

Winter-killed Cover Crop Mixtures for No-Till Sweet Corn Production in New England

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Rationale

Forage radish (*Raphanus sativus* var. *longipinnatus*) has become a popular cover crop in no-till agriculture. Recent research shows forage radish 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



Multi-species over crop mixtures may capture residual nitrogen, suppress weeds, and conserve soil for increased sustainability and higher yield potential for popular Northeastern cash crops.

Hypothesis

Cover crop mixtures can moderate spring decomposition rates to provide nitrogen synchrony for subsequent sweet corn cash crop. Combined with a no-till production system, early season sweet corn may successfully achieve optimum yield and take advantage of soil health benefits following cover crop mixtures.

Methods

Cover crop treatments were planted at the UMass Research Farm (Hadley loam soil) on August 23, 2014 and 2015.

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),
- no cover crop, local weeds (LW).



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 winter-killed in late November, 2014.

Sweet corn (var. 'Trinity') planted May 10, 2015.

Cover crop	Seeding rate: drilled (lbs/ac)	Seed price (\$/lb)	Seed cost (\$/ac)
Forage radish (FR)	7	\$3.00	\$21
Oat/FR (OFR)	50/3	\$0.40/\$3.00	\$29
Pea/Oat/FR (POFR)	45/30/2	\$1.20/\$0.40/\$3.00	\$72



Forage Radish



Oat/FR



Pea/Oat/FR



Local Weeds

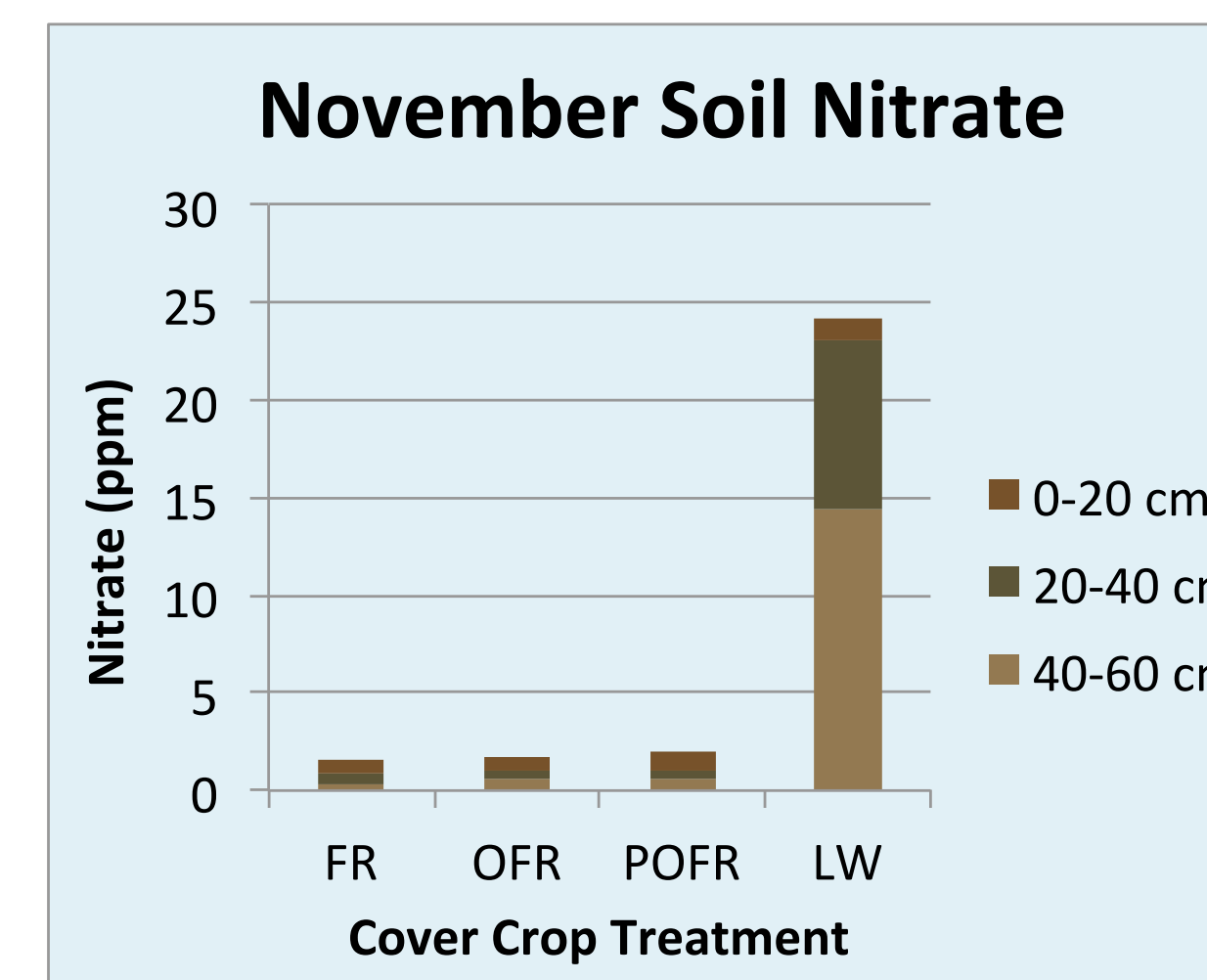
Objectives

Measure the effects of cover crop treatment on:

- Fall cover crop biomass
- Nitrate availability in soil
- Soil temperature in spring
- Corn yield
- Fall weeds
- Spring weed suppression
- Sweet corn quality

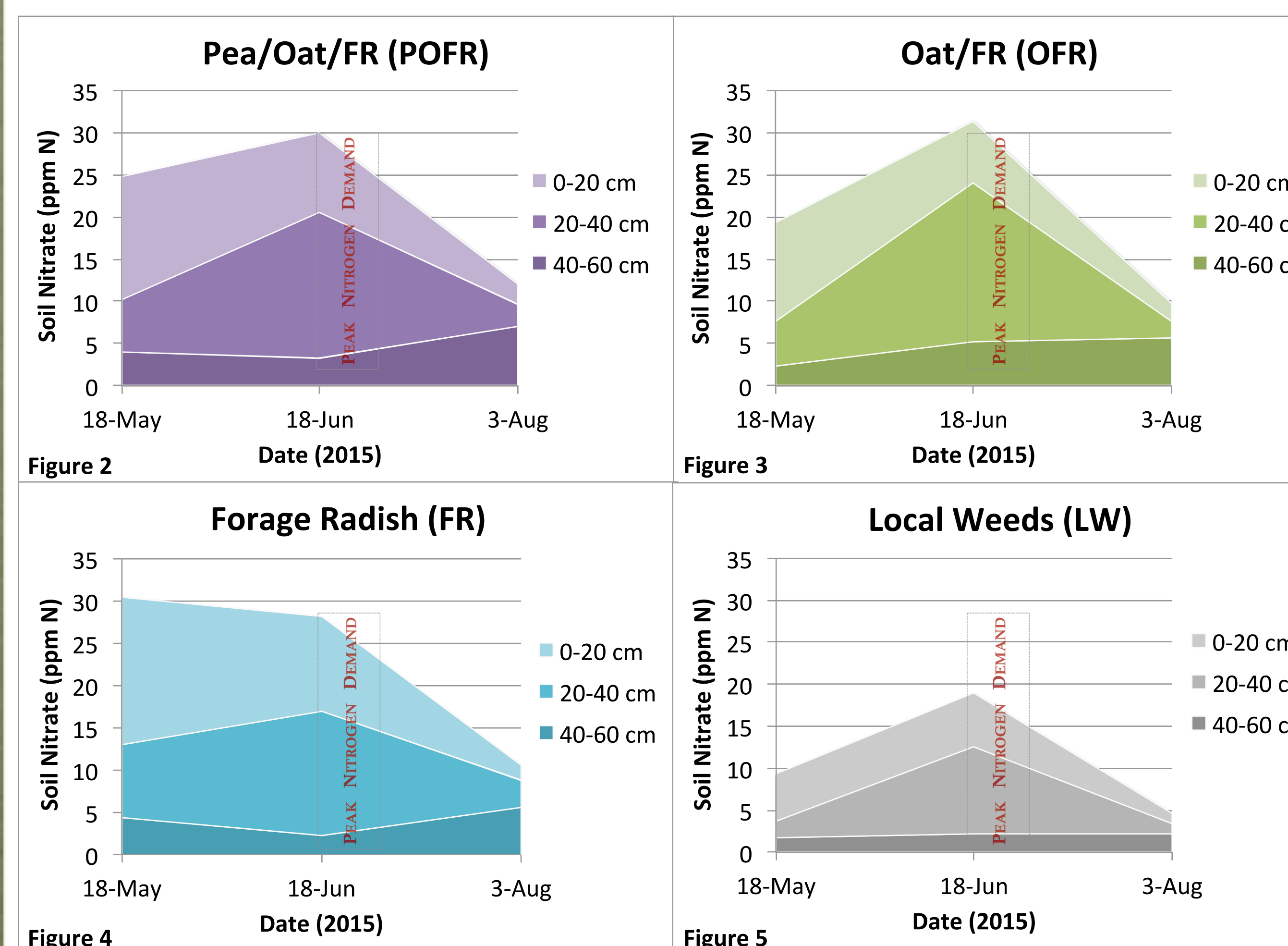
Fall Soil Nitrate Results

Figure 1 (right). Soil nitrate, November 2014. All cover crops removed residual nitrate from 3 depths of soil profile, compared with no cover crop. In weedy plots, all remaining nitrate will be leached out of the soil over winter.



Spring Soil Nitrate Results

Soil nitrate data from spring 2015, following winter-killed cover crops.



Figures 2-5. Soil nitrate at 3 depths in May and June 2015 showing the effects of fall-planted cover crops. Spring nitrate is shown because of its importance for sweet corn peak N demand in mid-June to early July.

Yield Results

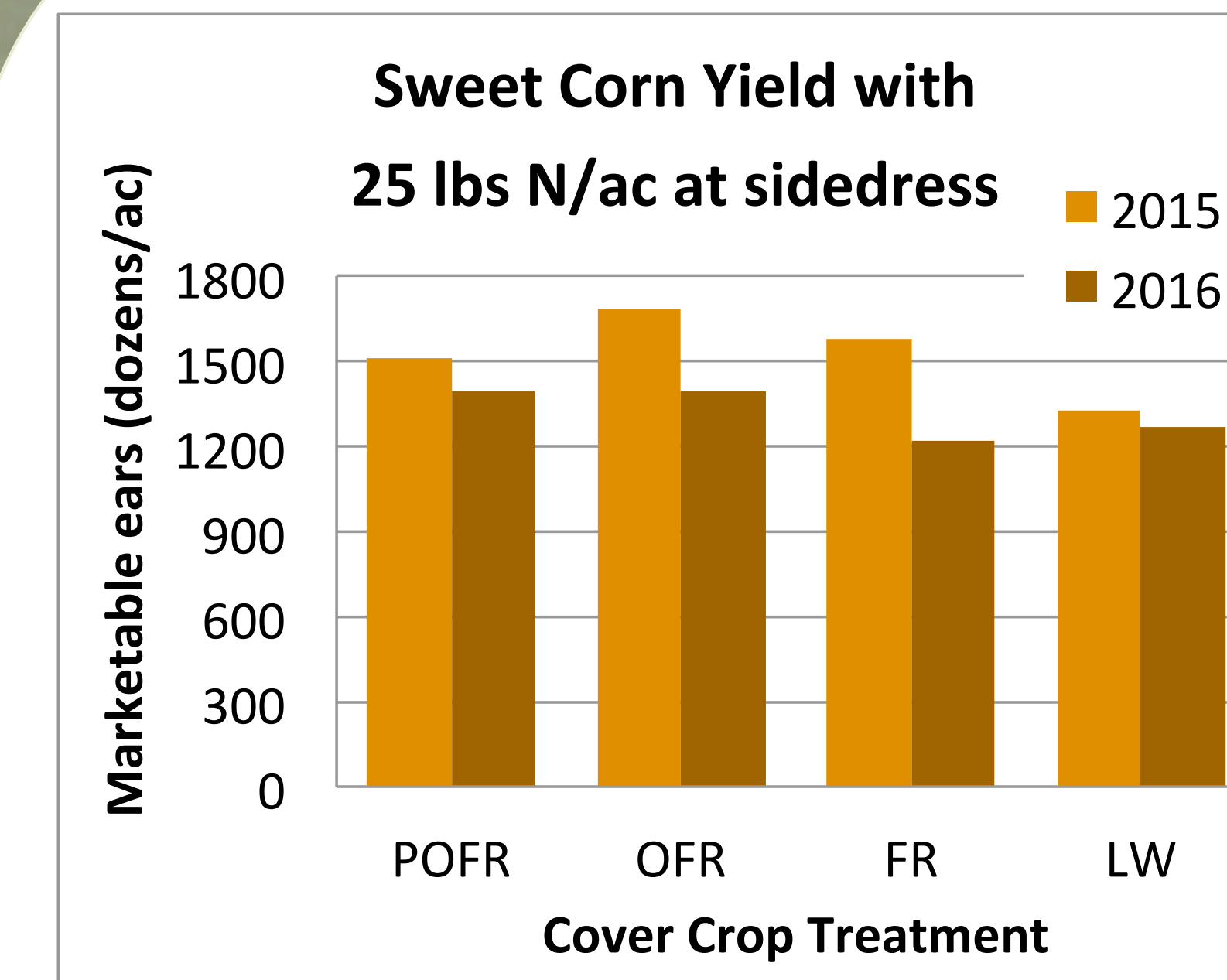
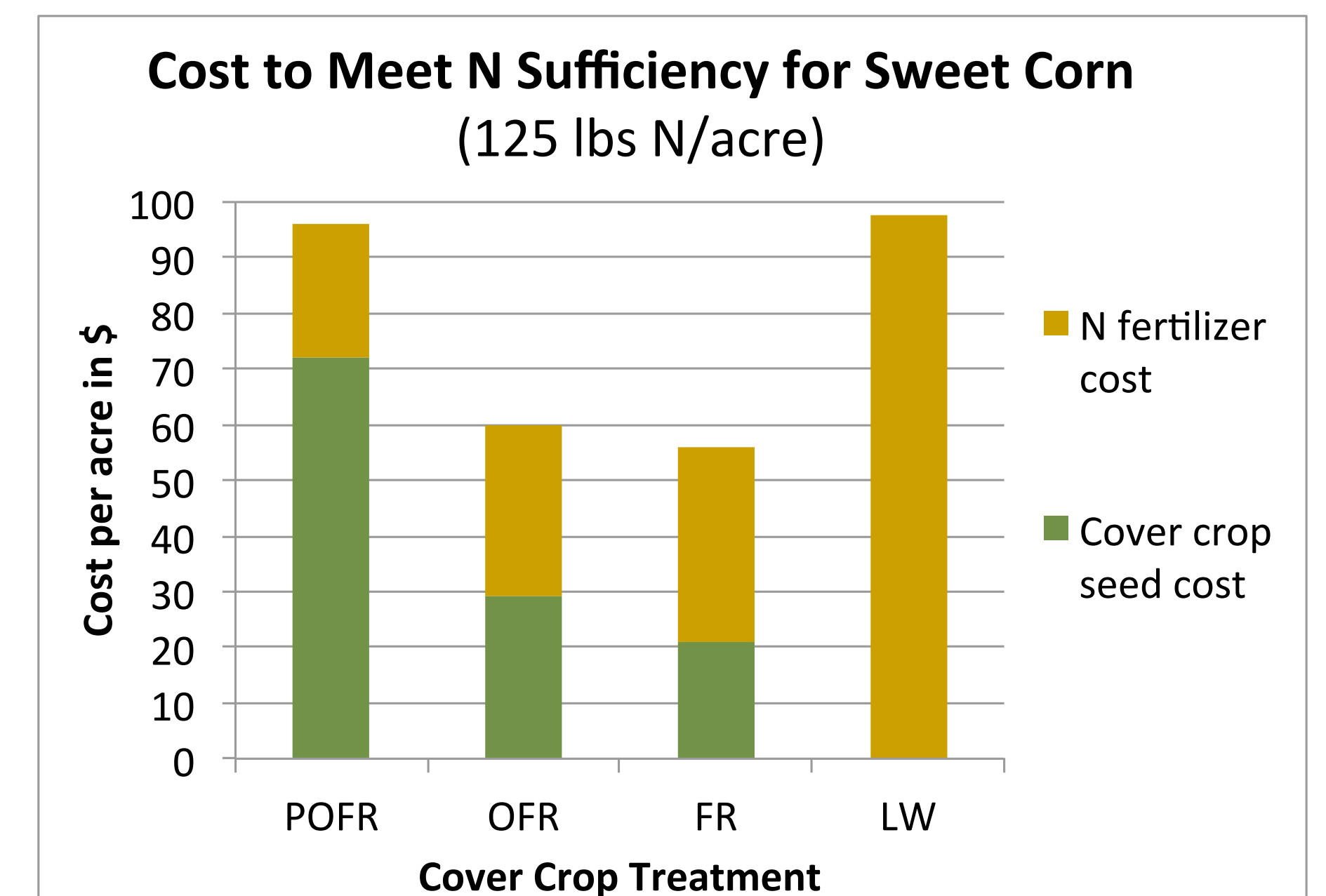


Figure 6 (left). Sweet corn yield for both years. Yield was highest when 25 lbs N/acre fertilizer was applied at side-dress. Additional 25 lbs N/acre at planting did not improve yield, but increased cost. Higher weed pressure in POFR and LW may have reduced yields (data not shown).

Figure 7 (right). Cover crop mixtures captured N in fall biomass and needed additional 30 to 45 lbs N/acre to meet the recommended rate for sweet corn of 125 lbs N/acre on moderate to heavy soil textures.



Additional Results

Spring soil temperatures were not decreased by cover crop mixtures.

Aboveground cover crop biomass was higher in POFR and OFR treatments compared to FR and LW.

Carbon to Nitrogen ratio were not significantly different among cover crop treatments; ratios ranged from 22:1 to 25:1.

Spring weed biomass was highest in POFR and LW treatments;

Sweet corn ear yields among cover crops were significantly higher than LW control.



Conclusions

- Cover crop mixtures scavenged fall soil nitrogen effectively.
- Cover crops provided cost-effective nitrogen cycling in a no-till system.
- Oat/FR provided optimal synchrony between nitrogen release and sweet corn demand while reducing spring nitrate leaching.
- Yields exceeded regional average of 1200 dozen ears/acre.