Cover crop economics: estimating a return on investment

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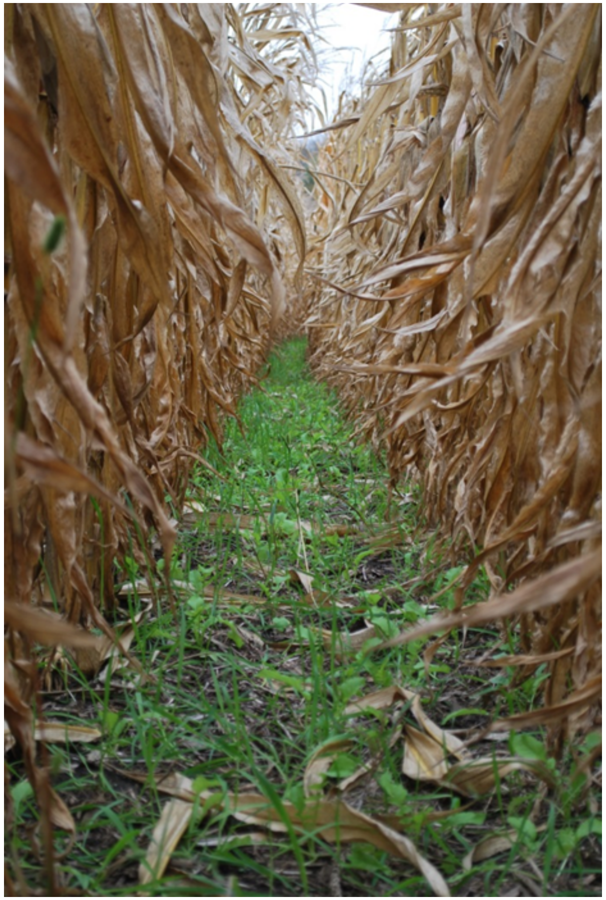
Iowa Nutrient Reduction Strategy

- Voluntary, science-based
- State goal of 45% reduction of Nitrogen (N) and Phosphorous (P)
- Point sources achieve maximum biological removal rate: 4% N and 16% P
- Non-point source goal 41% N and 29% P

Cover Crops in the NRS

Cost of Cover Crops

- Approximately $30+ per acre for seed, planting, and termination
- Costs offset by cost-share initially
- Can we estimate the value cover crops bring to the land?



How do you account for cover crop value in your operation?

Estimating the Value of Cover Crops

- Estimate reductions in soil loss using on-farm research sites comparing cover and no-cover treatments
- RUSLE2 model used to calculate estimates
- Change in land value and lost nutrients will be estimated base on protecting the soil from erosion

Soil Erosion

- Most sites in this study are no-till corn-soybean rotations
- Initial calculations range from 20-40% erosion reductions for the cover crop sites

Nutrient Value

- Topsoil is the most nutrient rich horizon
- Higher OM=higher nutrient content and value

Assumptions

- Nutrient value of soil just in the OM fraction ranges from $2-$10 per ton of soil
- In land value change calculations, cost of soil erosion averages $0.49 per ton

Cover Crop Scenarios

Scenario	No cover erosion rate	Cover crop erosion rate	Difference	Value of retained soil by cover crop use
1	2 tons/acre	1 ton/acre	1 ton/acre	$6.06/acre
2	3 tons/acre	1.5 tons/acre	1.5 tons/acre	$9.09/acre
3	5 tons/acre	2.5 tons/acre	2.5 tons/acre	$15.15/acre

How long does it take to observe a return on investment in terms of soil quality, erosion reduction, or other factors?

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In-Field Nitrate-N Reduction Practices

	Practice	Comments	% Nitrate-N Reduction+	% Corn Yield Change++
			Average (SD*)	Average (SD*)
Nitrogen Management	Timing	Moving from fall to spring pre-plant application	6 (25)	4 (16)
		Spring pre-plant/sidedress 40-60 split Compared to fall-applied	5 (28)	10 (7)
		Sidedress – Compared to pre-plant application	7 (37)	0 (3)
		Sidedress – Soil test based compared to pre-plant	4 (20)	13 (22)**
	Source	Liquid swine manure compared to spring-applied fertilizer	4 (11)	0 (13)
		Poultry manure compared to spring-applied fertilizer	-3 (20)	-2 (14)
	Nitrogen Application Rate	Nitrogen rate at the MRTN (0.10 N:corn price ratio) compared to current estimated application rate. (ISU Corn Nitrogen Rate Calculator – http://extension.agron.iastate.edu/soilfertility/nrate.aspx can be used to estimate MRTN but this would change Nitrate-N concentration reduction)	10	-1
	Nitrification Inhibitor	Nitrapyrin in fall – Compared to fall-applied without Nitrapyrin	9 (19)	6 (22)
	Cover Crops	Rye	31 (29)	-6 (7)
		Oat	28 (2)	-5 (1)
	Living Mulches	e.g. Kura clover – Nitrate-N reduction from one site	41 (16)	-9 (32)

Edge-of-Field and Land Use Nitrate-N Reduction Practices

Land Use	Perennial	Energy Crops – Compared to spring-applied fertilizer	72 (23)	
		Land Retirement (CRP) – Compared to spring-applied fertilizer	85 (9)	
	Extended Rotations	At least 2 years of alfalfa in a 4 or 5 year rotation	42 (12)	7 (7)
	Grazed Pastures	No pertinent information from Iowa – assume similar to CRP	85	
Edge-of-Field	Drainage Water Mgmt.	No impact on concentration	33 (32)	
	Shallow Drainage	No impact on concentration	32 (15)	
	Wetlands	Targeted water quality	52	
	Bioreactors		43 (21)	
	Buffers	Only for water that interacts with the active zone below the buffer. This would only be a fraction of all water that makes it to a stream.	91 (20)	
	Saturated Buffers	Divert fraction of tile drainage into riparian buffer to remove Nitrate-N by denitrification.	50 (13)	

+ A positive number is nitrate concentration or load reduction and a negative number is an increase.

++ A positive corn yield change is increased yield and a negative number is decreased yield. Practices are not expected to affect soybean yield.

* SD = standard deviation. Large SD relative to the average indicates highly variable results.

** This increase in crop yield should be viewed with caution as the sidedress treatment from one of the main studies had 95 lb-N/acre for the pre-plant treatment but 110 lb-N/acre to 200 lb-N/acre for the sidedress with soil test treatment so the corn yield impact may be due to nitrogen application rate differences.

In-Field Phosphorus Reduction Practices

	Practice	Comments	% P Load Reduction[a]	% Corn Yield Change[b]
			Average (SD[c])	Average (SD[c])
Phosphorus Management Practices	Phosphorus Application	Applying P based on crop removal – Assuming optimal STP level and P incorporation	0.6[d]	0
		Soil-Test P – No P applied until STP drops to optimum or, when manure is applied, to levels indicated by the P Index[f]	17[e]	0
	Source of Phosphorus	Liquid swine, dairy, and poultry manure compared to commercial fertilizer – Runoff shortly after application	46 (45)	-1 (13)
		Beef manure compared to commercial fertilizer – Runoff shortly after application	46 (96)	
	Placement of Phosphorus	Broadcast incorporated within 1 week compared to no incorporation, same tillage	36 (27)	0
		With seed or knifed bands compared to surface application, no incorporation	24 (46)	0
	Cover Crops	Winter rye	29 (37)	-6 (7)
	Tillage	Conservation till – chisel plowing compared to moldboard plowing	33 (49)	0 (6)
		No till compared to chisel plowing	90 (17)	-6 (8)

Edge-of-Field and Land Use Phosphorus Reduction Practices

Land Use Change	Perennial Vegetation	Energy Crops	34 (34)	
		Land Retirement (CRP)	75	
		Grazed pastures	59 (42)	
Erosion Control and Edge-of-Field Practices	Terraces		77 (19)	
	Buffers		58 (32)	
	Control	Sedimentation basins or ponds	85	