

Integrating Cover Crop Mixtures and No-Till for Sustainable Sweet Corn Production in the Northeast

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Rationale

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

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



Forage radish

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

Hypothesis

Low-residue winter-killed cover crop mixtures may capture residual nitrogen, protect soil, and provide nitrogen synchrony for subsequent sweet corn cash crop, increasing sustainability and yield potential for this popular Northeastern vegetable crop. Integrated with a no-till production system, early season sweet corn may achieve optimum yield and take advantage of soil health benefits following cover crop mixtures.

Methods

Cover crop treatments were planted at the UMass Crop and Animal Research Farm (Hadley loam soil) on August 23, 2014 and 2015. Cover crops winter-killed late November. Sweet corn (var. 'Trinity') planted May 10, 2015 and 2016. Supplemental fertilizer treatments were applied to split plots at planting and/or sidedress.

Cover Crop Treatments

FR	OFR	POFR	NCC
<ul style="list-style-type: none"> • Forage radish, 7.8 kg ha⁻¹ 	<ul style="list-style-type: none"> • Oats, 56 kg ha⁻¹ • Forage radish, 3.4 kg ha⁻¹ 	<ul style="list-style-type: none"> • Peas, 50 kg ha⁻¹ • Oats, 34 kg ha⁻¹ • Forage radish, 2.2 kg ha⁻¹ 	<ul style="list-style-type: none"> • No cover crop, weedy control

Supplemental N Fertilizer Treatments for Sweet Corn

- 0 kg N ha⁻¹
- 28 kg N ha⁻¹ at sidedress
- 28 kg N ha⁻¹ at planting +28 kg N ha⁻¹ at sidedress



Planting cover crops, Aug. 2014.

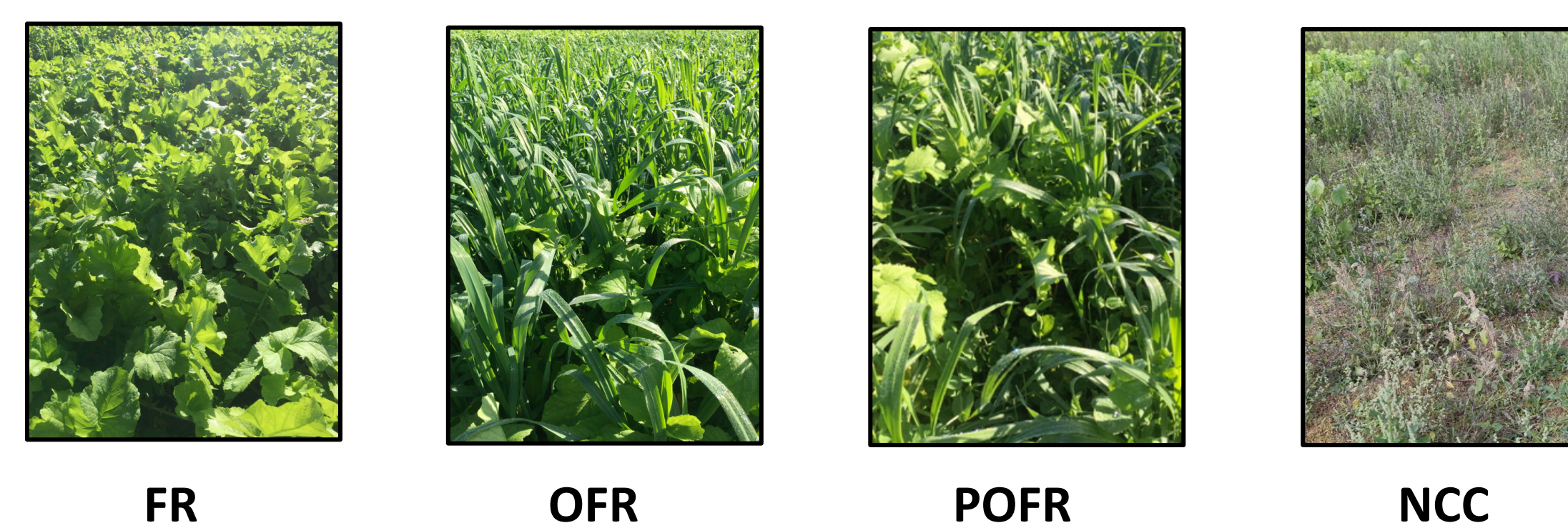
Objectives

Measure the effects of cover crop treatment on:

- Fall cover crop biomass
- Nitrate availability in soil
- Corn yield and quality
- Spring soil temperature (data not shown)

Measure the effects of supplemental N fertilizer treatment on:

- Corn yield and quality



FR

OFR

POFR

NCC

Results

Figure 1 & 2 (below). Spring soil temperatures prior to sweet corn planting. No significant differences were found between treatments, except on April 27.

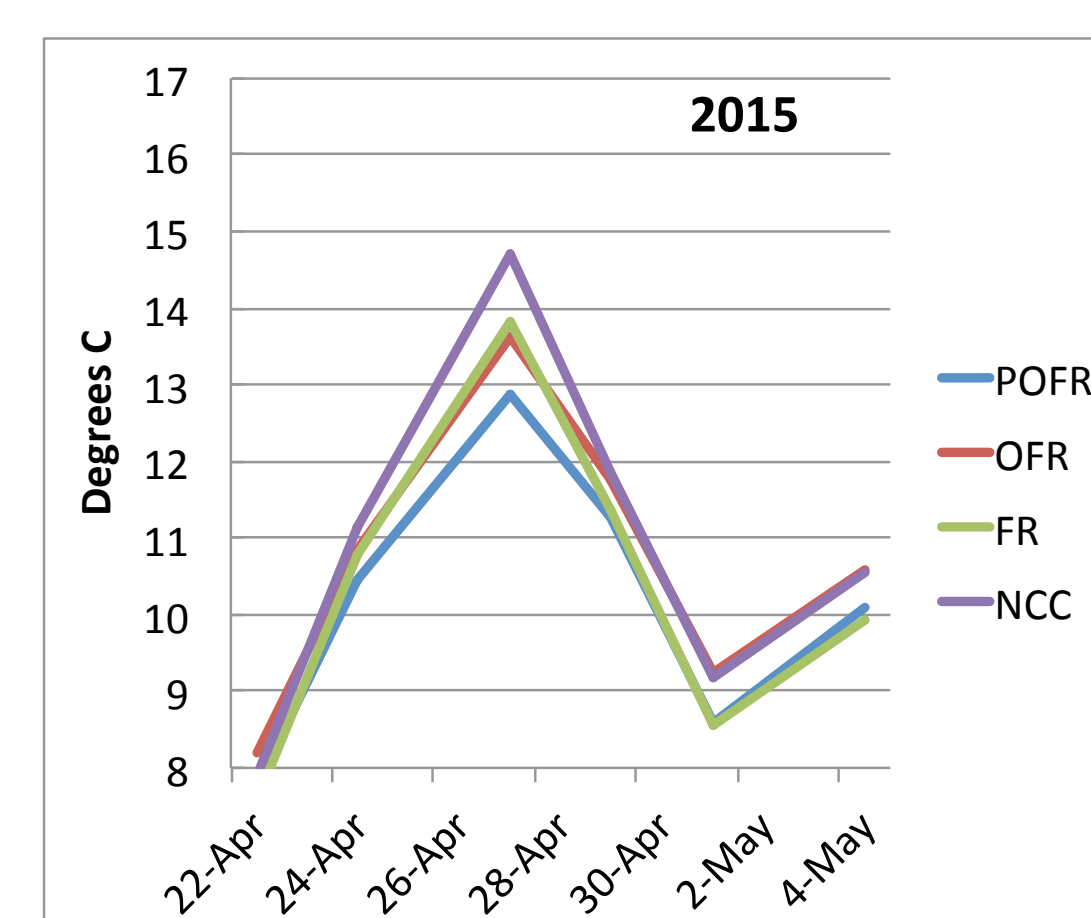


Figure 1

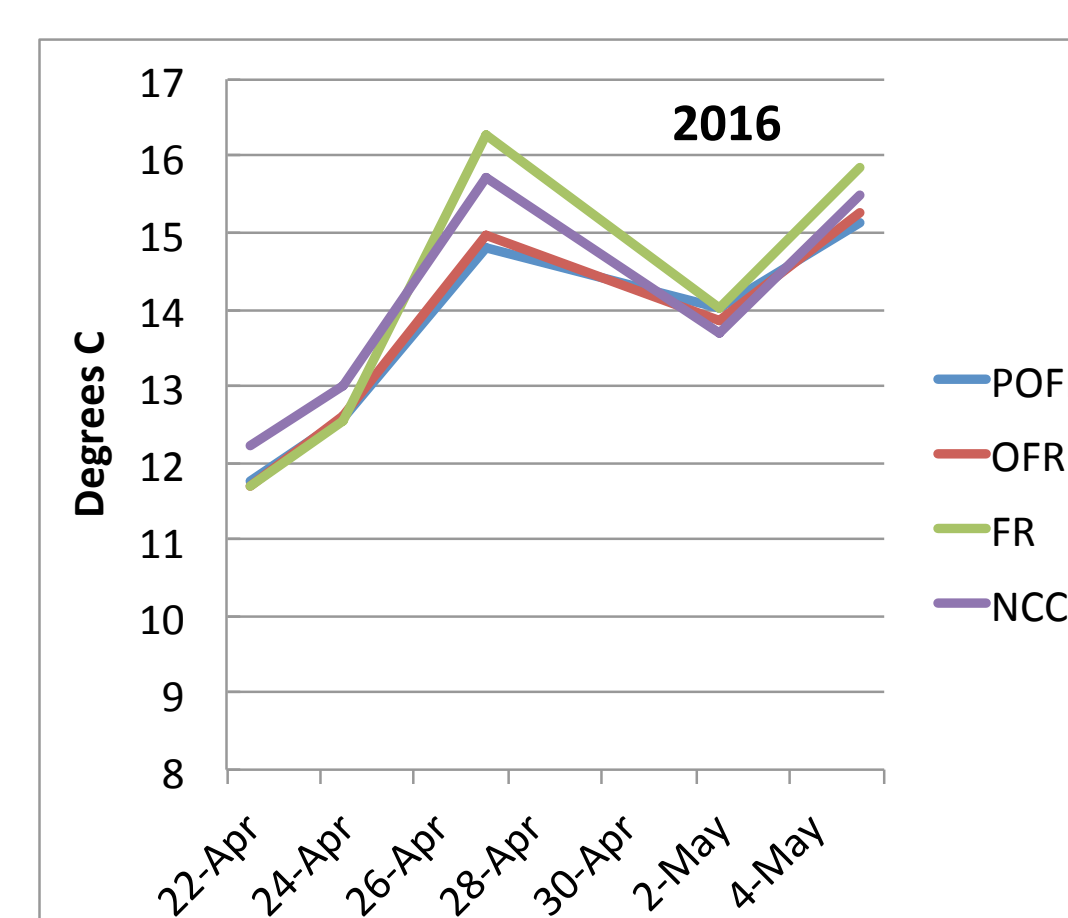


Figure 2

Spring Soil Nitrate

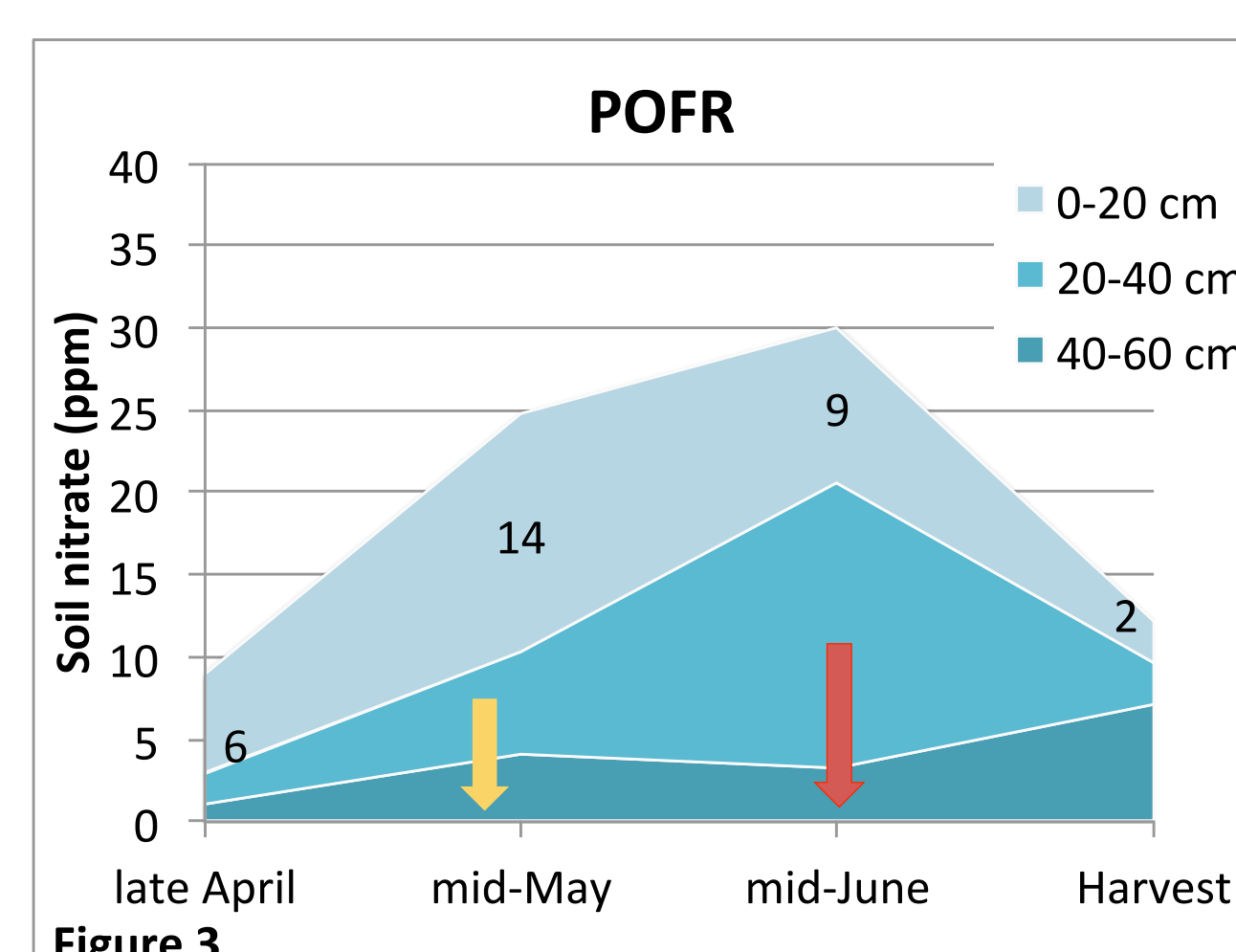


Figure 3

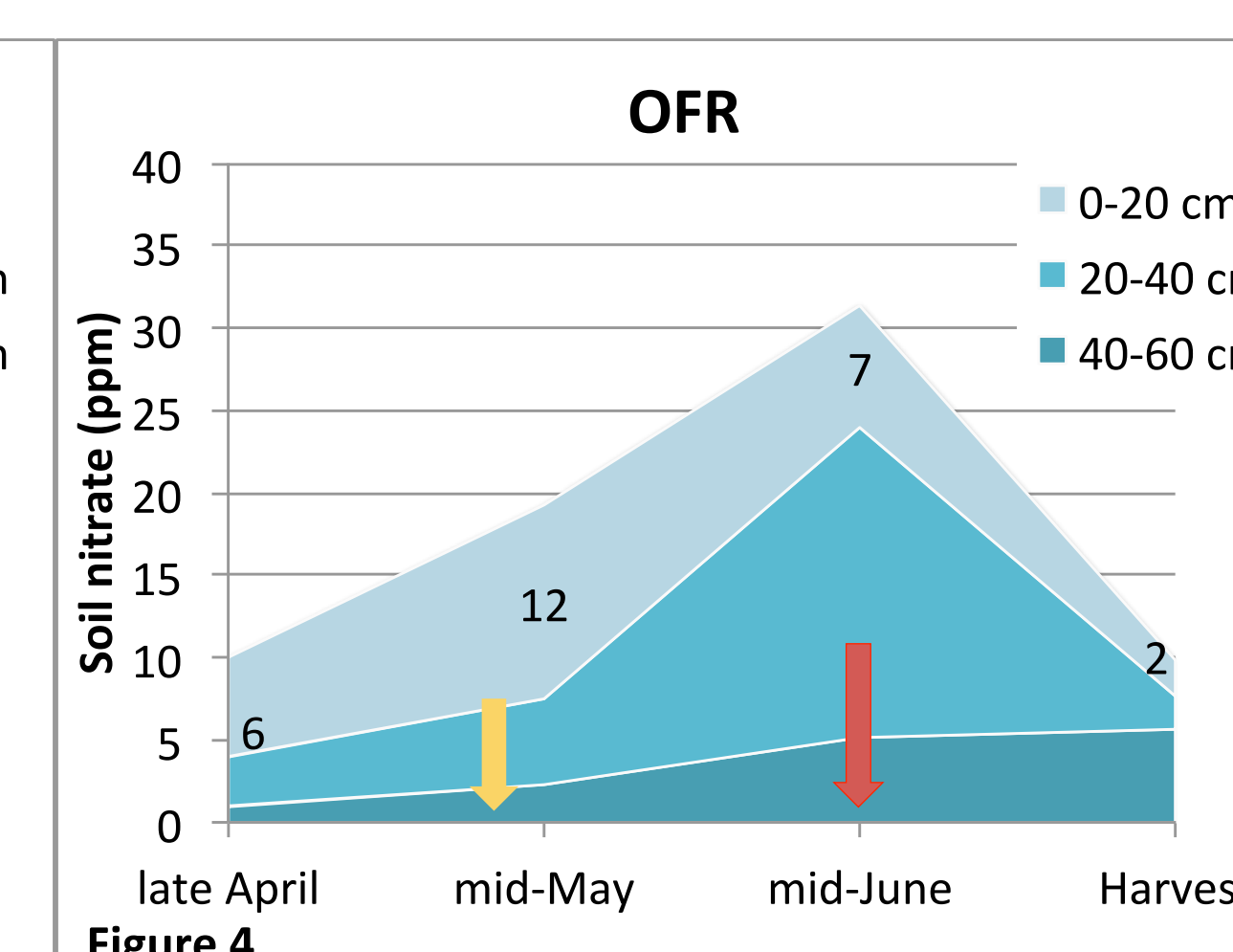


Figure 4

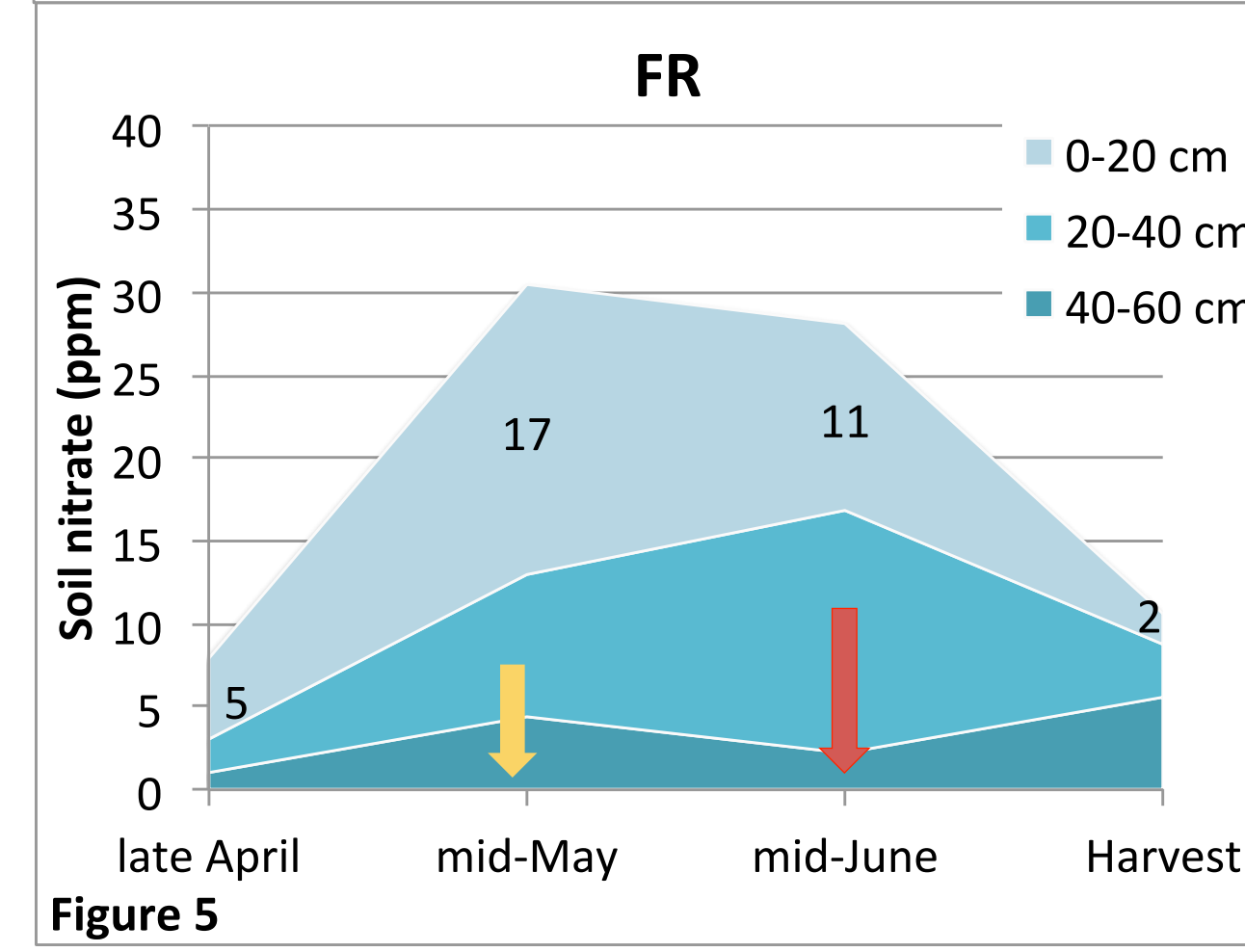


Figure 5

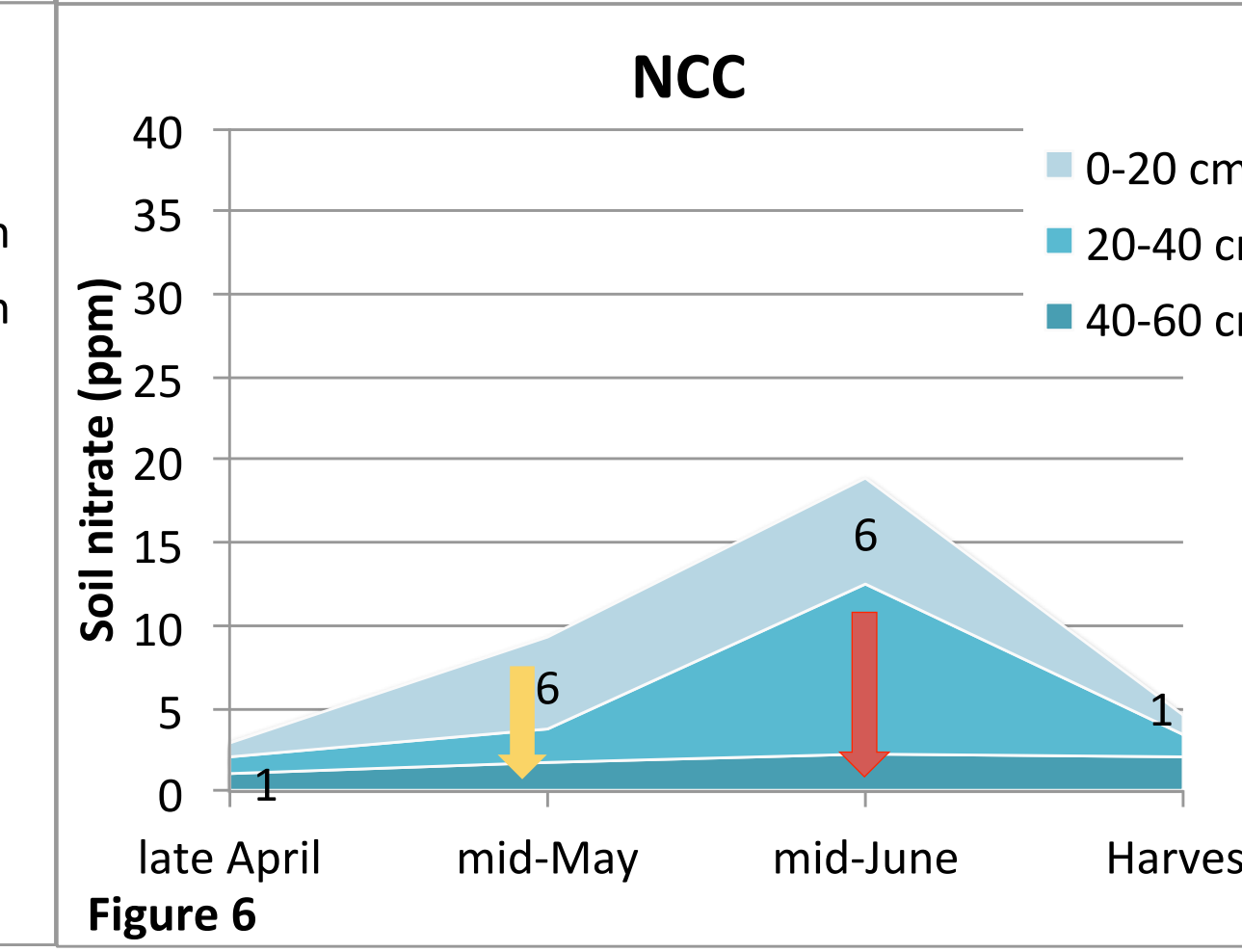


Figure 6

Figures 3-6. Soil nitrate at 3 soil depths during the 2015 growing season. Plots received no additional N fertilizer. Yellow arrows indicate when sweet corn was seeded. Red arrows indicate peak N crop demand. POFR=pea, oat and forage radish; OFR=oat and forage radish; FR=forage radish; NCC=no cover crop

Yield Results

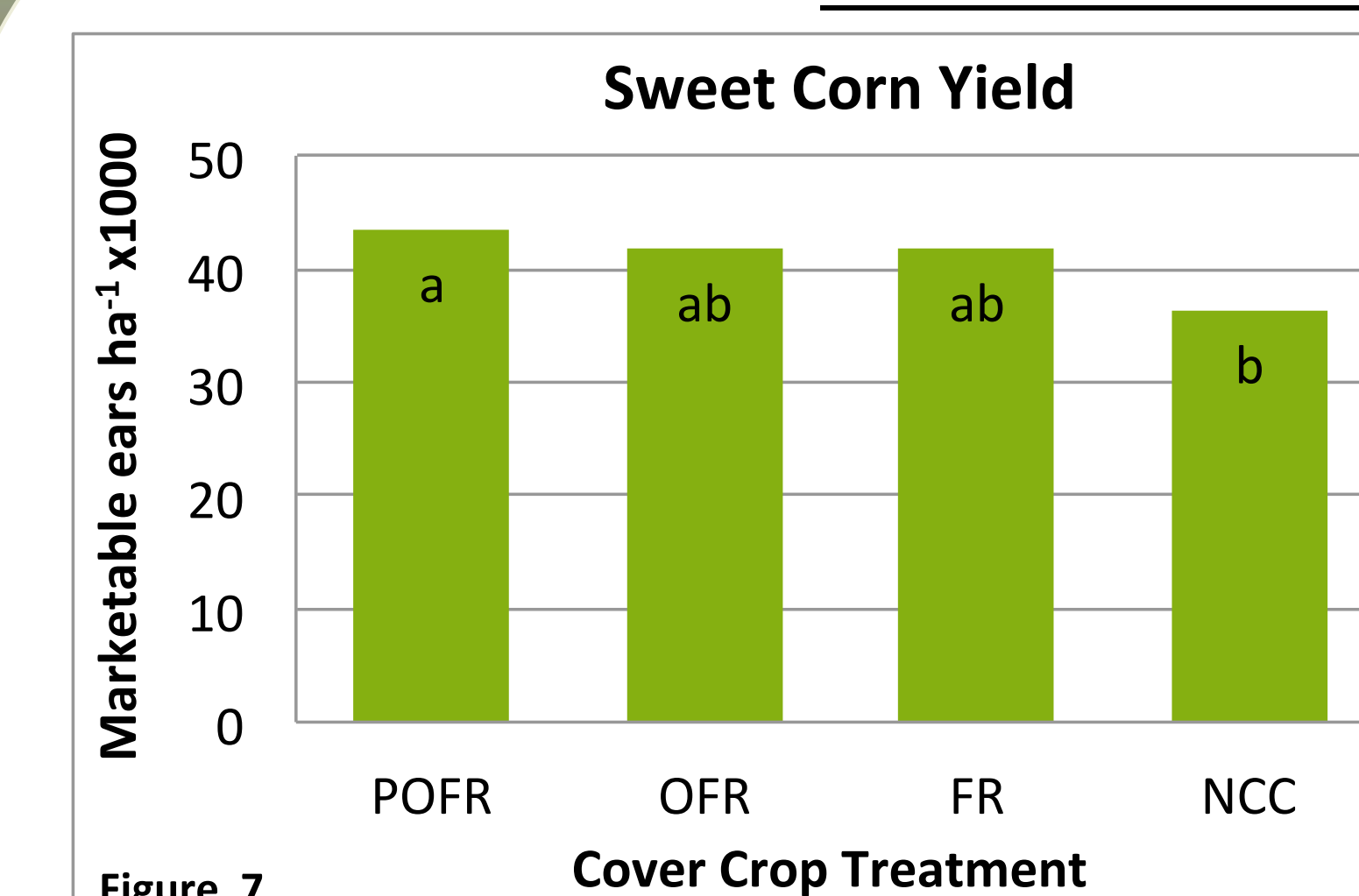


Figure 7

Figure 7 (left). Sweet corn marketable ear yield following cover crop treatments, averaged over two years among plots receiving supplemental N fertilizer treatments. All treatments exceeded the regional average yield.

Figure 8 (right). Average cover crop yield compared to NCC. Yield improved in plots following cover crop treatments when 28 kg N ha⁻¹ fertilizer was applied at sidedress. Additional 28 kg N ha⁻¹ applied at planting did not improve yield, but increased cost and risk of nitrate leaching.

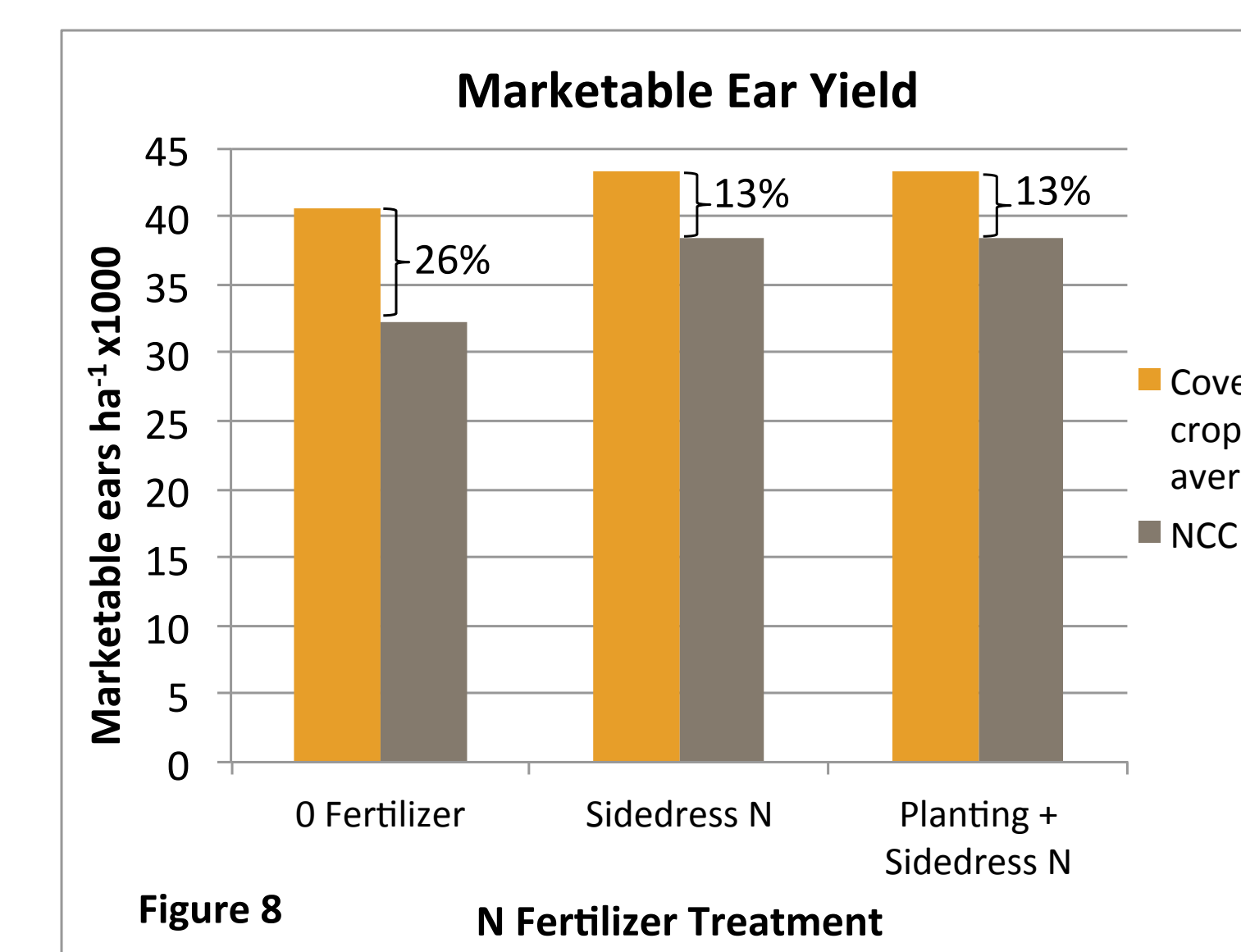


Figure 8

Economic Costs and Benefits of Cover Crop Treatments

	No cover crop (NCC)	Pea, oat, forage radish (POFR)	Oat, forage radish (OFR)	Forage radish (FR)
Profit gains ha ⁻¹ compared to NCC	-	\$1,971	\$1,926	\$1,434
Cost of planting cover crop	\$0	\$35	\$35	\$35
Cost of cover crop seed	\$0	\$131	\$68	\$52
Cost of N fertilizer	\$132	\$90	\$90	\$90
Cover crop impact on overall gains	-\$132	\$1,715	\$1,733	\$1,257

Conclusions

- Cover crop mixtures did not reduce spring soil temperatures (data not shown), indicating feasible timely planting of no-till sweet corn following winter-killed low-residue cover crops.
- OFR residue provided optimal synchrony between nitrogen release and sweet corn demand, reducing spring nitrate leaching.
- POFR and OFR treatments provided most cost-effective nitrogen cycling in a no-till sweet corn system providing growers with financial incentive to adopt cover crop practices.

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