THE OHIO STATE UNIVERSITY

Interseeding Cover Crops in Ohio Opportunities and Challenges

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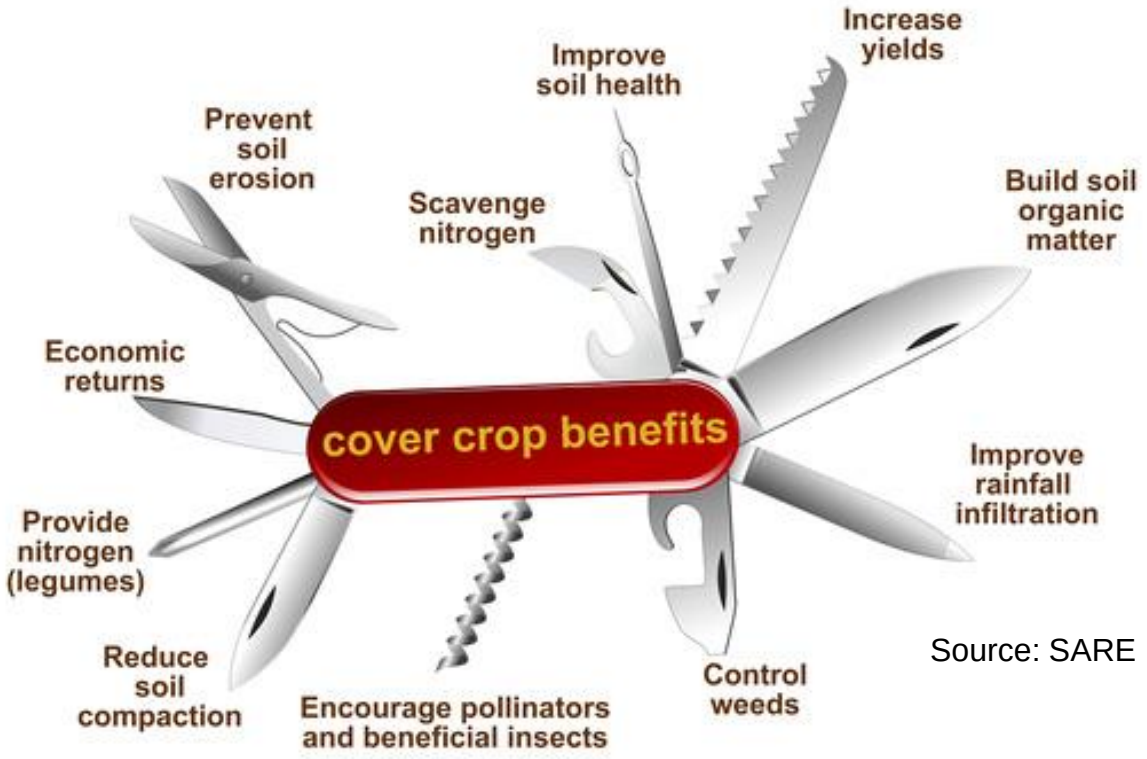
A Swiss Army Knife for Agriculture



Source: SARE Image Library

Hairy Vetch

Red Clover

Cereal Rye

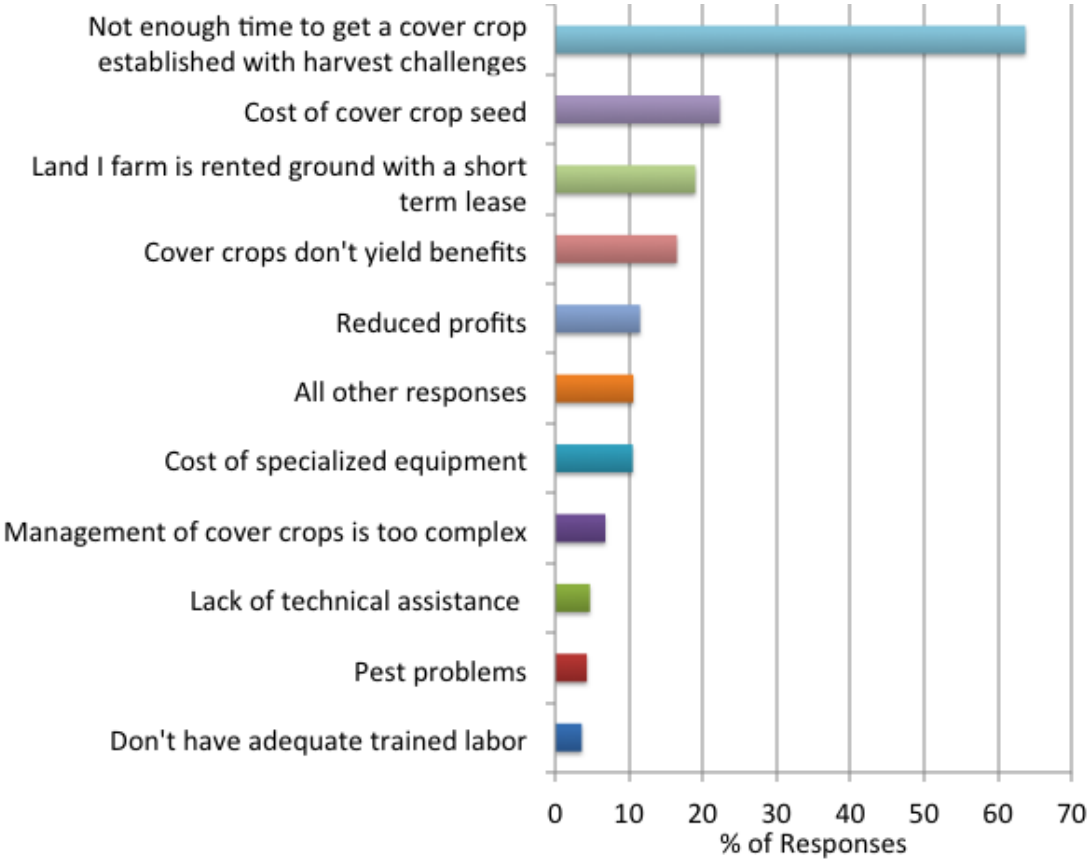
Winter Wheat

Oats

Forage Radish

Barriers to Cover Crop Utilization

2010 survey of over 800 farmers[1]



Seeding cover crops after fall harvest is a key challenge

In Ohio, cereal rye can often be seeded in mid-late November

[1]CTIC. 2010. Cropping decisions survey. Conservation Technology Information Center. www.ctic.org.

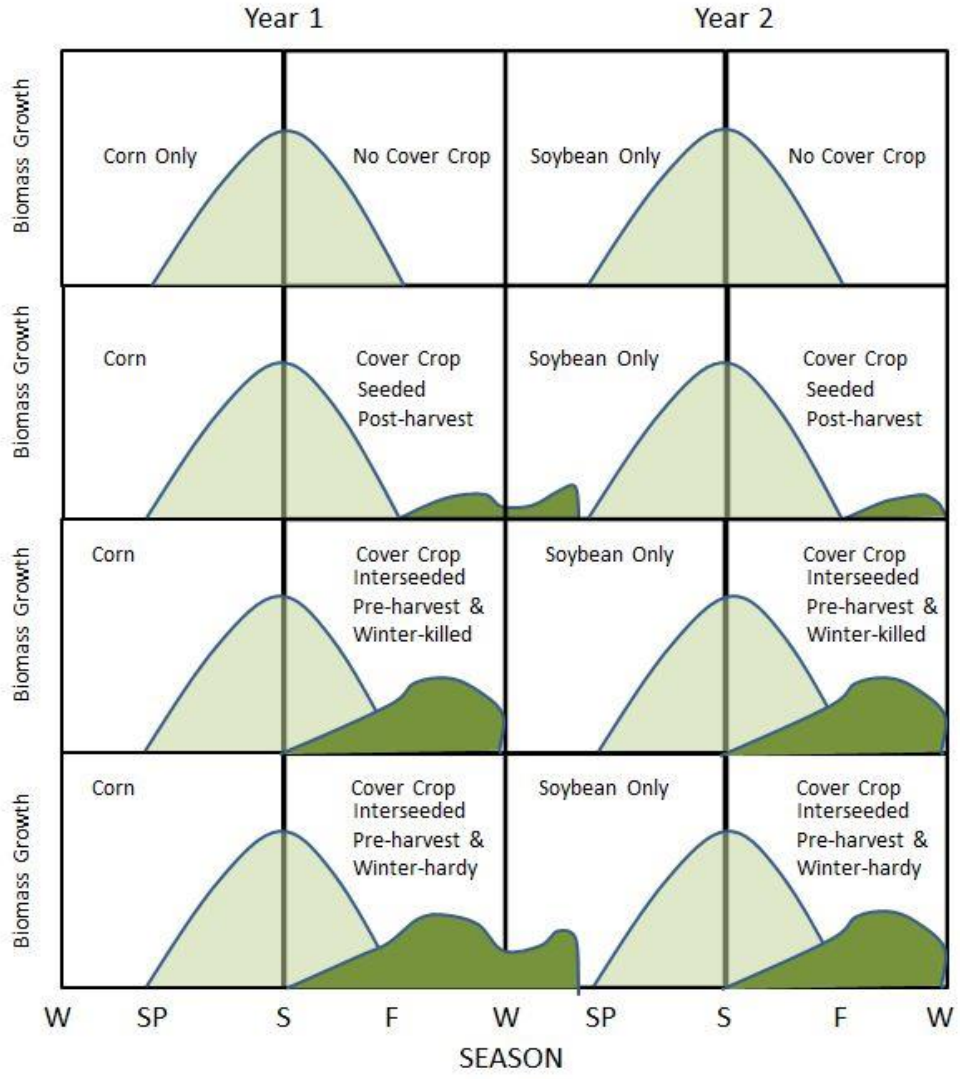
Interseeding Opportunities

Potential Benefits

- No need for fall seeding
- More cover crop species options following corn grain
- More soil cover in the fall and spring
- Enhanced provision of ecosystem services

Potential Tradeoffs

- Potential competition with main crop for nutrients and water
- Inconsistent establishment beneath crop canopy



Interseeding Methods

Aerial Interseeding

Pros

- Can cover large acreage quickly
- Cost effective if done with neighbors
- Minimal detraction from operations

Cons

- Seed not in soil
- Higher seeding rates required
- Need to carefully consider crop growth stage
- Weather dependent (moisture needed, wind)

Highboy Interseeding

Pros

- Can cover relatively large acreage quickly
- Can be done with modifications to common pneumatic equipment
- Could be used over a range of growth stages

Cons

- Seed not in soil
- Weather dependent (moisture needed)

High Clearance Drill Interseeding

Pros

- Improved seed-soil contact
- Somewhat less dependent on weather
- More consistent establishment
- Can be seeded up to V7 in corn
- Wide range of cover crop species can be used

Cons

- Requires specialized equipment
- Slow in covering large acreage
- Still weather dependent (emergence and survival)

Penn State / InterSeeder Tech at OSU

- Wooster (2 row model)
- South Charleston (2 row model)
- Larger (12 row) air-drill models are available for custom order

Interseeding in Silage Corn

Applications in Corn Silage Systems

- Earlier silage harvest allows for longer period of cover crop growth in fall
- Minimal corn residue reduces interference with cover crop
- Cover crops help to replace the residue that has been removed and protect the soil
- Can provide an alternate source of forage for livestock

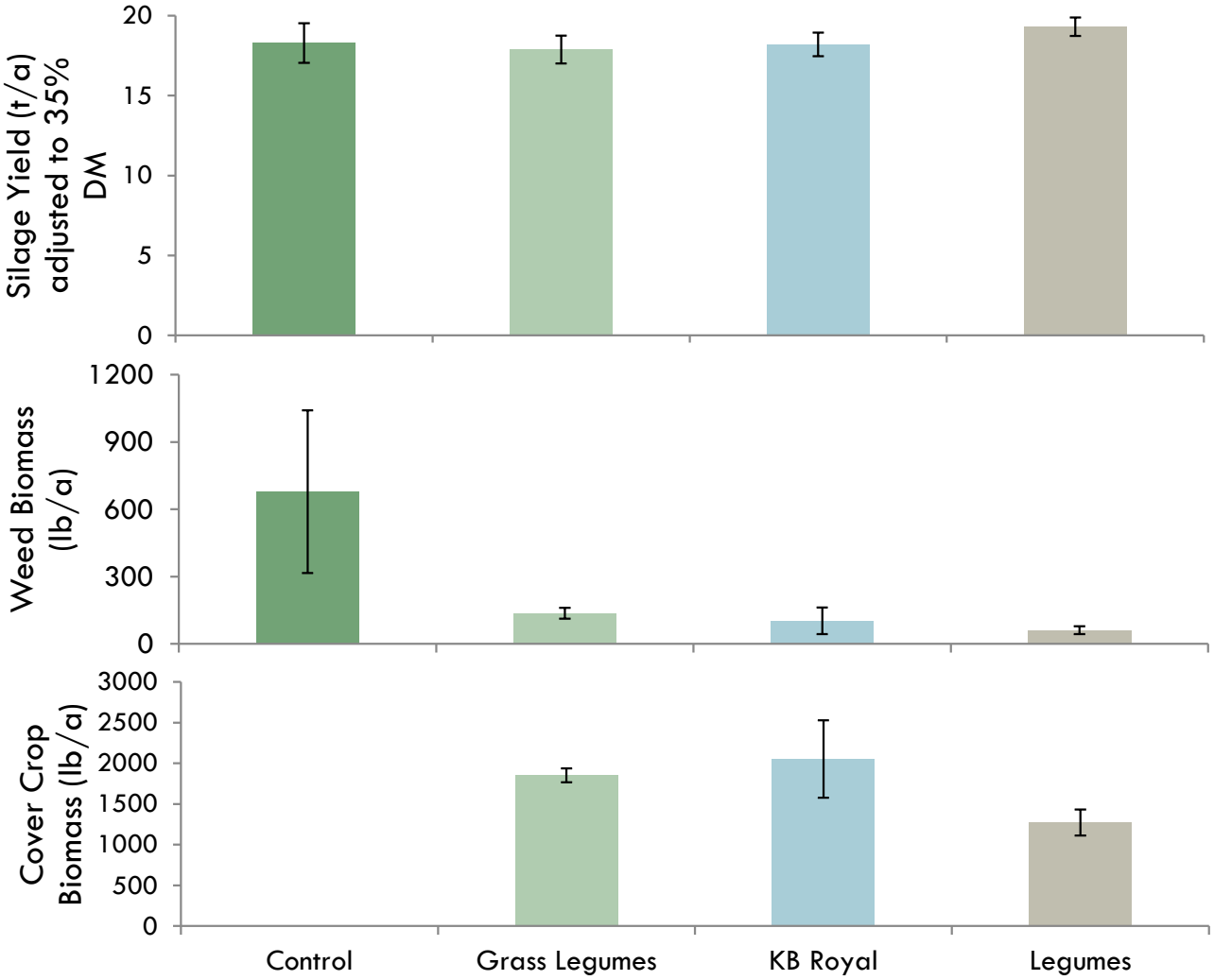
Corn yield, Weed & Cover Crop Biomass

On-Farm Trial, Pine Hollow Farm, Virgil, NY (2013) Data from Cornell

Similar Silage Yield

Weed Suppression

1-2 tons of cover crop biomass in following spring



Source: Matt Ryan, 2014

What about corn grain systems in Ohio?

- Will competition from cover crop reduce grain yields?
- Will incorporation of cover crop improve subsequent yields?
- What cover crop species are most successful under a corn canopy?
- Are some cover crops more shade tolerant than others?

Field Trial 1: Wooster 2015 & 2016

Cover Crop Species Treatments

- Control – Corn Only (no cover crop)
- Tillage radish, 10 lbs/A
- Red clover, 10 lbs/A
- Balansa clover, 10 lbs/A

Seeding Methods (interseeded at V5 stage)

- High clearance drill (InterSeeder Tech)

Field Trial 1: Wooster 2016

Cover Crop Species Treatments

- Control – Corn Only (no cover crop)
- Tillage radish
- Forage collard
- Red clover
- Balansa clover
- Berseem clover
- Crimson clover

Seeding Methods (interseeded at V5 stage)

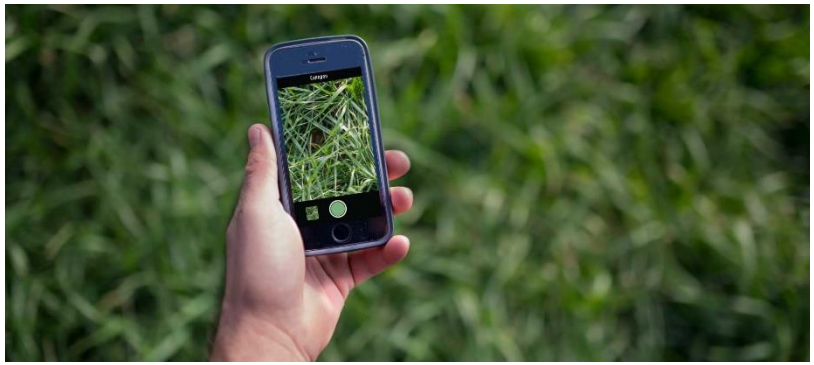
- High clearance drill (InterSeeder Tech)

PRELIMINARY DATA

Trial 1: Wooster OH 2015 & 2016

	Fall 2015		Spring 2016		Fall 2016
Cover Crop Species	Grain Yield	Cover Crop Biomass	Cover Crop Biomass	Green Cover	Grain Yield
	bu /a	lbs / a	lbs / a	%	bu /a
Control – No CC	133 a	0 a	0 a	6.5 a	149 a
Tillage Radish	143 a	651 b	0 a	1.0 a	157 ab
Red Clover	133 a	642 b	1184 b	66.5 b	167 bc
Balansa Clover	145 a	580 b	1435 b	69.2 b	169 bc

*Parameter values followed by the same letter are not statistically different (*P*=0.05).



Canopeo App

Free Download at:
https://appcenter.okstate.edu/content/canopeo

Percent Green Cover in April 2016

(measured prior to spring termination)

Red Clover
66.5%

Tillage Radish
1.0%
Winter Killed

PRELIMINARY DATA

Trial 2: Wooster OH 2016

	Fall 2016		Spring 2017
Cover Crop Species	Grain Yield	Cover Crop Biomass	Cover Crop Biomass
	bu /a	lbs / a	lbs / a
Control – No CC	187.2 ab	0 a	0 a
Forage Collard	180.1 ab	589 c	143 b
Tillage Radish	187.9 ab	635 c	0 a
Balansa Clover	181.2 ab	262 b	195 b
Berseem Clover	197.2 b	307 b	39 b
Crimson Clover	182.1 ab	302 b	1655 d
Red Clover	170.2 a	338 b	801 c

*Parameter values followed by the same letter are not statistically different (P=0.05).

2015 Conditions in Wooster

	April	May	June	July	Aug.	Sept.	Oct.	Nov.
Corn								
Cover Crop								
Precip. (in)	2.8	4.3	5.4	3.3	0.8	3.5	2.3	1.3

Schedule of 2015 Operations:

4/30 Burndown herbicide (glyphosate / 2-4D)
5/20 Chisel tillage to incorporate residue
5/21 Corn seeded (glyphosate tolerant variety)
6/18 Post-emergent herbicide sprayed (glyphosate)
6/18 Cover crop interseeded (V5-V6)
11/10 Corn grain harvested
11/15 Cover crop biomass sampled in fall
4/19 Cover crop biomass sampled in spring

2016 Conditions in Wooster

	April	May	June	July	Aug.	Sept.	Oct.	Nov.
Corn								
Cover Crop								
Precip. (in)	2.7	2.5	1.3	2.9	3.9	2.4	3.8	0.9

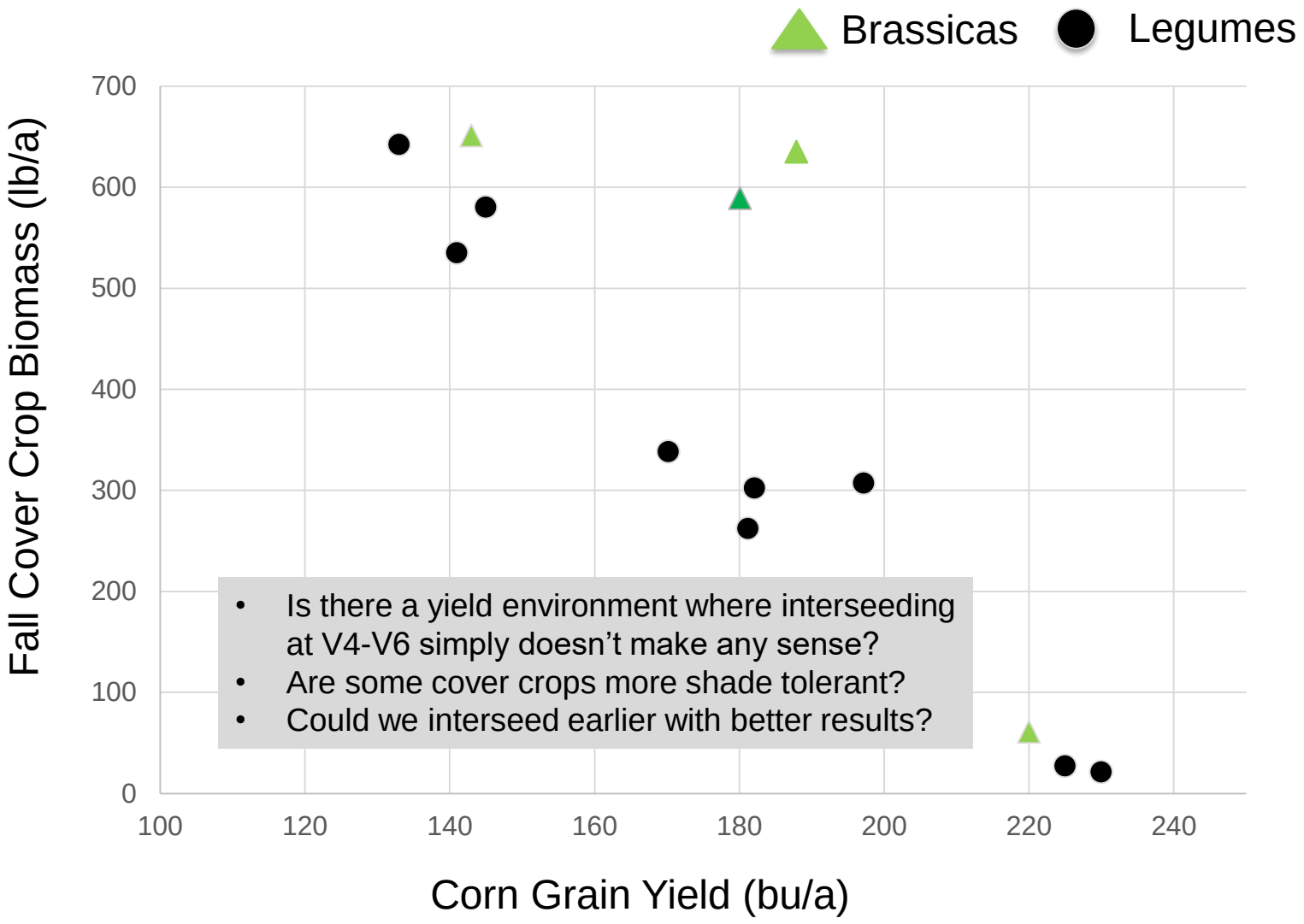
Schedule of 2016 Operations:

4/20 - Burn-down herbicides sprayed (glyphosate / 2-4D / Outlook / Sharpen)
5/23 - Chisel tillage to incorporate residue
5/24 - Corn seeded (glyphosate tolerant variety)
6/20 - Post emergent herbicide sprayed (glyphosate)
6/20 - Cover crop interseeded (V5-V6)
11/4 - Corn grain harvested
11/15 - Cover crop biomass sampled in fall

South Charleston - 2016

- Average corn yields = 225 bu/a
- No yield differences among the cover crop treatments and the control
- Dry June-July severely limited cover crop biomass (24-61 lbs/a in fall)
- Tillage radish that was interseeded seemed to tolerate the drought a bit better, but still very poor.
- Dense shade of higher yielding corn stand appeared also contribute to the poor establishment

PRELIMINARY DATA

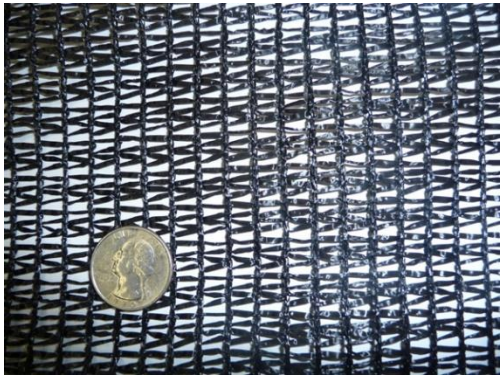


Greenhouse Experiment 2017

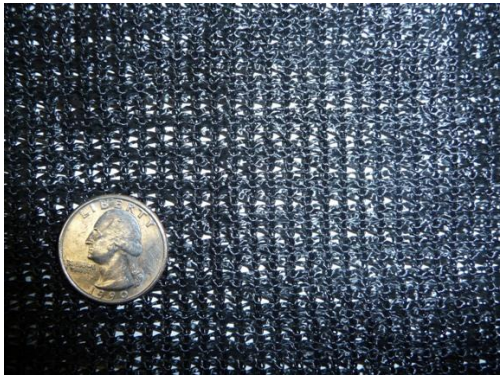
Duration: 60 days **Design:** RCBD w/ 4 reps

Shade treatments: Frames were constructed to suspend shade cloth over the greenhouse benches rated to block either 50% or 90% of photosynthetically active radiation (PAR).

Cover Crops: Cover crop species seeded in pots and allowed to germinate for 7 days in pots prior to applying the shade cloth for 53 days.



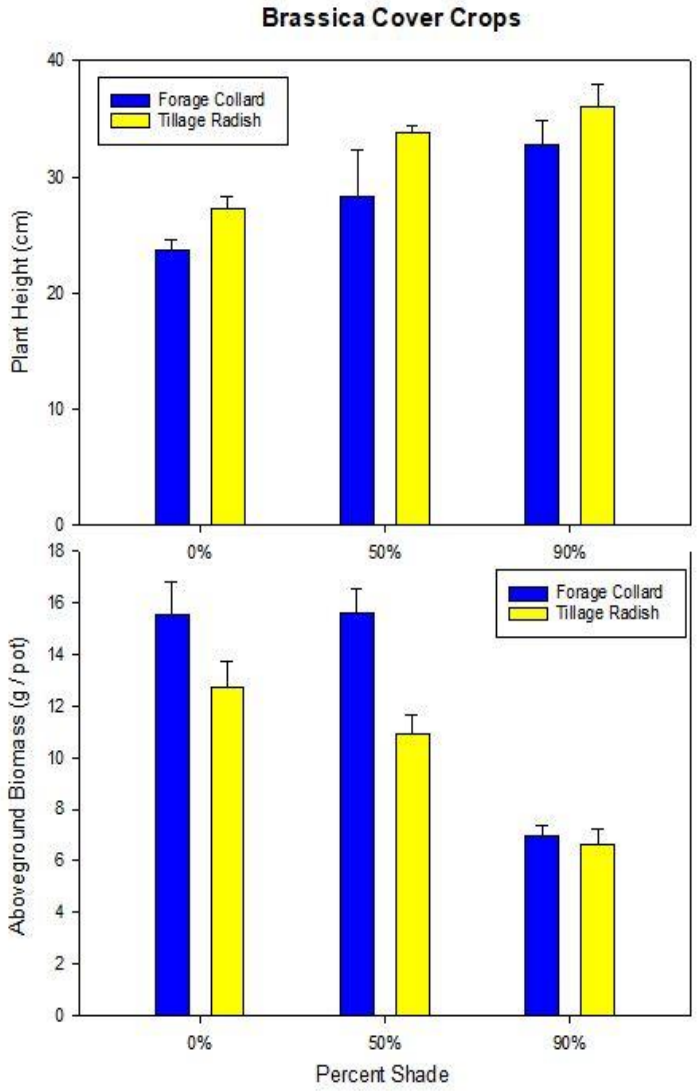
50% Shade

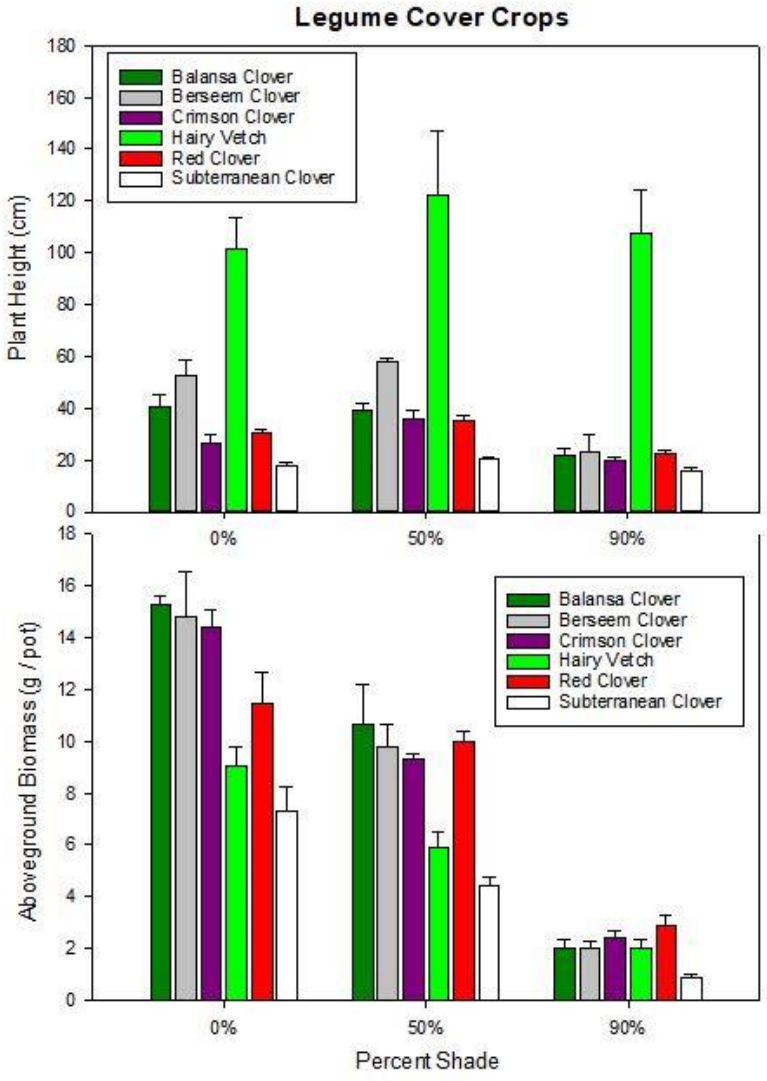


90% Shade

PRELIMINARY DATA

Greenhouse Experiment 2017





PRELIMINARY DATA

Greenhouse Experiment 2017

Cover Crop	50% Shade Tolerance Index	90% Shade Tolerance index
Forage Collard	100.81	45.00
Tillage Radish	85.67	52.30
Balansa Clover	69.91	13.15
Berseem Clover	66.18	13.59
Crimson Clover	64.72	16.93
Hairy Vetch	65.14	22.52
Red Clover	87.13	25.17
Subterranean Clover	60.88	11.81

50% Shade Tolerance Index
= (Dry Weight @ 50% Shade / Dry Weight @ 0% Shade) x 100

90% Shade Tolerance Index
= (Dry Weight @ 90% Shade / Dry Weight @ 0% Shade) x 100

Summary

- Interseeding at V5-V6 poses little risk to corn yields.
- Interseeding legumes into continuous corn may offer yield benefits in the following year if cover crop generates >1000 lbs/a of spring biomass.
- Successful interseeding is still heavily reliant on timely and adequate rainfall in June and July.
- Higher yield environments (>200 bu/a) may generate too much shade for successful cover crop establishment.
- Brassicas (collards and radishes) appear to exhibit more shade tolerance than legumes.

Questions?

Cover Crop Selection Tool

http://www.mccc.msu.edu/selectorINTRO.html


Cereal Rye


Winter Wheat


Oats


Hairy Vetch


Red Clover


Forage Radish