Next Generation Cover Crop Management to Increase Cash Crop Production and Water Quality





The goal of most farmers is to operate in a *Sustainably Intensified Agriculture (SIA)* System

SIA Principles:

- Maximize Production and Profit
- Maximize Nutrient Use Efficiency
- Minimize Environmental
 Degradation



National News: The Gulf of Mexico's Dead Zone Is The Biggest Ever Seen (2017)



This week, NOAA announced that this year's dead zone is the **biggest one ever measured**. It covers **8,776 square miles** — an area the size of New Jersey. <u>And it's adding fuel to a debate</u> <u>over whether state and federal governments are doing</u> <u>enough to cut pollution that comes from farms.</u>

Farmers use those nutrients on fields as fertilizer. Rain washes them into nearby streams and rivers. And when they reach the Gulf of Mexico, those nutrients unleash blooms of algae, which then die and decompose. That is what uses up the oxygen in a thick layer of water at the bottom of the Gulf, in a band that follows the coastline.

Scavia, however, recently published a blog post calling these voluntary measures inadequate.



Cover Crop Performance



Cover Crops Reduce Tile-Drainage Nitrate Loss (Field Scale)



Ruffatti et al. (2018) Agricultural Water Management 211:81-88.

Cover Crops Reduce Tile-Drainage Nitrate Loss (Watershed Scale)



What About Cover Crops and Phosphorus?

Do cover crops promote the loss of Dissolve Reactive P?

Does Cover Crop Species impact Dissolve reactive P loss in surface Runoff?



Impact of long-term Cover Crop Management on DRP loss

Research Site:

- Arcadian IN (Central IN)
- 9 years of cover crop management
- Treatments (Control, Cereal Rye, Radish/Oats, Annual Ryegrass)

<u>Objective</u>

• Determine the impact long-term cover crop species management on soil P sorption.

Impact of long-term Cover Crop Management on DRP loss

Greater P release from 0-2 cm depth

0

 Not-till no cover crops = Radish Oats

> Radish/Oats>CR>AR at the 0-2cm depth





Environmental Ecosystem Services



Maximize Production and Profit



Sustainably Intensified Agriculture

Cereal Rye Impact on Corn Yields



Regional CR-Cash Crop Yield Study			 ✓ = Corn locatio ✓ = Soybean locatio 	on cation
• 430 lotal Pairec Experimental Si	tes			
 430 Corn Paired observations from 20 Experimental sites 				
			1	
Сгор	Treatment	Yield Mg ha ⁻¹ (SE)	Average ∆ Yield Control – Cereal Rye	
Corn	Control	9.6 (0.183)	$(-0.6 Mg ha^{-1})$	
N= 430 pairs	Cereal Rye	9.0 (0.162)	%6 reduction	

Cereal Rye Impact on Corn N Uptake



Field Based 15N Estimate of Cereal Rye Residue Nitrogen Release in a Midwest Corn and Soybean System



9-12% recovery of Cereal Rye N by Corn at Harvest



Changes in Soil Nitrogen Availability <u>During the Life Cycle</u> of Cereal Rye



Next Generation Cover Crop and N Fertilizer Management that could reduce Yield Lag?



SEPAC Legume Inclusion Study 2020

PPAC NEPAC TPAC DPAC SEPAC FPAC SWPAC SIPAC Shalamar Armstrong, Asmita Gautam, Joel Wahlman Soil Ecosyster Nutrient Ounar

Inclusion of Over-Wintering Legumes



Treatments

- Crimson Clover
- Balansa Clover
- Radish/Oats/Hairy Vetch
- Control

Nitrogen Rates:

- All plots received 40 lbs A⁻¹ at planting as starter
- Sidedress rates: 65(105), 128 (170), 170(210) lbs A⁻¹

2020 Experiment

Cover Crop Performance





Sampling

May 12, 2020



Cover Crop Performance



Cover Crop Performance



Results: Corn Yield



SEPAC Legume Inclusion Study 2021

Shalamar Armstrong, Amir Sadeghpour, and Joel Wahlman



Treatment Factors

Cover Crop Species

- 1. Balansa Clover
- 2. Cereal Rye

Planting Method

- 1. Conventional
- 2. Precision

Nitrogen Rate

0, 40, 100, 150, 200. 250 lbs A⁻¹

Cover crops

- Planted Sept. 11th
- Terminated: CR (4/6) BC (5/20)

Precision Planted



Patience!



Balansa Clover May 15, 2021



Cover Crop Performance



Average Biomass

- Balansa Clover (4560 lbs A⁻¹)
- Cereal Rye
 (2386 lbs A⁻¹)

Cover Crop Performance



Planting into Precision Cereal Rye May 15







Reduction in Harvestable Ears

	Ave. Ear Count (thousands A ⁻¹)	% from NC treatment
Zero Control	30	-3
Conv. Balansa	23	-26
Prec. Balansa	25	-19
Conv. CR	28	-9
Prec. CR	29	-4
Control	31	0



SEPAC Brown Stink Bug Damage 6-30-2021

Summary



- Cover Crops (Cereal Rye and Annual Rye) advanced water quality by reducing N and P loss
- Balansa Clover has the potential to be a viable cold tolerant cover crop option and alternative to cereal especially before corn.
- Balansa Clover produced an average of 5,630 lbs A⁻¹ of biomass and 214 lbs A⁻¹ of N within aboveground biomass.
- More efficient management of Balansa Clover spring biomass is needed to maximize nitrogen cycling and corn yield potential.

Questions

https://ag.purdue.edu/agry/armstrong-sendlab/

💋 @covercropDr

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