### Using Science and On-Farm Research to Investigate Cover Crops in Iowa

#### **Stefan Gailans**

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#### **Cover crops don't reduce yields if...**



#### Soybeans can be planted "green"



#### **Cereal rye is the option unless...**

NRCS/SWCS Photo by Lynn Betts

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#### **HOW DO WE KNOW THIS?**

- Cover crops don't reduce yields if... properly managed
- Soybeans can be planted "green"
- Cereal rye is the option unless... you diversify

#### **ON-FARM RESEARCH**

# PRACTICAL FARMERS OF IOWA

#### FARMER-LED RESEARCH



#### **RANDOMIZED, REPLICATED STRIP TRIALS**

	B	B			B		B
REP 1		REP 2		REP 3		REP 4	











54 COOPERATORS TOOK PART IN 77 RESEARCH TRIALS







#### 240COOPERATORS HAVE CONDUCTED 1,436RESEARCH TRIALS

## **SINCE 1987**





FARMER-LED RESEARCH

#### **DO COVER CROPS AFFECT CROP YIELDS?**

- Bill Buman, Harlan
- Randy Caviness, Greenfield
- Jim Funcke, Jefferson
- Devan Green, Conrad
- Rick Juchems, Plainfield
- Mark Pokorny, Clutier
- George Schaefer, Kalona
- Jerry Sindt, Holstein
- Rob Stout, Washington
- Gary & Dave Nelson, Fort Dodge
- Kelly Tobin, New Market
- Whiterock Conservancy, Coon Rapids



#### **DO COVER CROPS AFFECT CROP YIELDS?**



#### 12 ON-FARM SITES EST. 2008 & 2009



#### **COVER VS. NO-COVER: CORN**

Corn response to cover crop



#### **COVER VS. NO-COVER: AVG. CORN YIELDS**

Era	Cover	<b>No-cover</b>
2009-2012 (early years)	158 bu/ac	162 bu/ac
2013-2018	197 bu/ac	196 bu/ac

#### **COVER VS. NO-COVER: SOYBEANS**



#### **COVER VS. NO-COVER: AVG. SOYBEAN YIELDS**

Era	Cover	<b>No-cover</b>
2009-2012 (early years)	59 bu/ac	57 bu/ac
2013-2018	58 bu/ac	56 bu/ac

#### **DO COVER CROPS AFFECT CROP YIELDS?**

#### • Corn

- No effect in 32/39 trials
- Mostly yield-neutral
- Yield drag mostly occurred in "early" years

#### Soybeans

- No effect in 20/29 trials
- Improved yields in 8/29 trials

#### **PROPER MANAGEMENT IS KEY!**

#### WHEN SHOULD COVER CROPS BE TERMINATED?

- Jack Boyer, Reinbeck
- Jeremy Gustafson, Boone
- Arlyn Kauffman, Weldon
- Tim Sieren, Keota
- Dick Sloan, Rowley
- Loran Steinlage, West Union
- Michael Vittetoe, Washington

#### WHEN SHOULD COVER CROPS BE TERMINATED?

At-planting of cash crop

2-3 weeks before planting cash crop

#### **TERMINATION DATE: SOYBEAN YIELDS (bu/ac)**



#### **NO STATISITICAL DIFFERENCES**

#### PLANTING SOYBEANS DAY OF TERMINATING COVER CROP (Ensure closure of seed trench!)

#### >7,000 lb/ac

#### **COVER CROP TERMINATED AT SOYBEAN PLANTING**



#### **COVER CROP TERMINATED AT SOYBEAN PLANTING**



#### **OFFSETTING COSTS**

- Cost of cover crop (seed + application) = \$25-30
- Savings in weed control (1 less pass) = \$30-40
- **BALANCE = \$0-15**



## SHOULD I ROLL DOWN ALL THAT COVER CROP RESIDUE?

• Jack Boyer, Reinbeck



**Drill/plant in mid-May** 

**Roll in early June** 

#### DRILL SOYBEANS IN 10-IN. ROWS & ROLL?

**Mid-July** 



#### PLANT SOYBEANS IN 30-IN. ROWS & ROLL?

**Mid-July** 

Planted in 30-in. rows & not rolled

Planted in 30-in. rows & rolled

## SHOULD I ROLL DOWN ALL THAT COVER CROP RESIDUE?



\*SOYBEAN YIELD REDUCED WHEN PLANTED IN 30-IN. ROWS AND NOT ROLLED (rye residue interfered with harvest)

#### PUSH THE COVER CROP TERMINATION DATE FOR SOYBEANS?

Cover crop terminated May 30 21 days after planting



Cover crop terminated May 16 7 days after planting

#### PUSHING THE TERMINATION DATE: SOYBEAN YIELDS (bu/ac)



#### \*YIELD DRAG FROM DELAYED TERMINATION .....BUT LESS WEED PRESSURE?

#### WHAT ABOUT FOR CORN?



#### **TERMINATION DATE: CORN YIELDS (bu/ac)**



#### \*SIGNIFICANT YIELD DRAG FROM TERMINATING COVER CROP AT CORN PLANTING (~14 bu/ac)

#### **COVER CROP BIOMASS AT TERMINATION**



~1,000 lb/ac when terminating 2-3 weeks before planting >4,000 lb/ac when terminating at-planting

SOIL NUTRIENT/SEEDLING DISEASE ISSUES?

#### **SOLUTION: TWIN-ROW COVER CROPS?**



#### TWIN-ROW COVER CROPS & TERMINATION DATE: CORN YIELDS (bu/ac)

		<b>Cover crop termination</b>			
Year	Farm	3 weeks before planting	Near planting	1 week after planting	
2018	Steinlage	238	229	229	
	Vittetoe		236	228	

- Steinlage
  - Corn planted May 18
  - No effect of cover crop termination date

- Vittetoe
  - Corn planted May 1
  - 8 bu/ac benefit to terminating near corn planting

#### SHOULD N-RATE FOR CORN BE INCREASED AFTER COVER CROP?



#### **"NORMAL" VS. "HIGH" SIDE-DRESS N RATE**
#### **N-RATE AFTER COVER CROP: CORN YIELDS**



#### **\*NO ADVANTAGE TO "HIGH" N RATE IN 5/8 TRIALS**

## WHEN SHOULD COVER CROPS BE TERMINATED?

#### • Corn

- Abide by the "rule-of-thumb"
- 2-3 weeks prior to corn planting
- Twin-row cover crops may allow for exceptions to rule
- N timing and placement important
  - Likely do not need more N applied than "normal"
  - Future research further exploring this

#### Soybeans

- Plant "green"
  - Terminate cover crop within 5 days of planting
  - Consider rolling residue if planting in wider rows
- Potential weed control benefits
- Improved soil conservation when "letting the rye run in the spring"
  - More biomass

## WHAT ABOUT OTHER COVER CROPS (NOT RYE)?



## LEGUMES? BRASSICAS?

## **COVER CROP VARIETY TRIAL, 2012-2017**

- Art Behrens, Carroll
- Jerry Depew, Laurens
- Jeremy Gustafson, Boone
- Stephanie Hyde, Marshalltown
- Chad Ingels, Randalia
- ISU Agronomy Farm, Boone
- Paul Kassel, Spencer
- Greg King, DeWitt
- Clarke McGrath, Clearfield
- Steve McGrew, Emerson
- Mark Peterson, Stanton
- Myron Rees, Crawfordsville
- Dave & Meg Schmidt, Exira
- Bil Schrader, Rake
- Mike VerSteeg, Inwood
- Neal Willaimsen, Emmetsburg

## **COVER CROP VARIETY TRIAL, 2012-2017**

Grasses	Brassicas	Legumes
Oats	Radish	Hairy vetch
Cereal rye	Rapeseed	Crimson clover
Winter wheat	Mustard	Winter pea
Winter triticale	Turnips	
Winter barley	Pennycress	
Annual ryegrass		

## ENTRIES HAND-SEEDED INTO CORN OR SOYBEANS IN AUG/SEPT INTO REPLICATED 7' x 25' PLOTS

## **COVER CROP VARIETY TRIAL, 2012-2017**



#### **GROUND COVER ASSESSED IN FALL & SPRING**

## **SPRING COVER RELATIVE TO CEREAL RYE**



## WHAT COVER CROP SHOULD I USE? CEREAL RYE



## **HOW TO DIVERSIFY?**

## SMALL GRAINS + "GREEN MANURE" COVER CROPS







### **SMALL GRAINS SUMMER HARVEST PRESENTS OPPORTUNITIES**



## **SMALL GRAINS PRESENT OPPORTUNITIES**







Feb/March frost-seeding

June under canopy

July post-harvest

## FROST-SEED RED CLOVER TO SMALL GRAIN IN LATE FEB/EARLY MARCH

# **10-spp mix planted after rye harvest Stanton (SW lowa)**

Mark & Melanie Peterson Photo taken Oct. 6, 2014

#### **REALISTIC EXPECTATIONS**



Planted in mid-August (after small grain)

Planted in late September (after soy/corn)

## WHY GREEN MANURES?: LEGUME COVER CROPS ACCESS ATMOSPHERIC N

Rhyzobia – symbiotic N-fixing bacteria

## HOW MUCH N FERTILIZER CAN BE REPLACED BY RED CLOVER "GREEN MANURE" COVER CROP?

#### • Tim Sieren, Keota



#### **N FERT. REPLACEMENT OF CLOVER: CORN YIELDS**



#### \*N FERTILIZER REPLACEMENT = 90 lb N/ac

## **HOW ELSE TO DIVERSIFY?**

## GET CREATIVE! NEXT HORIZONS





Camelina as a fall-seeded cover crop?

## 60-VS. 30-IN. CORN ROW-WIDTHS FOR INTERSEEDING

- Fred Abels, Holland
- Jack Boyer, Reinbeck

- Brian & Heather Kessel and Jim Johnson, Lamoni
- Chris Teachout, Shenandoah



#### **60-VS. 30-IN. CORN ROW-WIDTHS FOR INTERSEEDING**



#### \*CORN YIELD REDUCED AT TWO FARMS \*CORN YIELD SIMILAR AT TWO FARMS

#### **60- VS. 30-IN. CORN ROW-WIDTHS FOR INTERSEEDING**

	Cover crop biomass (lb/ac)		Cove (lb	r crop N N/ac)	
Farm	<b>30-in.</b>	60-in.	<b>30-in.</b>	60-in.	
Abels	3,681	4,225			
Boyer	339	3,870	7	100	
Kessel/Johnson	964	3,766	20	60	

#### **MORE COVER CROP BIOMASS AND N AT 2 FARMS**

#### **60- VS. 30-IN. CORN ROW-WIDTHS FOR INTERSEEDING**

Potential for: --Forage to graze --N for succeeding crops

## **ON THE HORIZON: CAMELINA COVER CROP?**

- Jack Boyer, Reinbeck
- Wade Dooley, Albion
- Bill Frederick, Jefferson
- Wendy Johnson, Mason City
- Rob Stout, Washington

(with Dr. Andy Lenssen, ISU)



#### **ON THE HORIZON: CAMELINA COVER CROP?**

Bill Frederick Oct. 13, 2018 Seeded: Oct. 5, 2018

#### **ON THE HORIZON: CAMELINA COVER CROP?**



## **SO... WHAT HAS ON-FARM RESEARCH TAUGHT US?**

#### **CROP YIELDS CAN BE MAINTAINED –** WITH PROPER MANAGEMENT!



## **PROPER MANAGEMENT IS...**

- Termination date
- Residue management
  - Close the seed trench
  - Roll residue if planter/drill left it standing
- N rate, timing
  - Applying N at corn planting likely vital for success



#### **CEREAL RYE IS KING UNLESS....**



#### **DIVERSIFICATION, CREATIVITY**



#### WHY COVER CROPS?

#### WHY COVER CROPS? -SCIENTIFIC EVIDENCE POINTS TO SOIL IMPROVEMENT

- Reduce soil erosion
- Reduce nutrient loss
- Alleviate soil compaction
- Improve soil physical structure

#### WHY COVER CROPS? -PFI EVIDENCE POINTS TO ECONOMICS WEED CONTROL IN SOYBEANS



#### WHY COVER CROPS? -PFI EVIDENCE POINTS TO ECONOMICS N FERTILIZER REPLACEMENT WITH DIVERSE ROTATIONS



#### WHY COVER CROPS? -PFI EVIDENCE POINTS TO ECONOMICS FORAGE FOR GRAZING LIVESTOCK



# **Because it's the right thing to do.**

-Rob Stout PFI Cooperators' Dinner Dec. 13, 2018

#### WHY ON-FARM RESEARCH?

No matter the trial, I've always learned valuable

information by doing them, and generated more

questions that make me want to try doing more with

cover crops.

-Tim Sieren

## CONTACT ME (STEFAN) IF YOU'D LIKE TO GET INVOLVED stefan@practicalfarmers.org









#### practicalfarmers.org/research


## **PFI RESEARCH REPORTS CITED IN THIS PRESENTATION**

- Winter Cereal Rye Cover Crop Effect of Cash Crop Yield Year 10
  - <u>https://practicalfarmers.org/research/winter-cereal-rye-cover-crop-effect-of-cash-crop-yield-year-10/</u>
- Cereal Rye Cover Crop Termination Date Ahead of Soybeans, 2016 Update
  - <u>https://practicalfarmers.org/research/cereal-rye-cover-crop-termination-date-ahead-of-soybeans-2016-update/</u>
- Rolling Cover Crops and Soybean Row-Width
  - <u>https://practicalfarmers.org/research/rolling-cover-crops-and-soybean-row-width/</u>
- Cover Crop Termination Date Ahead of Corn
  - <u>https://practicalfarmers.org/research/cover-crop-termination-date-ahead-of-corn/</u>
- N Fertilizer Strategies for Corn Following Cover Crop
  - <u>https://practicalfarmers.org/research/n-fertilizer-strategies-for-corn-following-cover-crop/</u>
- Side-Dressing Corn Following a Winter Rye Cover Crop Updated 2014
  - <u>https://practicalfarmers.org/research/side-dressing-corn-following-a-winter-rye-cover-crop-updated-2014/</u>
- Cover Crop Variety Trial 2016-2017 (and previous years)
  - <u>https://practicalfarmers.org/research/cover-crop-variety-trial-2016-2017/</u>
- Nitrogen Replacement Value of Red Clover
  - <u>https://practicalfarmers.org/research/nitrogen-replacement-value-of-red-clover/</u>
- Economic Impact of Grazing Cover Crops in Cow-Calf Operations
  - <u>https://practicalfarmers.org/research/economic-impact-of-grazing-cover-crops-in-cow-calf-operations/</u>
- Winter Feed Monitoring on a Grass-Fed Cattle Farm
  - <u>https://practicalfarmers.org/research/winter-feed-monitoring-on-a-grass-fed-cattle-farm-2/</u>

## **PFI RESEARCH REPORTS CITED, CONT.**

- Planting Corn in 60-in. Row-Widths for Interseeding Cover Crops
  - <u>https://practicalfarmers.org/wp-content/uploads/2019/01/PFI2018\_ResearchReport\_60-in.-corn-interseeded-with-cover-crops\_FINAL.pdf</u>

## **PFI RESEARCH REPORTS YET TO BE PUBLISHED**

- Terminating Cover Crops after Seeding Soybeans
- Cover Crop Termination Date Before Corn
  - Includes twin-row cover crop seeding method
- Camelina as a Cover Crop