Validation of Emerging Nitrogen Management Technologies for Corn in Wisconsin

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Objectives:
1) Validate Adapt-N and Crop Canopy Sensing (Greenseeker/CropCircle/SPAD meter) as methods for determining a sidedress N application rate.
2) Assess the ability of the PSNT soil test to adjust sidedress N application rates for modern hybrids and a changing climate.
3) Obtain additional corn N response data to further develop the statewide MRTN database.

Hypotheses:
1) The economic optimum N rate will be within 10 lb/a of the MRTN rate.
2) The PSNT will provide a better estimate of N credits compared to book values.
3) Adapt-N will provide a better estimate of the actual EONR than MRTN.
4) Crop Canopy sensing will provide a better estimate of the actual EONR than MRTN.
5) Crop Canopy sensing will provide a better estimate of the actual EONR than Adapt-N.
6) Crop Canopy sensing and Adapt-N will provide better estimates of the actual EONR compared to PSNT.

Site Selection:
1) Any field that will be corn in 2013 and which has a previous crop of corn or soybean. While alfalfa is an important previous crop, the small or nonexistent response of corn to N when it follows alfalfa suggests that initial efforts should be made where larger N responses are likely.
2) Try to find a field with relatively uniform soil series and/or soil drainage classes.
3) Manure history – Fields that received manure for the 2013 crop at rates that exceed 100 lb/a of first year available N are not ideal candidates. Large amounts of manure N will result in minimal N response and make statistical comparisons of the results more difficult. Lower rates of manure applied for the 2013 crop or manure applied for the 2012 or previous crops should be ok.

Treatments:

Treatment #	N Rate (lb N/a)	Time of Application
1	0	sidedress
2	40	sidedress
3	80	sidedress
4	120	sidedress
5	160	sidedress
6	200	sidedress
7	200	preplant or at emergence

Treatment 7 should be applied preplant or at emergence. This treatment will serve as a non-limiting reference area that is necessary to evaluate the crop canopy reflectance sensors.

Experimental design:
Randomized complete block with 3 or 4 replications

Plot size:
Plot size will be dependent upon the width of N application equipment and combine. The combine should harvest the center rows of the N application swath. There should be at least 1 buffer row on either side of the combine head. For example, if the N application equipment covers 16 rows and the combine is 12 rows, then the combine should harvest the center 12 rows, leaving two border/buffer rows on either side. Another example, if the N application equipment covers 12 rows and the combine is 16 rows, then each treatment will need to be 24 rows wide (two passes of the fertilizer applicator). The center 16 rows should be harvest with the combine leaving 4 buffer rows on each side of the plot. Plots should be at least 300 feet long.

Soil Sampling:
1) PPNT samples (NO_3^-)
   a. 0-1' and 1-2' samples for each replication (3 reps x 2 depths = 6 samples)
      i. Composite 10 cores in a replication to make one sample
      ii. Collect samples within 2 weeks prior to planting
   b. Fields which were corn in 2012 and which were impacted by drought should also have 2-3' samples collected (3 reps x 1 additional depth = 3 samples)
2) Routine soil test (P, K, pH, OM)
   a. 0-6" sample for each replication (1 depth x 3 res = 3 samples)
      i. Composite 10 cores in a replication to make one sample
      ii. Collect prior to N application
3) PSNT sample (NO_3^-)
   a. 0-1' sample for each replication (1 depth x 3 reps = 3 samples)
      i. Composite 10 cores in a plot to make one sample.
      ii. Collect samples throughout the 0 lb N/a treatment.
      iii. Sample each replication individually.
      iv. Take samples about just prior to sidedressing.

Crop Canopy Sensing:
1) Take Greenseeker measurements at the same time as PSNT sample collection.
   a. Must be done prior to sidedress N application. Can be same day as sidedress.
2) Take Greenseeker measurements in each replication of the 200 lb N/a broadcast treatment and the 0 lb N/a sidedress treatment.
3) To take Greenseeker measurements:
   a. Hold the Greenseeker 24" above the canopy. The washer attached to the sensor should graze the top of the canopy.
      i. It is important to hold the instrument level and at a uniform height above the canopy.
   b. Hold the Greenseeker so that the center of the instrument is directly over the center of the row. Your forearm should be over the center of the row.

       c. Pull the trigger and walk the length of the plot. At the end of the plot, release the trigger and record the number that appears on the readout.
          i. This number will need to be reported in the data reporting spreadsheet file.
4) Record growth stage (exposed leaf collars) at the time of Greenseeker measurements.
    a. If sidedressing occurs more than 1 day after sampling and measurements, record growth stage at sidedressing.
    b. Take the average of 10 plants in each treatment and replication where Greenseeker was used.
5) Record canopy height at the time of Greenseeker measurements.
    a. Hold a yard stick or tape measure against the plants. This is the height of the tallest point on the plant as the leaf naturally flops over. This is the height where the washer on the Greenseeker grazes the canopy.
    b. Take the average of 10 plants in each treatment and replication where Greenseeker was used.
6) Record extended leaf height at the time of Greenseeker measurements.
    a. Hold a yard stick or tape measure against the plants. Pull the leaves vertically. Measure the height of the highest leaf tip.
    b. Take the average of 10 plants in each treatment and replication where Greenseeker was used.

Grain Yield Results:
a) Harvest methods.
    i) Yield monitor (calibrated).
    ii) Weigh wagon.
b) For all methods, data must include yield (bu/a at 15.5%) and % grain moisture.
c) Collect pre-harvest stand counts (Optional, but really, really nice to have).
    i) Record the number of plants in 50 ft of row for each plot.

Background information that needs to be documented:
1) Soil name and texture.
2) GPS coordinates.
3) Nearest city/town (for weather station information).
4) Five-year crop and N rate/source history.
5) Five-year manure history, application rates, and analysis.
6) Tillage and surface reside cover after planting
7) Corn hybrid, relative maturity, planting date.
8) Forage legume stand at time of establishment (plants/ft^2 and amount of regrowth).
9) Fertilizer N treatment application date, rates, placement, source.
10) Other fertilizer applied including starter, rate, analysis, and placement (Note: starter N rate should not exceed 20 lb N/a).
11) Growing season weather conditions.

Data reporting:
1) A spreadsheet template will be provided to assist in data compilation and reporting.
2) After harvest, email spreadsheet to Carrie Laboski, she will statistically analyze data.

Example Plot Diagrams

Numbers within the diagram are N rates in lb N/a.

200 preplant	0	120	200	80	160	40	Rep 3
0	160	40	80	200	200 preplant	120	Rep 2
200	80	200 preplant	40	160	0	120	Rep 1

OR

200 Broadcast	200	0	120	160	80	40	0	160	40	200 Broadcast	80	200	120	200	40	0	80	200 Broadcast	160	120

——— Rep 1 ——— ——— Rep 2 ——— ——— Rep 3 ———