goal = 125 bu/ac
Ryerson loam
Previous crop = wheat
CHU = 108% of normal
Precip = 106 % of normal
Soil nitrate = 57 lb N/ac
OM = 4.0%
1. MB Ag rec = 120 lb N/ac
2. NDSU rec = 93 lb N/ac
3. AgVise rec = 93 lb N/ac
4. PSNT = 95 lb N/ac
5. GreenSeeker = 0 lb N/ac
6. MERN = 200 lb N/ac (arrow)

Discussion

The most economic rate of N (MERN) varied among sites and was not well predicted with the available tools and guidelines.

Further research considering in-season measurement and/or estimation of N losses and mineralization may prove useful in improving N rate recommendations for corn.

Yields from in-season application with the Y-drop simulation were no different than applications following seeding. Inadvertent foliage splash caused leaf burn and slightly lower yields at the Morden site.

Of great intrigue are the record high yields achieved in 2016, especially at the 0 N rate (check yields). Yield potential benefitted from the 6-12% higher CHU and generally greater precipitation than normal during the growing season.

Soil mineralization of OM obviously contributed greatly to the high check yields. A very crude calculation of N mineralization is shown in Table 1. The estimate is based on using a 1.12 lb whole plant N uptake/bu⁴ less soil nitrate, less starter fertilizer N. Unfortunately measurements were not taken to allow consideration of nitrate-N from deeper depths or residual N at harvest. Such high corn yields and large N mineralization rates challenge N recommendations developed with current preplant planning techniques.

Table 1. Crude estimation of N mineralization in 2016.

Site	Check Yield Bu/ac	Est .N uptake ³ lb N/ac	Soil nitrate 0-2' lb N/ac	Starter fertilizer N lb N/ac	Mineralized N est. lb N/ac
St Adolphe	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

References

- 1 Manitoba Soil Fertility Guide. 1996. Manitoba Agriculture
- 2 Franzen. 2014. Soil Fertility Recommendations for Corn. NDSU SF722
- 3 <http://www.nue.okstate.edu/SBNRC/mesonet.php>
- 4 Bender et al. 2013. Better Crops. Vol.97 No. 1 p7-10.

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