Cover Crop Mixtures for Sustainable No-Till Sweet Corn Production

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Rationale

Forage radish (*Raphanus sativus var. longipinnatus*) has become a popular cover crop. Recent research shows forage radish (FR) cover crops provide:

- ✓ Fall nitrogen scavenging
- ✓ Weed suppression and soil coverage
- ✓ Manageable residue in spring

However, **disadvantages** of a forage radish monoculture are:

- ○ Rapid biomass decomposition
- ○ Potential spring nitrogen leaching
- ○ Lack of synchrony between recycled nutrients and crop demand
- ○ Short-lived weed suppression

Cover crop mixtures may provide longer duration of nutrient availability, more biomass, increased sustainability and higher yield potential for popular Northeastern cash crops.

Hypothesis

Early season sweet corn may successfully take advantage of early spring nutrient availability. This could be combined with a no-till production system to improve soil health and conserve resources while maintaining yields.

Cover crop mixtures with different C:N ratios can moderate spring decomposition rates to provide nitrogen synchrony for sweet corn cash crop.

Methods

Cover crop treatments were planted at the UMass Crop and Animal Research Farm (S. Deerfield, MA) on August 23, 2014 in a randomized complete block design.

Cover crop treatments include:

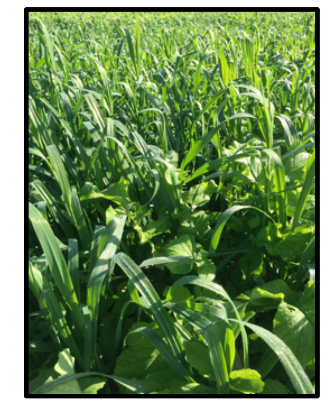
- forage radish monoculture (**FR**),
- a mix of forage radish and oats (**OFR**),
- a mix of forage radish oats and peas (**POFR**),
- and no cover crop (**NO CC**).

Fertility treatments include:

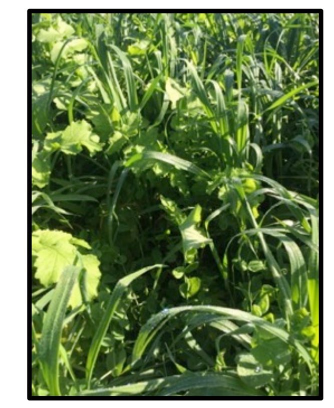
- 0 lbs N/acre
- 0 lbs N/acre at planting and 25 lbs N/acre side-dressed
- 25 lbs N/acre at planting and 25 lbs N/acre side-dressed

Cover crops were winter-killed in late November, 2014.
Sweet corn (var. 'Trinity') was planted on May 10, 2015.

Forage Radish



Oat/FR



Pea/Oat/ FR

No CC

Objectives

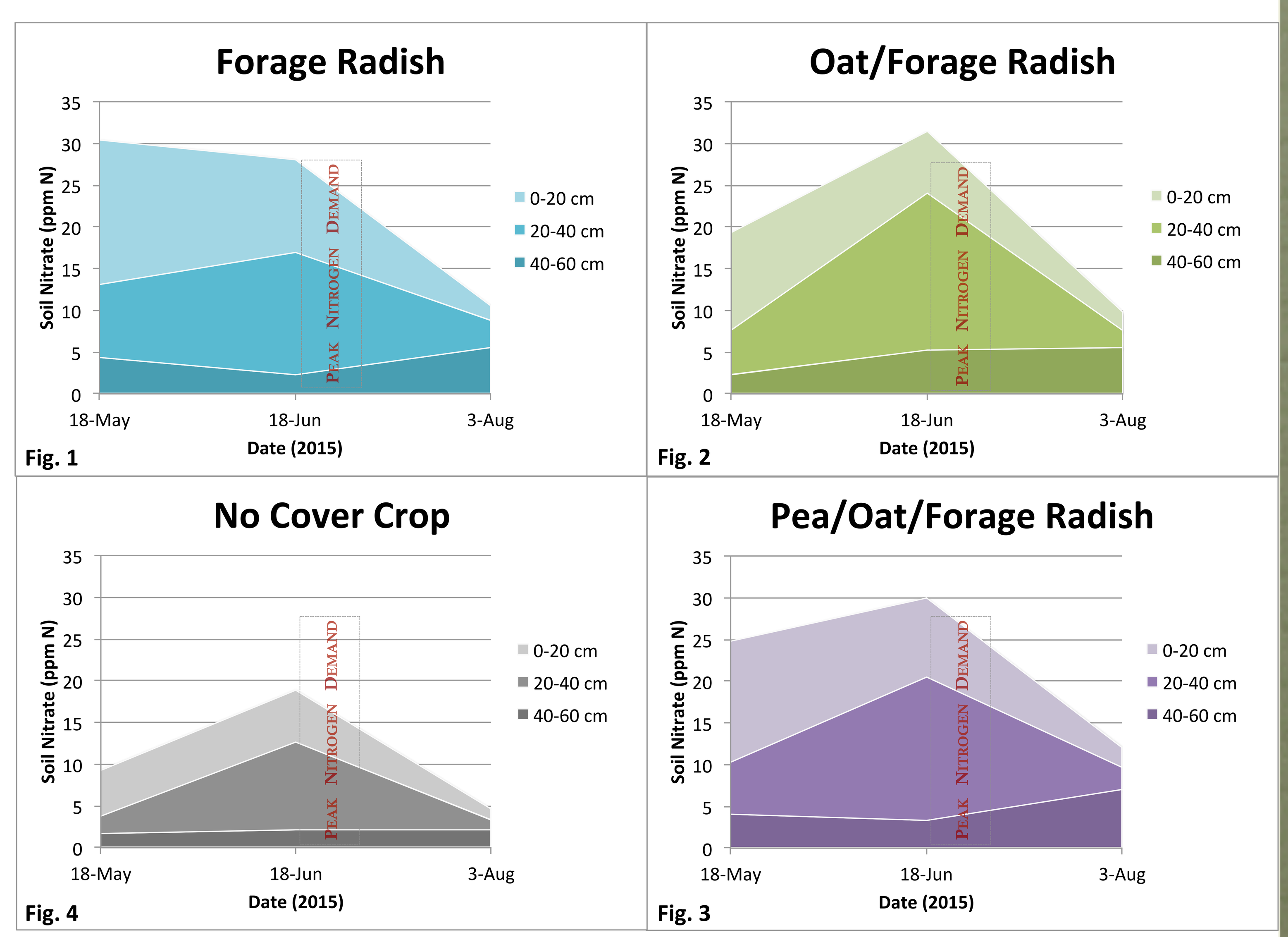
Measure the effects of cover crop treatment on:

- Fall cover crop biomass
- Carbon to Nitrogen ratio of biomass
- Soil fertility and nutrient cycling (N, P, K, Ca, Mg)
- Nitrate scavenging capacity of cover crop treatments
- Soil temperature in spring
- Spring weed suppression (duration and population)
- Corn yield (ears/acre, ear fresh weight)

Soil samples were extracted with Modified Morgan solution and analyzed for nitrate by colorimetric determination using Lachat QuickChem 8000.

Selected Results

Soil nitrate data from spring 2015, following fall/winter cover crops.



Figures 1-4. Soil nitrate at 3 depths in May and June 2015 showing the effects of fall-planted forage radish (Fig. 1), Oat/FR (Fig. 2), Pea/Oat/FR (Fig. 3) and no cover crop (Fig. 4). Spring nitrate is shown because of its importance for sweet corn peak N demand in mid-June to early July.

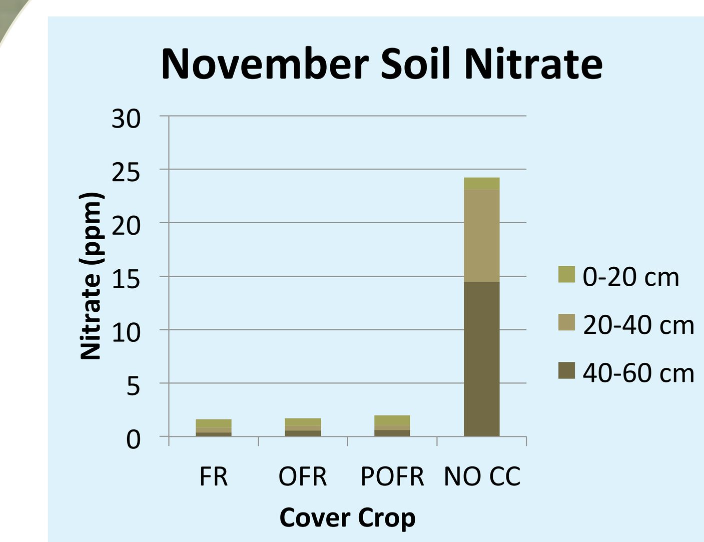


Figure 5. **Soil nitrate (ppm) in November 2014**. All remaining nitrate will be leached out of the soil over winter.

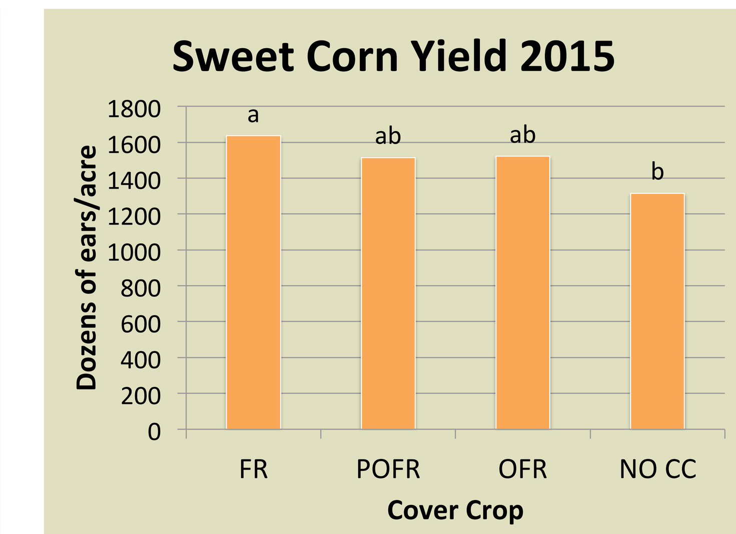


Figure 6. Sweet corn yield July 2015. Different letters indicate significant difference between treatments (P<0.05) based on Tukey HSD means separation.

Spring soil temperatures in OFR and NO CC cover crop treatments were significantly warmer than POFR and FR (p<0.01) (data not shown)

Cover crop biomass and **Carbon to Nitrogen ratio** were not significantly different among cover crop treatments due to high variability (data not shown)

Soil nitrate levels among cover crop treatments differed significantly in June 2015, with OFR highest and NO CC lowest (p<0.01)**.** No significant differences for May and August sampling dates (Figs. 1-4)

Cover crop treatment and sampling date interacted significantly, with soil nitrate highest in OFR on June 18th and lowest in FR on November 14th (p<0.01) (Figs. 1-5)

Soil depth and cover crop treatment interacted significantly, with FR at 0-20 cm highest and FR at 40-60 lowest (p<0.01) (Figs. 1-5)

Significant three-way interaction between soil depth, cover crop, and sampling date (p<0.01). Understanding this complicated interaction may help draw conclusions about cover crop timing and fertilizer recommendations. (Figs. 1-5)

Nitrogen fertilization had no significant effect on corn ear yield (data not shown)

Highest sweet corn yield occurred in FR treatments, although not significantly higher than OFR and POFR (p<0.05) (Fig. 6)

Analysis of variance (ANOVA) was conducted by PROC GLM procedure of SAS 9.4.

Conclusions

Cover crop mixtures scavenged fall soil nitrogen effectively, compared with no cover crop, preventing winter nitrate leaching. Cover crops provided nitrogen cycling in a no-till system. Based on these results, Oat/FR provided optimal synchrony between nitrogen release and sweet corn demand while reducing spring nitrate leaching.

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