Organic Nutrient and Weed Management with Sweet Corn on Sandy Soil

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INTRODUCTION

- The Central Sands of WI hosts commercial-scale vegetable production, requiring intense nitrogen (N) crop fertilization. Sandy soil has poor nutrient retention, and fertilization contributes to groundwater nitrate levels.
- Organic management appeals to many growers as a means to avoid use of synthetic fertilizers and pesticides; the organic market is also profitable and fast-growing.
- Asynchrony between N release from organic sources and N uptake by plants is a challenge of organic nutrient management, likely exacerbated by poor nutrient retention of sandy soil.
- Organic management practices, such as use of composted poultry manure (CPM) and green manures (GrM), can maintain/increase soil organic matter and soil organic carbon, extending long-term soil fertility; but…
- Organic N inputs have not been evaluated on sandy soils.

Field pea stand prior to incorporation, 29 May 2012.

Sweet corn, 9 weeks after planting, 18 Aug. 2011.

OBJECTIVES

- Determine optimal N rate (as Organic Materials Review Institute (OMRI)-approved fertilizer) for organic sweet corn production with early season CPM or GrM management and varying weed pressure
- Evaluate soil nitrate concentrations under a range of N management practices during the sweet corn season

METHODS

Study Design

- RCB strip-split plot design with 4 replications
- **Manure system**: composted poultry manure (CPM, NPK: 4:5:3), field pea green manure (GrM), no manure (NM)
- **Weed management**: Intense (INT, minimum weed pressure) and moderate (MOD, moderate weed pressure)
- **N fertilization rate**: 0, 112, 168, 224, 280 kg ha^{-1} of N (OMRI-approved feather meal, NPK: 11-0-0) broadcast applied in two equal split sidedress applications at ~V4 & V8

Data Collection

- **Yield**, reported as fresh weight of ears
- **Soil nitrate-N (SNN)** measured in soil samples (0-30cm) collected in 2012 from INT weed treatment, all manure systems, at 0N, 168N and 280N at 5 time points (TP): emergence (TP1), V4 (TP2), V8 (TP3), tassel (TP4), and harvest (TP5)

YIELD RESULTS

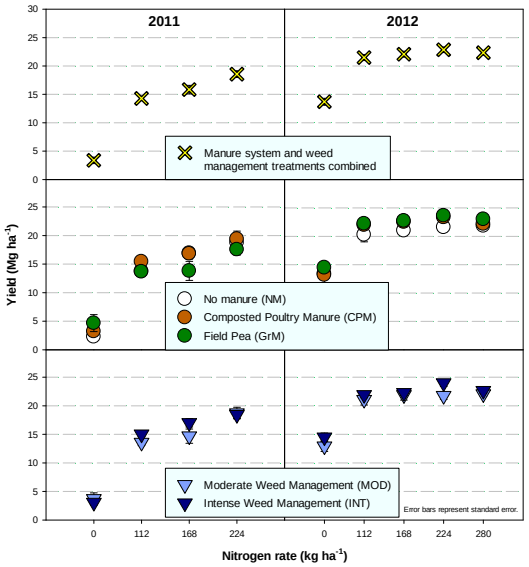

Figure 1. Mean fresh corn yield (Mg ha^{-1}) vs. N rate (kg ha^{-1}) in 2011 and 2012, by combined manure system & weed management treatments (top), manure system (middle) and weed management (bottom).

Selected yield findings (statistically significant):

- Yield in all > 0 kg ha^{-1} of N treatments greater than that of 0N (2011 & 2012)
- Yield in 224N treatment greater than that of 168N or 112N treatment (2011)
- No yield differences between any treatments receiving N, averaged across other factors (2012)
- Yield in GrM treatment was greater than that of NM (2012)
- Yield in INT weed treatment was greater than that of MOD treatment (2012)

Selected Soil nitrate-N findings (statistically significant):

- SNN greater in 280N & 168N treatments than 0N, and 280N treatment greater than 168N treatment (Fig. 2)
- SNN at TP3 (after fertilizer application) and TP4 (after 2nd fertilizer application) greater in 168N & 280N treatments than 0N treatment at respective TPs (Fig. 2)
- SNN was highest at TP2 than all other TPs, indicating an increase in plant-available N from the time of emergence to the first fertilizer application; This lines up with a critical biological need for N by the crop. (Fig. 3)
- SNN was lowest at TP5; in the 280N treatment, SNN at TP5 was greater than 168N and 0N treatments (Fig. 2)
- SNN was greater in CPM than NM treatment (Fig. 3)
- SNN in GrM treatment was greater at TP1 than NM treatment (before N rate differentiation), associated with greater yield in GrM treatment than NM treatment (Fig. 3)

SOIL NITRATE-N RESULTS

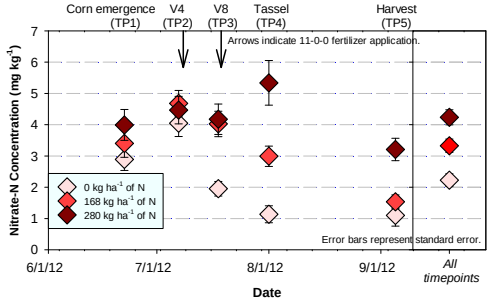

Figure 2. Nitrate-N concentration (mg kg^{-1}) in soil over time, by nitrogen rate (averaged across manure system). Time points: TP1 (22 June, 23 days after CPM and GrM incorporation), TP2 (3 July, just prior to first fertilizer split application), TP3 (18 July, just prior to second fertilizer split application), TP4 (1 Aug.), and TP5 (5 Sep.).

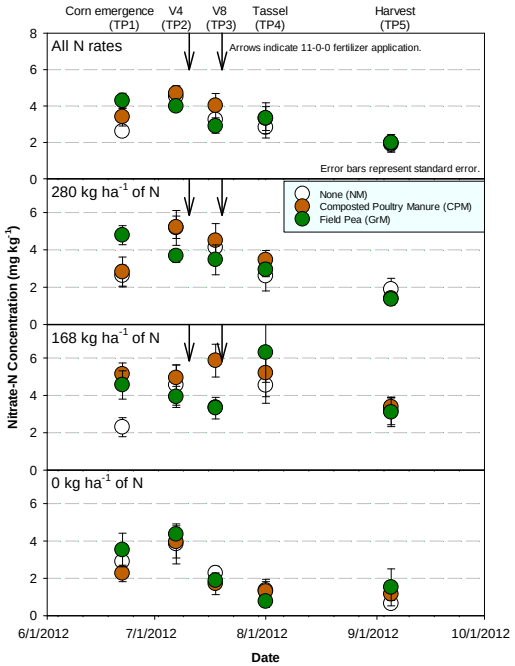

Figure 3. Nitrate-N concentration (mg kg^{-1}) in soil over time, by manure system at three nitrogen rates and averaged over N rate.

CONCLUSIONS

- OMRI 11-0-0 feather meal produced yields comparable to those of conventional fertilizer, though optimal yield varied by year and is highly driven by weather patterns.
- Yield increases associated with intense weed management were modest and not likely to be economically justifiable.
- Though some yield increases were associated with early-season manure treatments, results varied greatly by year and did not result in a nitrogen credit.