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NORTHEAST SARE
Sustainable Agriculture Research & Education

Planting Green

Research and Experiences from the Keystone State

By Sjoerd Duiker and Heidi Reed

Penn State University

With Heather Karsten ◦ Bill Curran ◦ John Tooker ◦ Ron Hoover

The Basics

Farmers Plant Green For:

- **Soil Health**

Farmers Plant Green For:

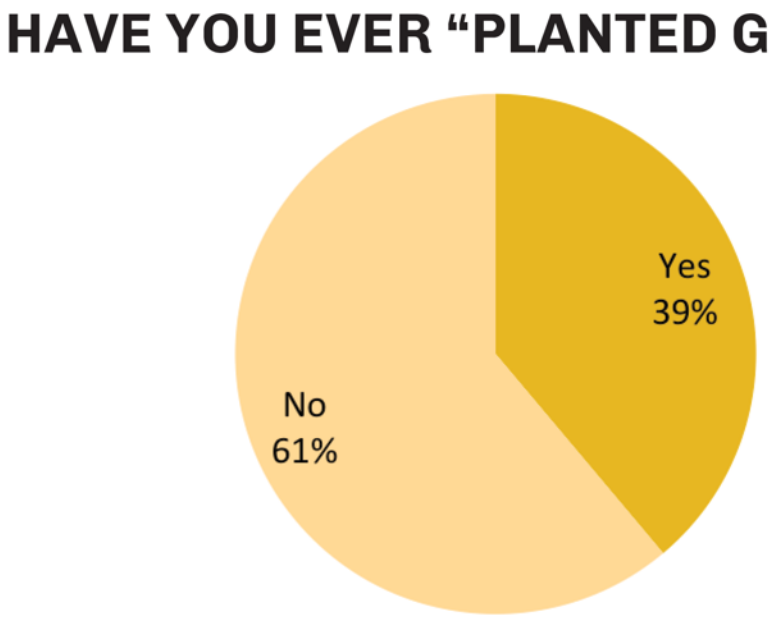
- Soil Health
- **Water Management**

Photo courtesy Ron Hoover, Penn State University

Farmers Plant Green for:

- Soil Health
- Water Management
- **Slug management***

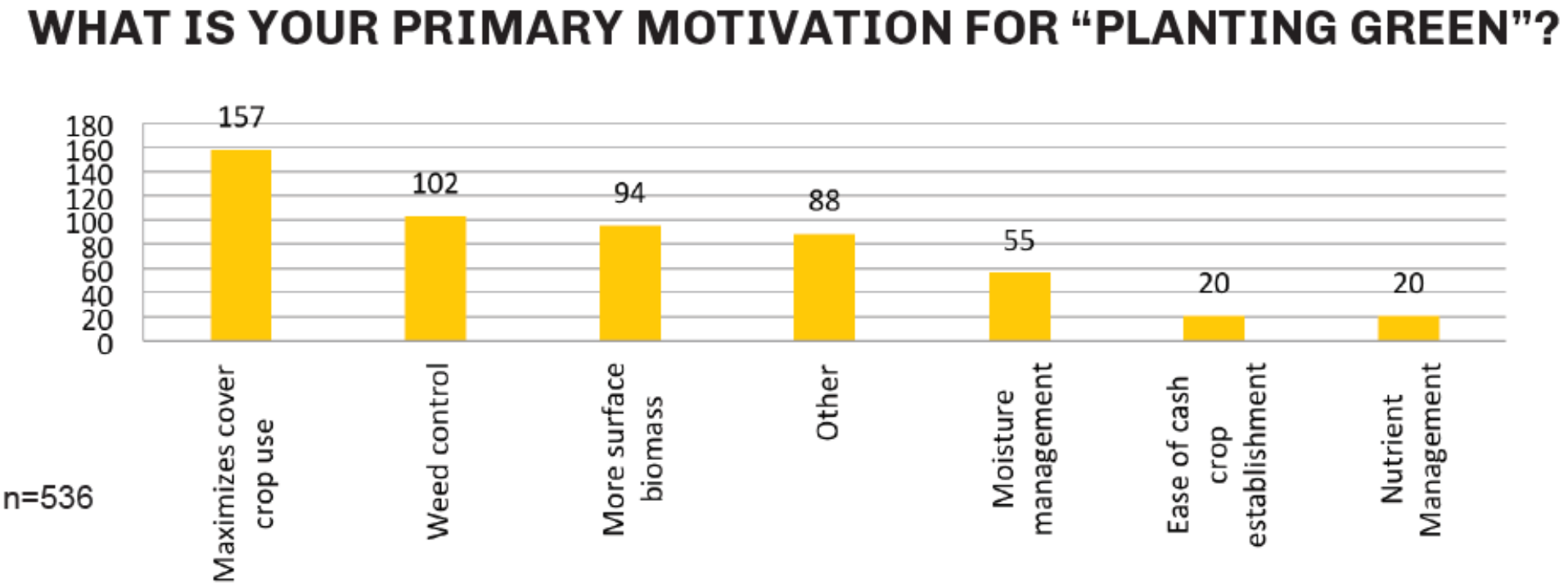
SARE Cover Crop Survey 2016-2017



N=1,412

Many no-till farmers are already using planting green

SARE Cover Crop Survey 2016-2017

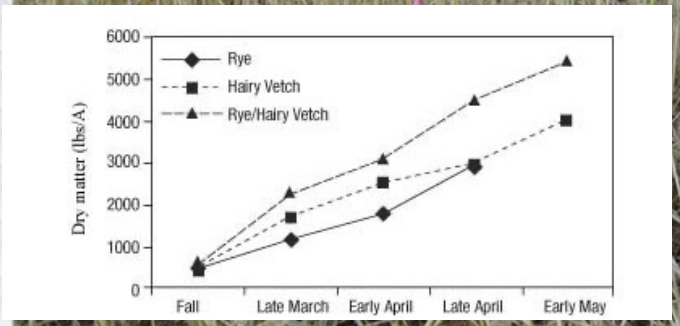


Primary motivation for planting green is to **maximize cover crop benefits**, such as **weed control** and more **organic matter**

Reasons for Planting Green: Increased Cover Crop Biomass

1,767 lb/A
Killed 4/28/2016
(~3 wks before planting)

4,495 lb/A
Killed 5/20/16
(at planting)



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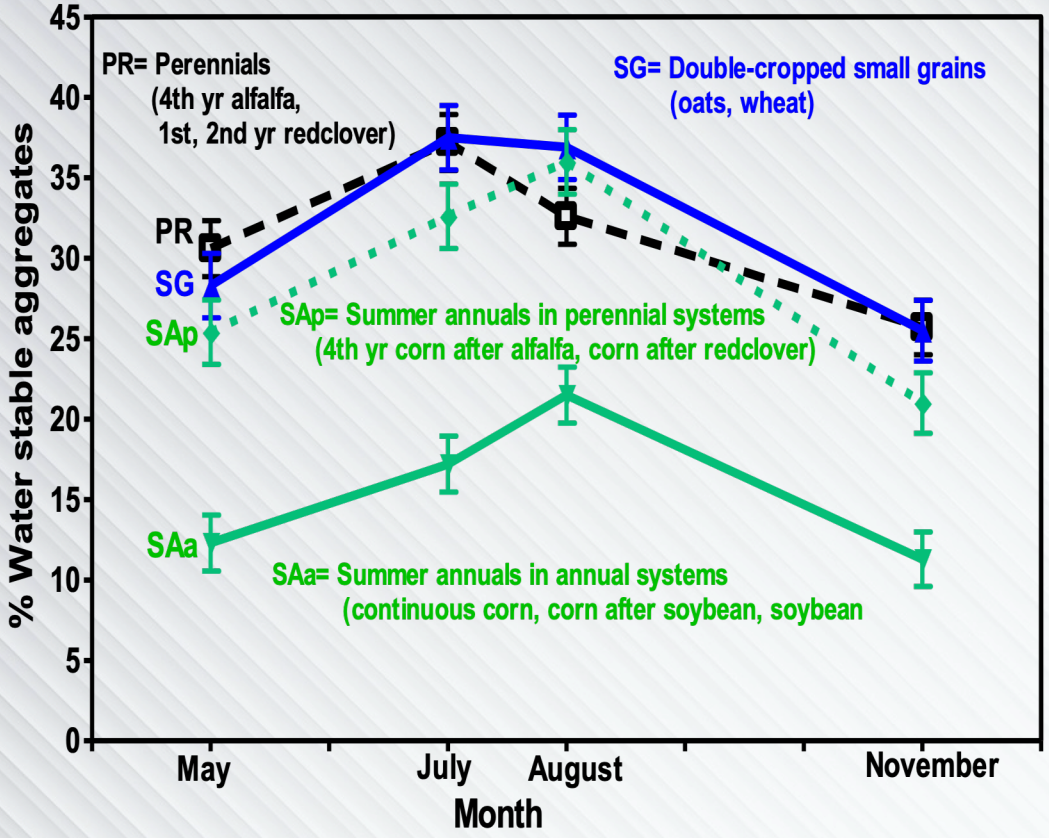
Reasons for Planting Green:
Problems No-Tilling into Partially-Killed Cover Crop

Cover crop partially dead – difficult to cut by coulter, ‘hairpinning’

Creating ”Cover Crop Bales” with Row Cleaner

Reasons for Planting Green: Increased Root Mass to Improve Soil Structure



Most Biological Activity Around Live Roots

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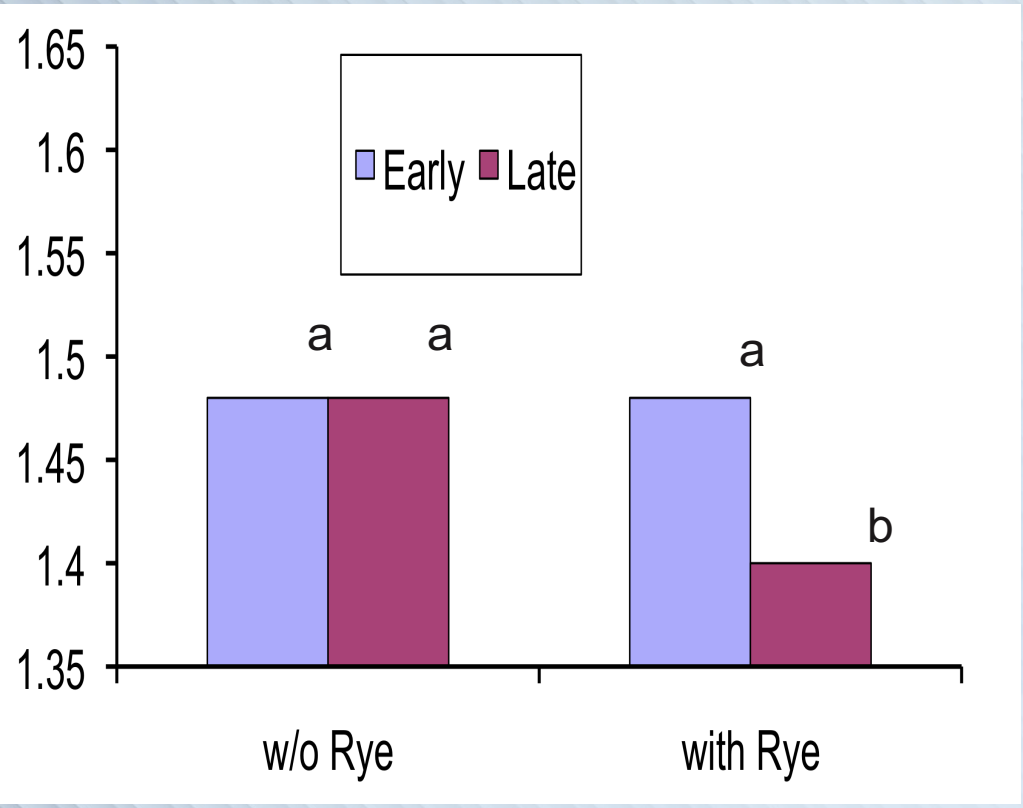
Reasons for Planting Green:
Big Root System Helps Soil Resist Compaction



With Rye

w/o Rye

Both samples under manure spreader tracks on dairy farm op

Rye effect on bulk density (g/cm^3) in summer

Hopes and Concerns

Will Planting Green:

1. *Reduce or increase soil moisture in spring?*
2. *Reduce soil temperature in spring?*
3. *Conserve extra soil moisture in summer?*
4. *Increase beneficials and reduce slugs and other pests?*
5. *Improve or reduce cash crop yield*

We compared NT corn and soybeans planted
1. Into early killed rye (1-3 wks prior to planting) to
2. Planting Green

Planting Green Research from 2015-2017

PENNSYLVANIA
www.amaps.com
0 25 Miles
50 KM

Clinton Co. Cooperator

Centre Co. Cooperator

Rock Springs

Landisville

Lancaster Co. Cooperator

Dawn Biologic ZRX

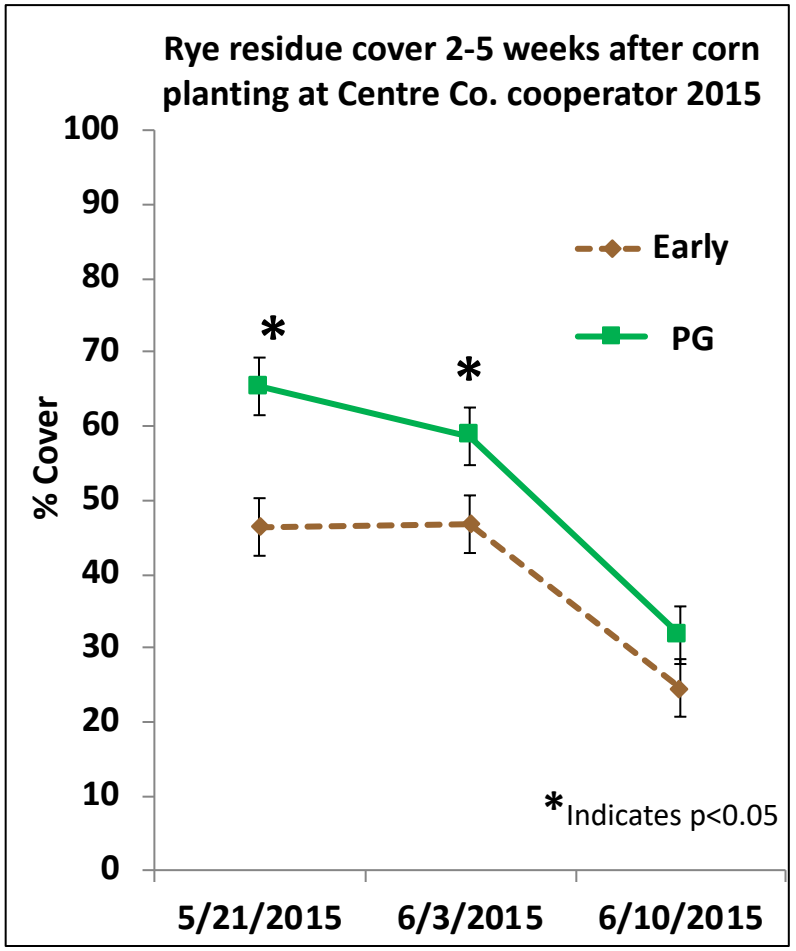
Clinton Co. Cooperator NT drill

Centre Co. Cooperator NT planter w/ aggressive row cleaners

Effects of Planting Green

Effect 1: Planting green doubled cover crop biomass and increased residue cover

Rye killed 27 days before planting (L) and one day after planting (R). Clinton Co. cooperator site, June 21, 2016



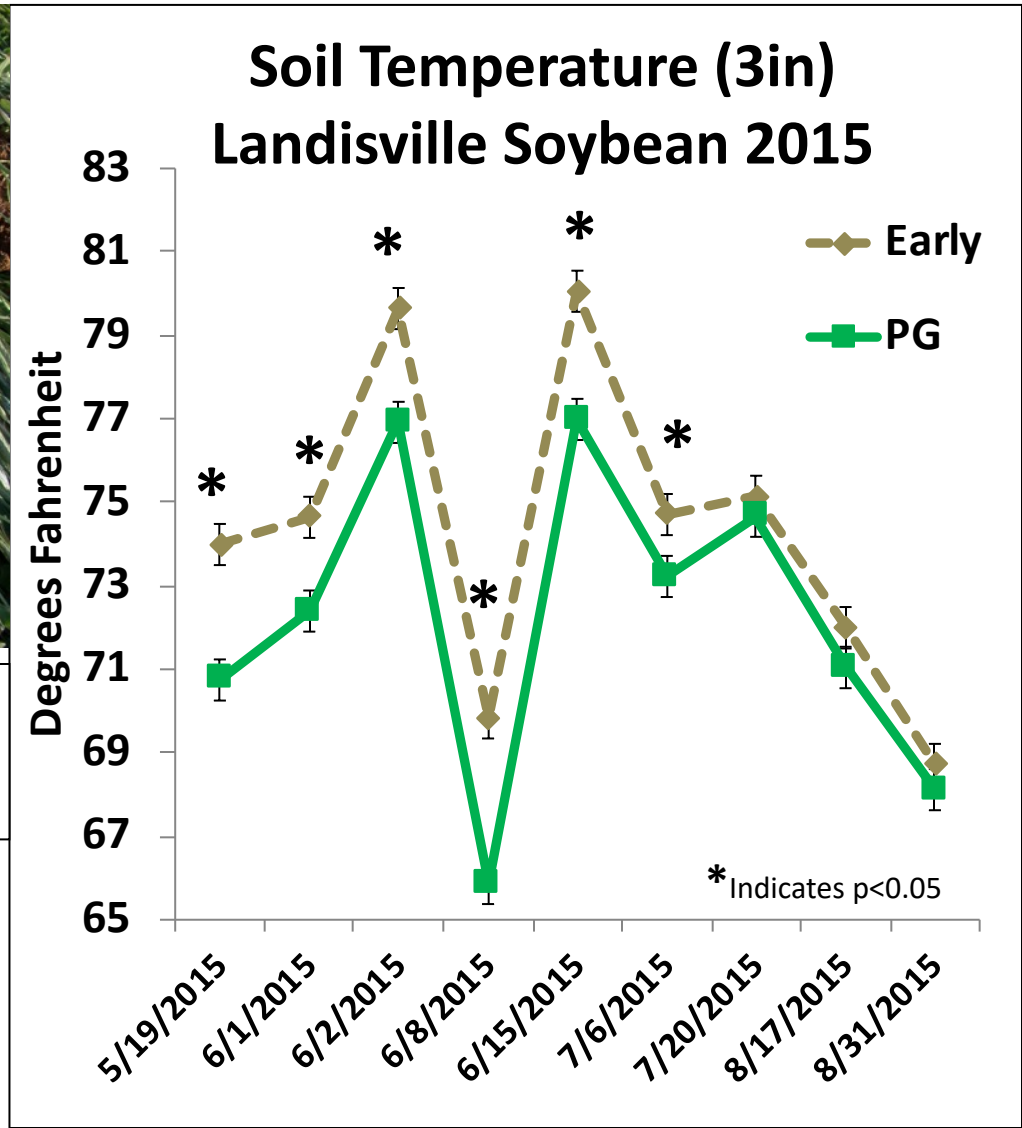
Percent residue cover estimated using the NRCS Transect Method. USDA.NRCS.Agronomy Tech Note #MN-19. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_022074.pdf

Rye residue after planting green generally lasts the entire growing season

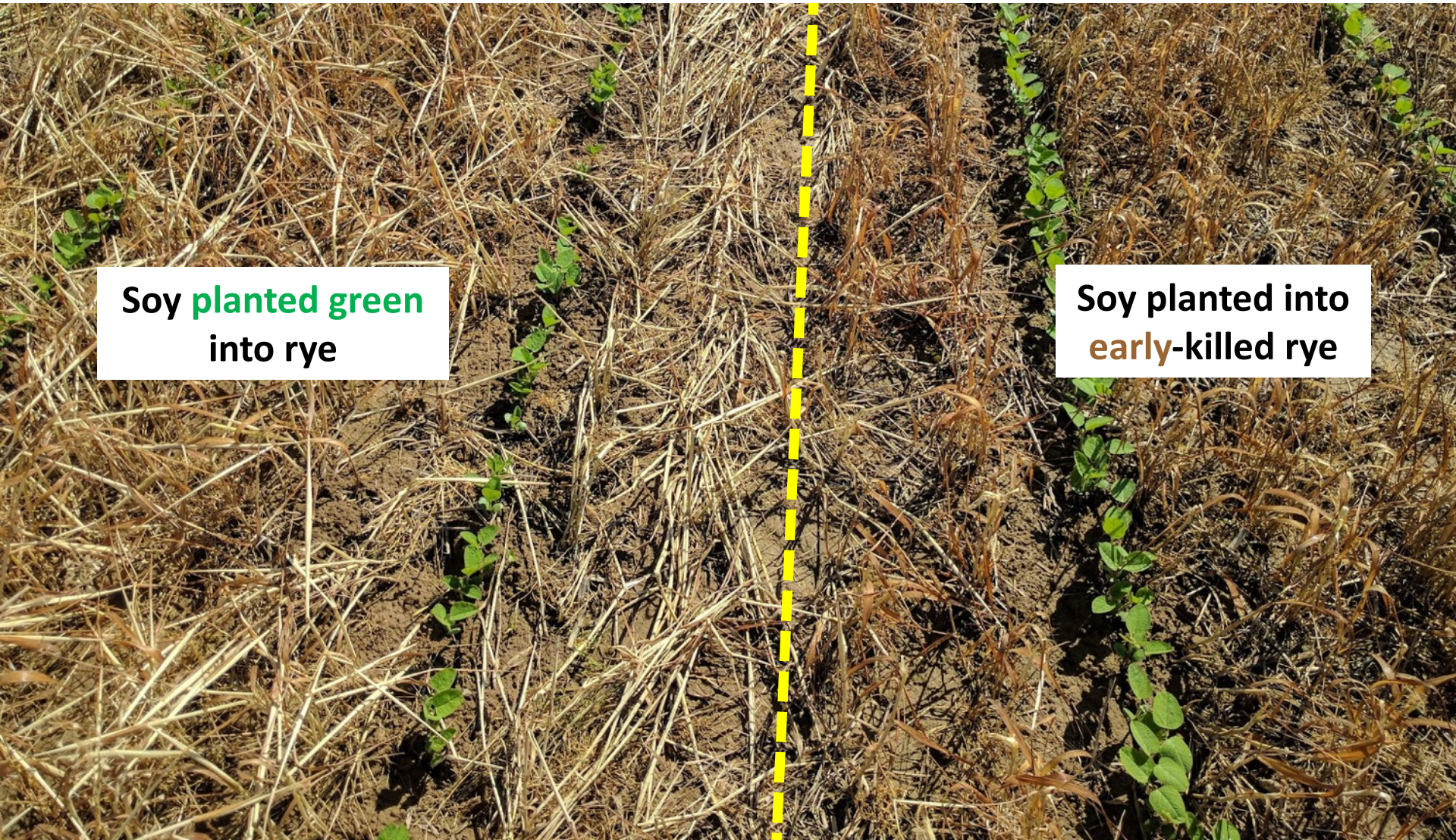
Clinton Co. Cooperator, October19, 2017

Effect 2: Increased biomass/residue meant cooler soil throughout the growing season

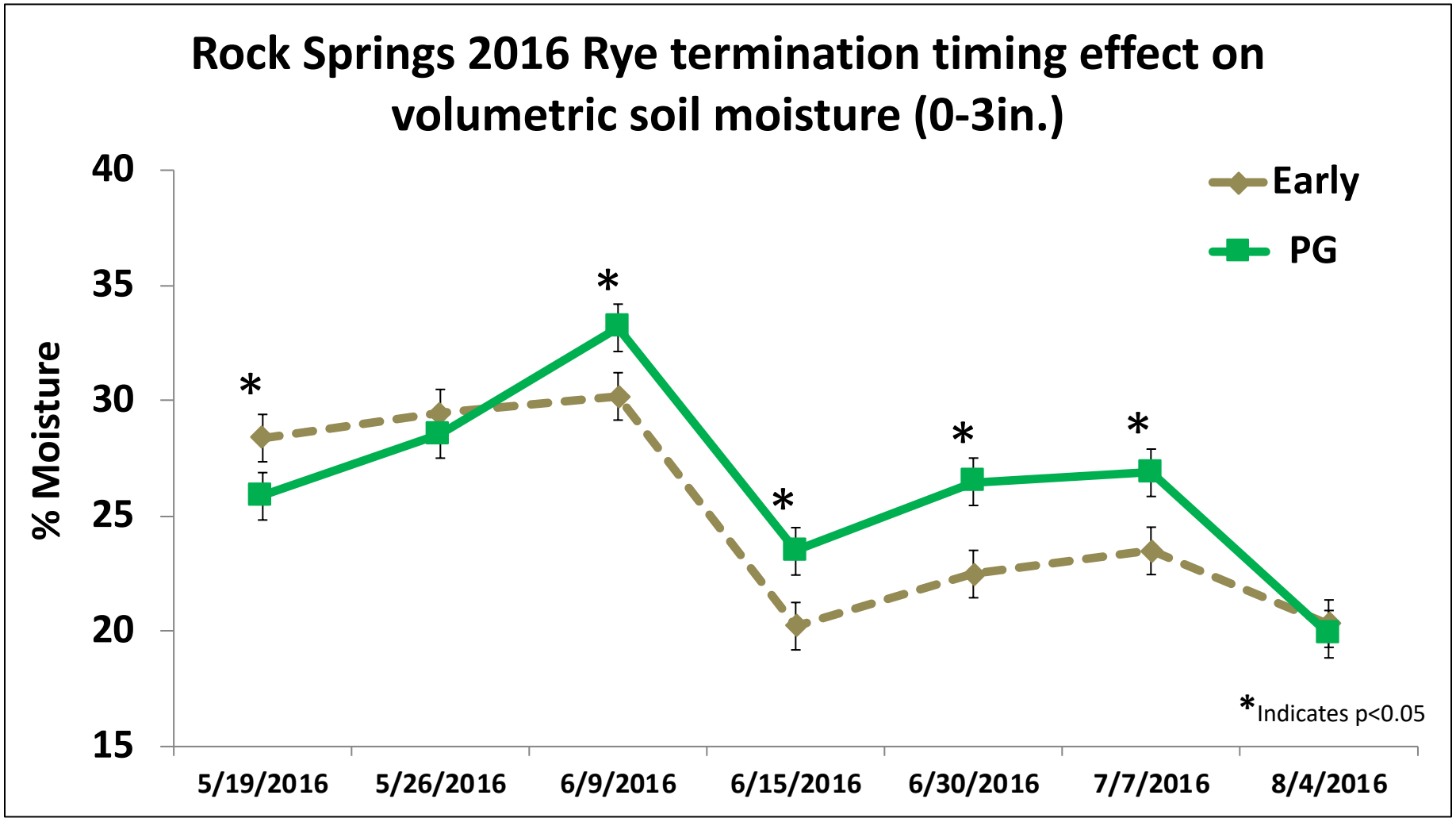
Measuring soil moisture and temperature at planting at Landisville Research Farm. May 19, 2015



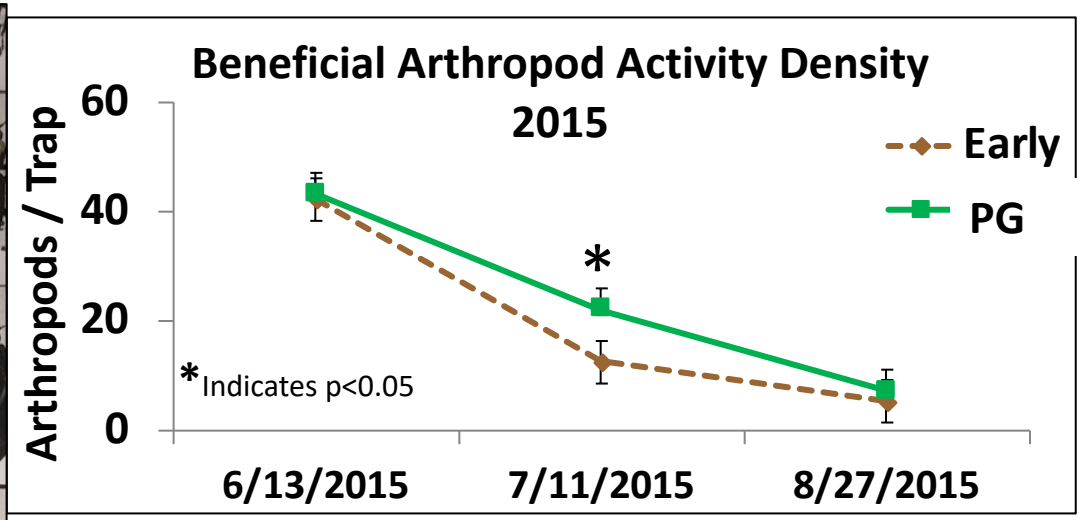
Cooler soils (PG) delayed cash crop emergence and maturity



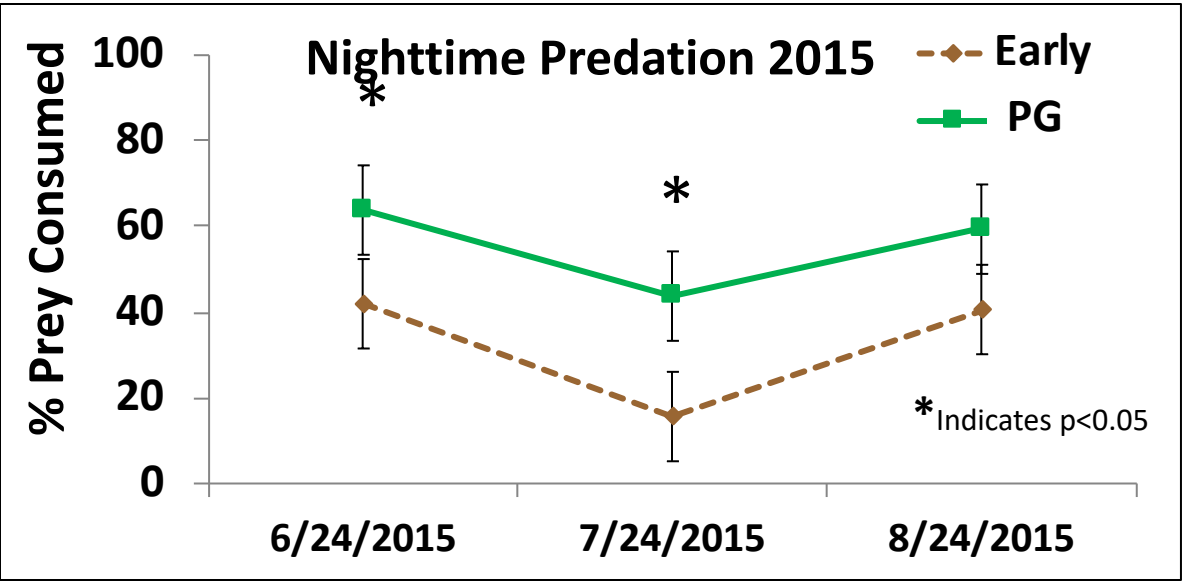
Effect 3: Planting Green dried soil at planting, but conserved soil moisture later



Effect 4: Groundbeetle activity-density was higher in July in planted green corn (1/3 site-years)



Effect 4: Caterpillar predation was higher in June and July in planted green corn (1/3 site-years)



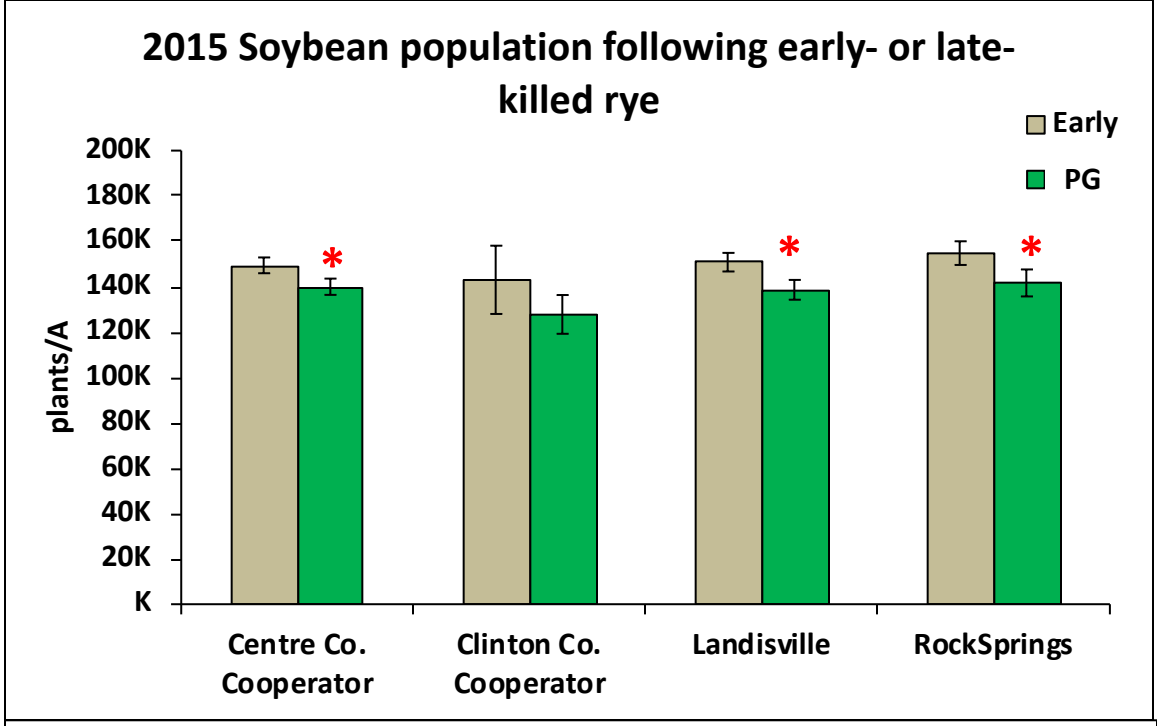
Planting Green Effect on Soybeans

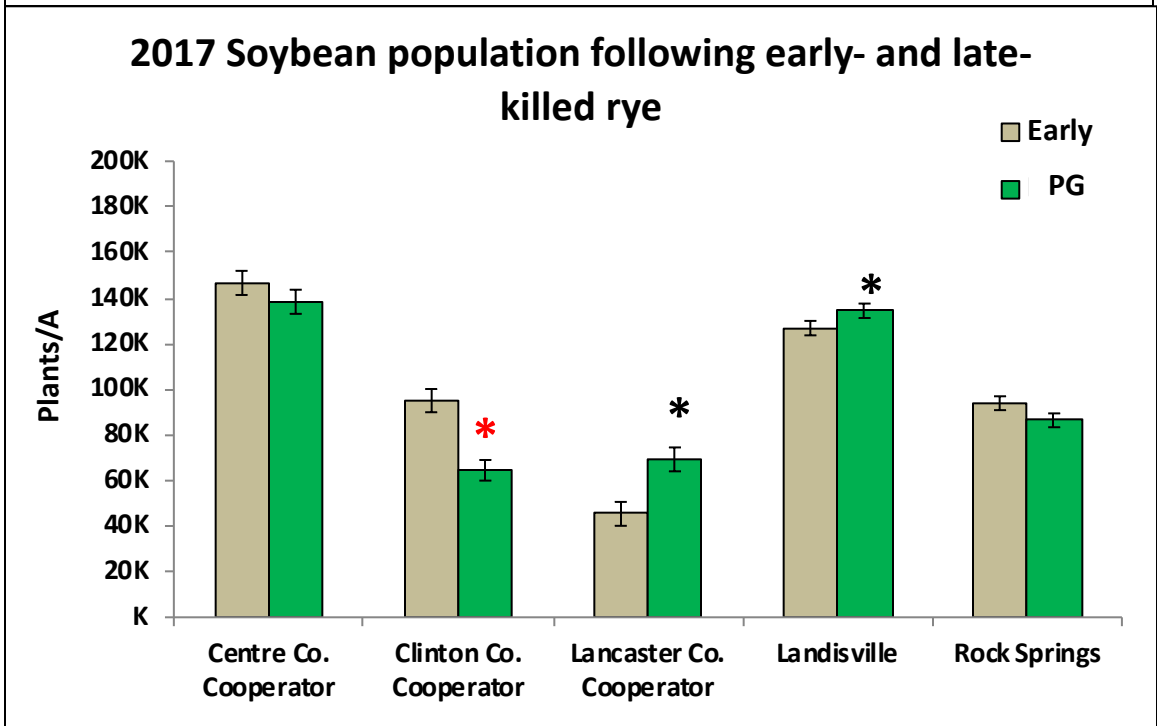
Centre Co. Cooperator, June 28, 2016

SOYBEAN POPULATION

- With dry spring in 2015, planting green resulted in 8% reduction in soybean population

- In more typical 2016 and 2017 spring, soybean populations were the same or higher when planted green, except one site in 2017 where extreme winds knocked down tall rye

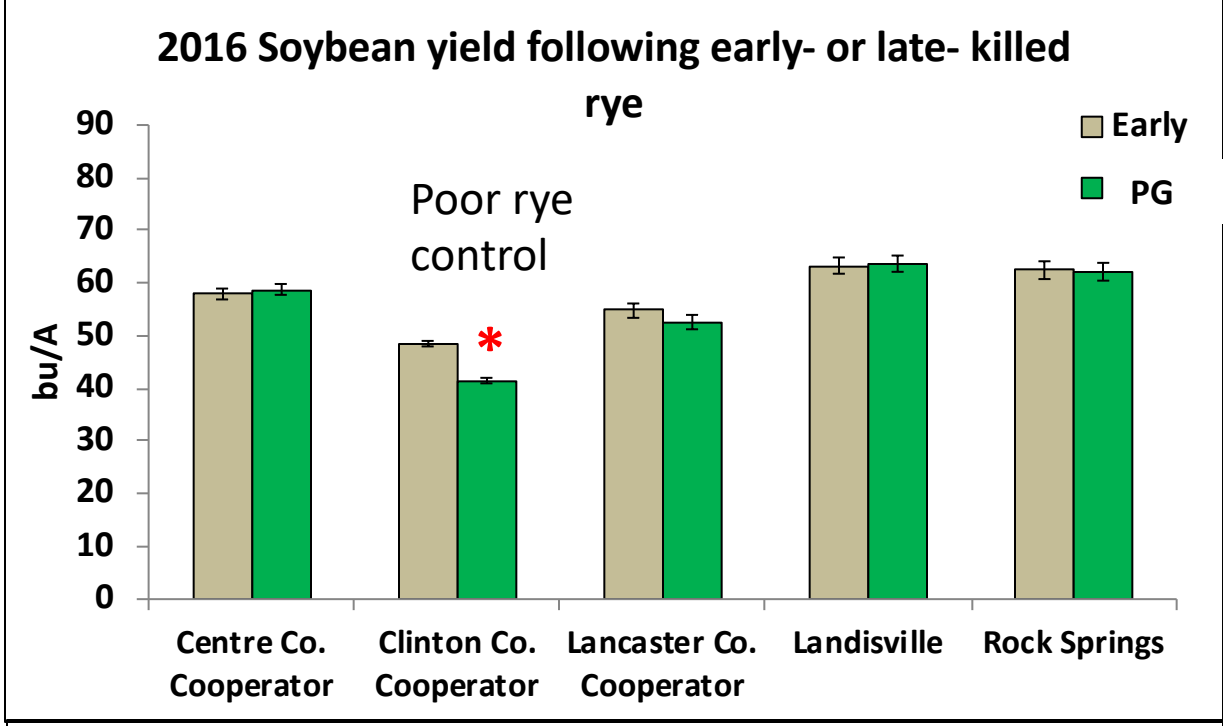


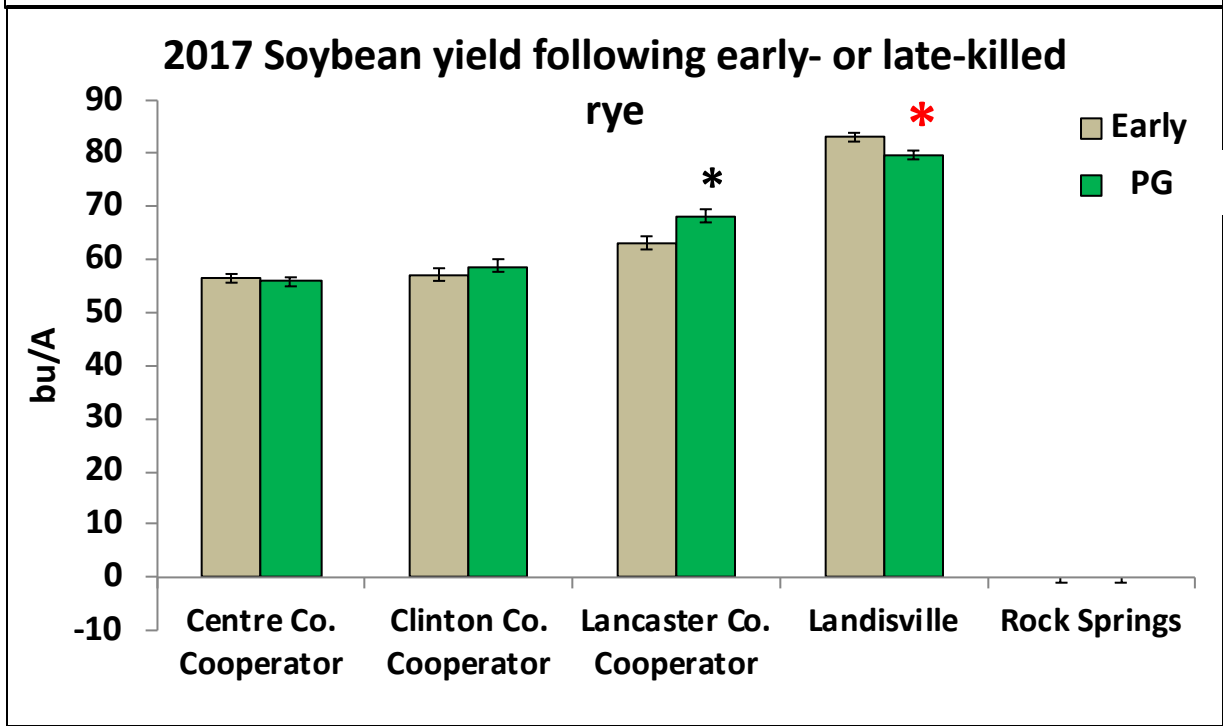


SOYBEAN YIELD

- Soybean yield was not different or higher when planted green 11 of 13 site years

- Planting green reduced yield by 15% at one site in 2016 when late rye termination was unsuccessful, and by 4% at one site in 2017



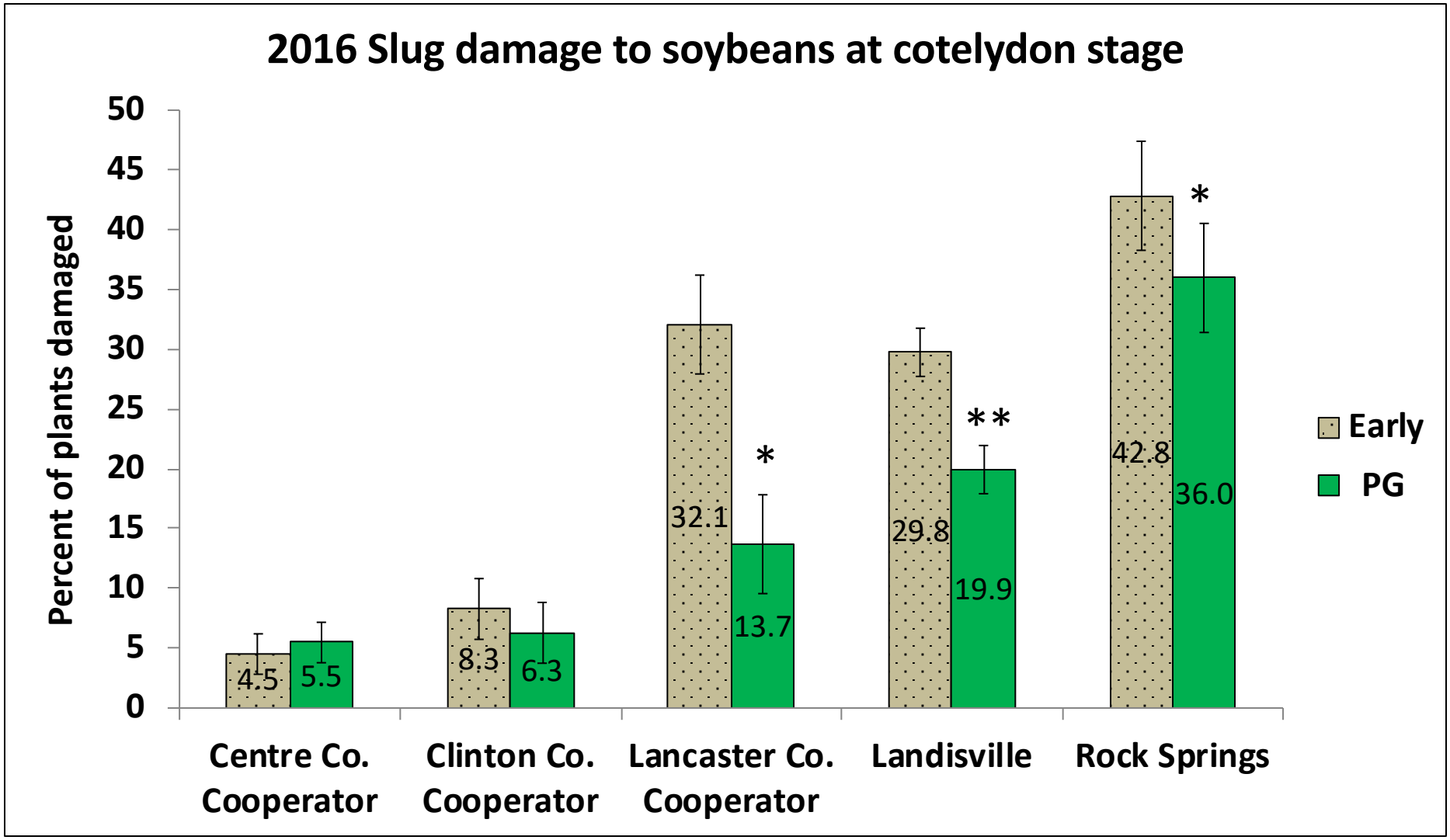


Some Planting Green Challenges

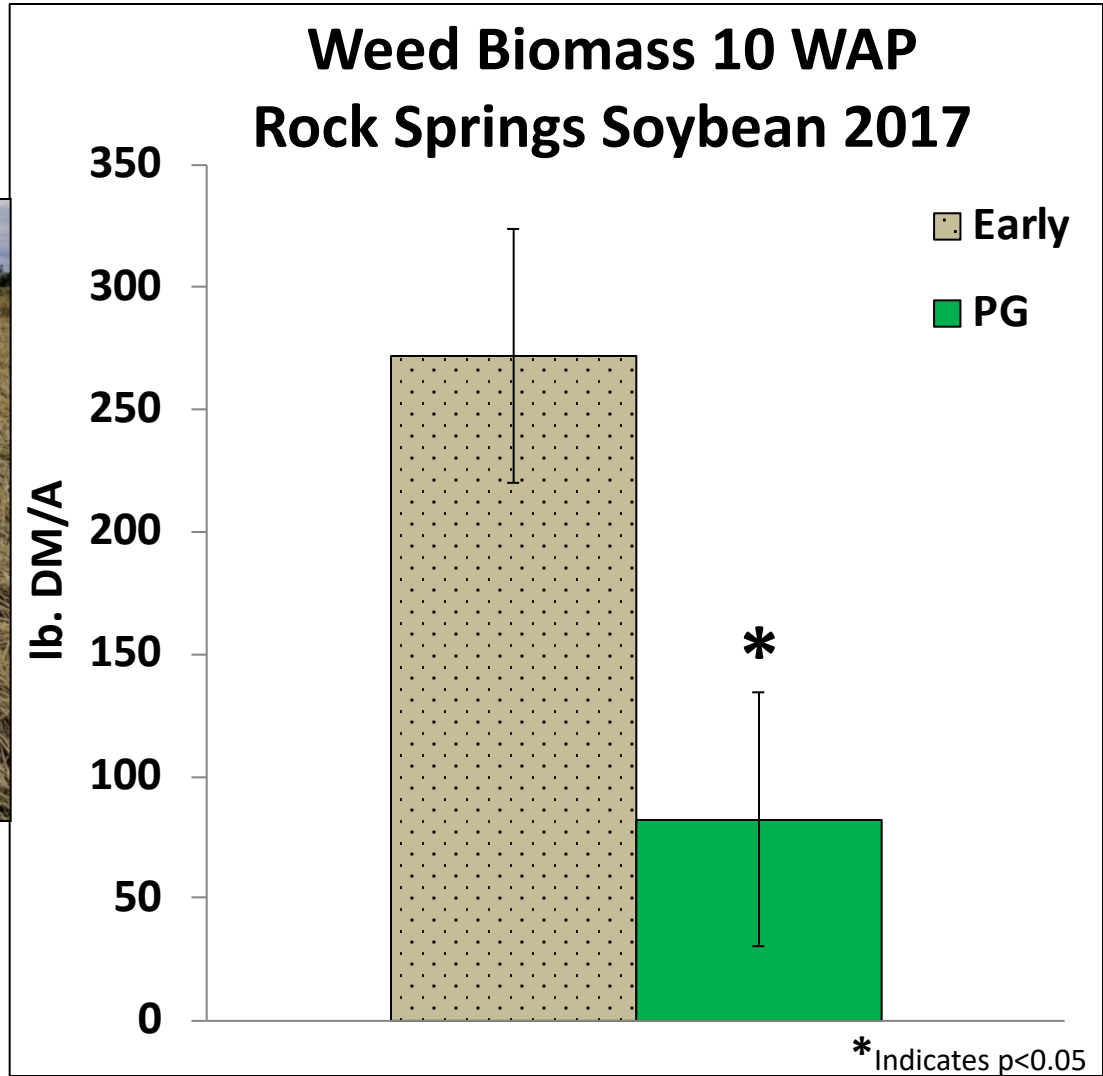
Clinton Co. Cooperator, June 21 , 2016 (3WAP)

Some Planting Green Challenges

Slug feeding on soybeans was reduced by 35% when planted into green rye (3/5 sites) in 2016



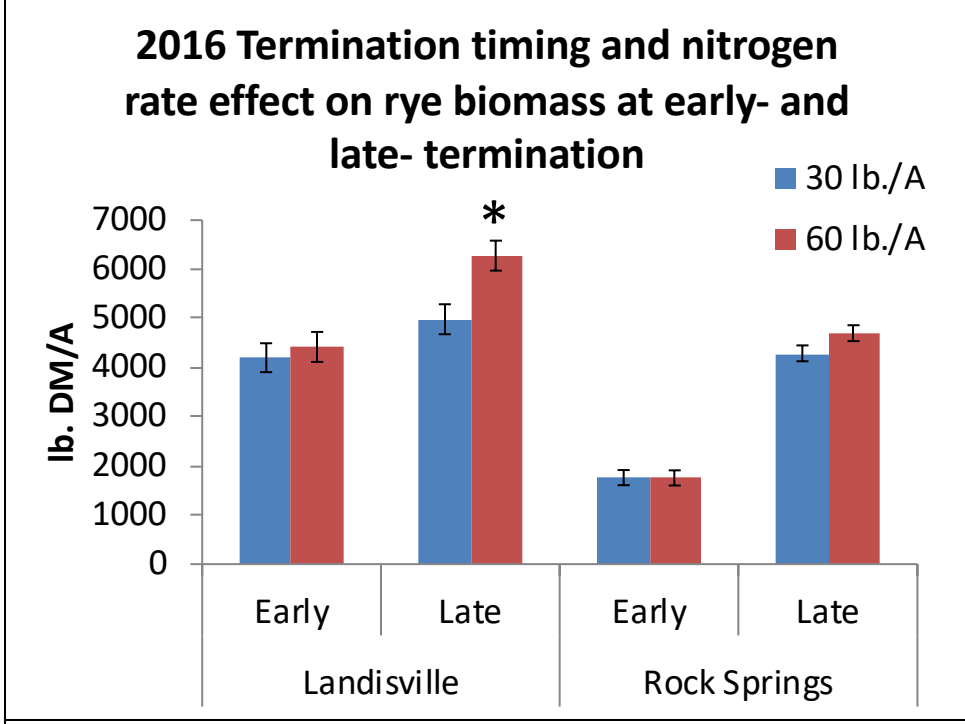
Late-season weed biomass was reduced by 70% in 2017 when soybeans were planted green

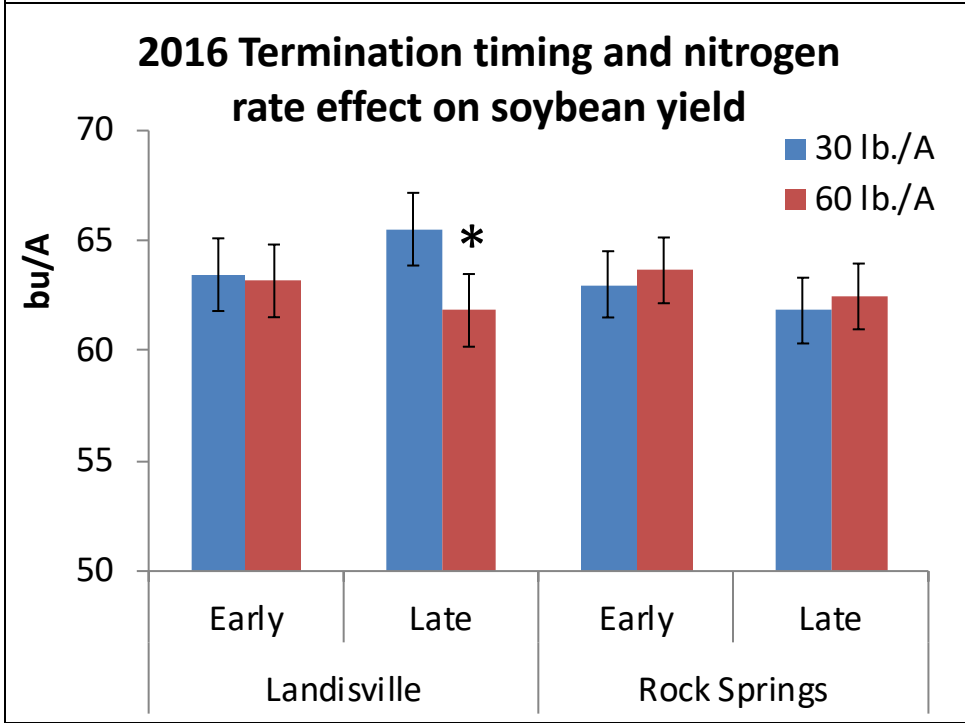


Rye seeding rate and N fertilization effects

- Rye seeding rate didn't impact rye biomass or soybean yield–farmers can save $$ on seed

- Putting too much N on rye cover crop can have negative impacts on soybean yield—could have rotation and manure management implications

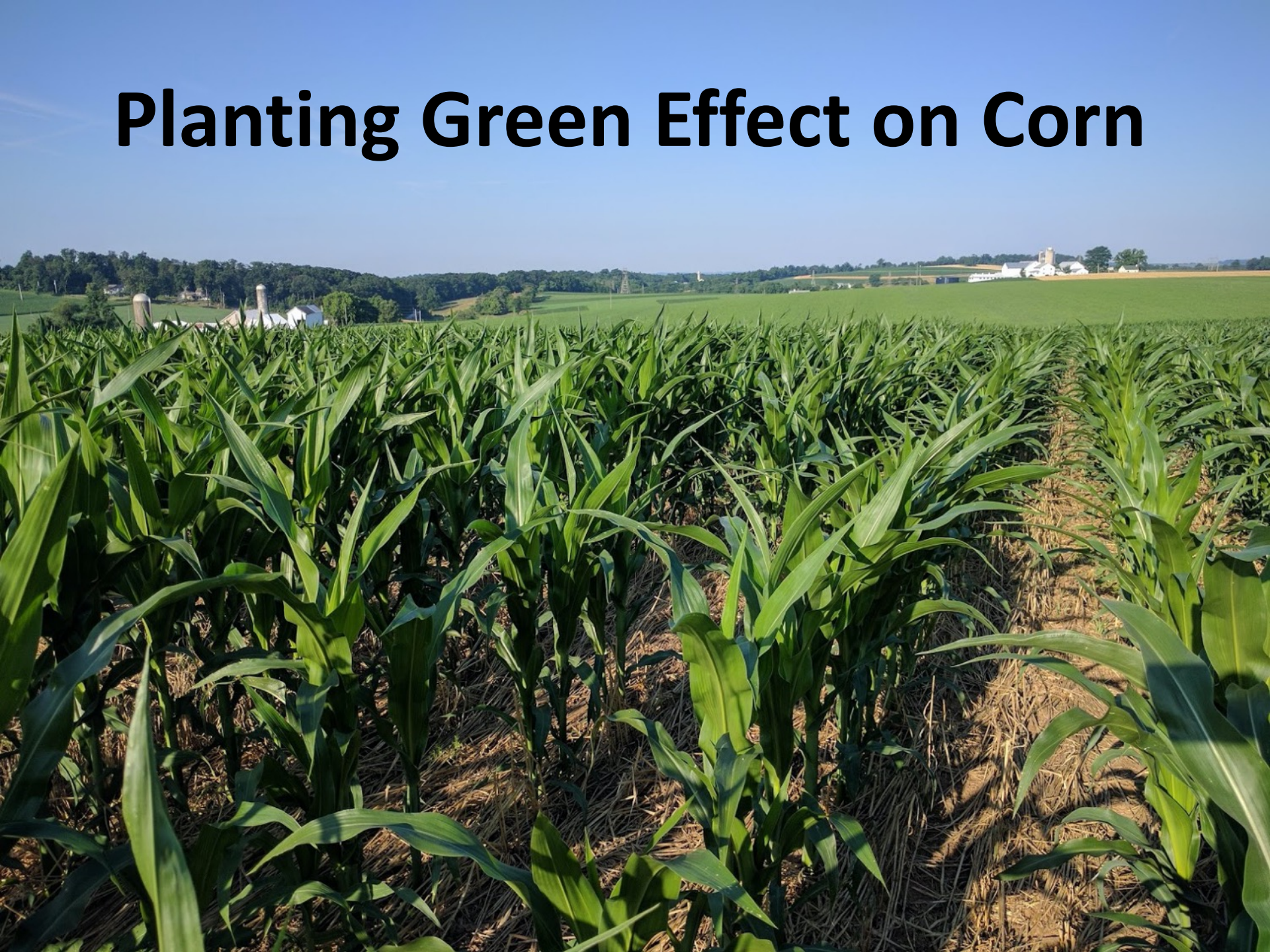




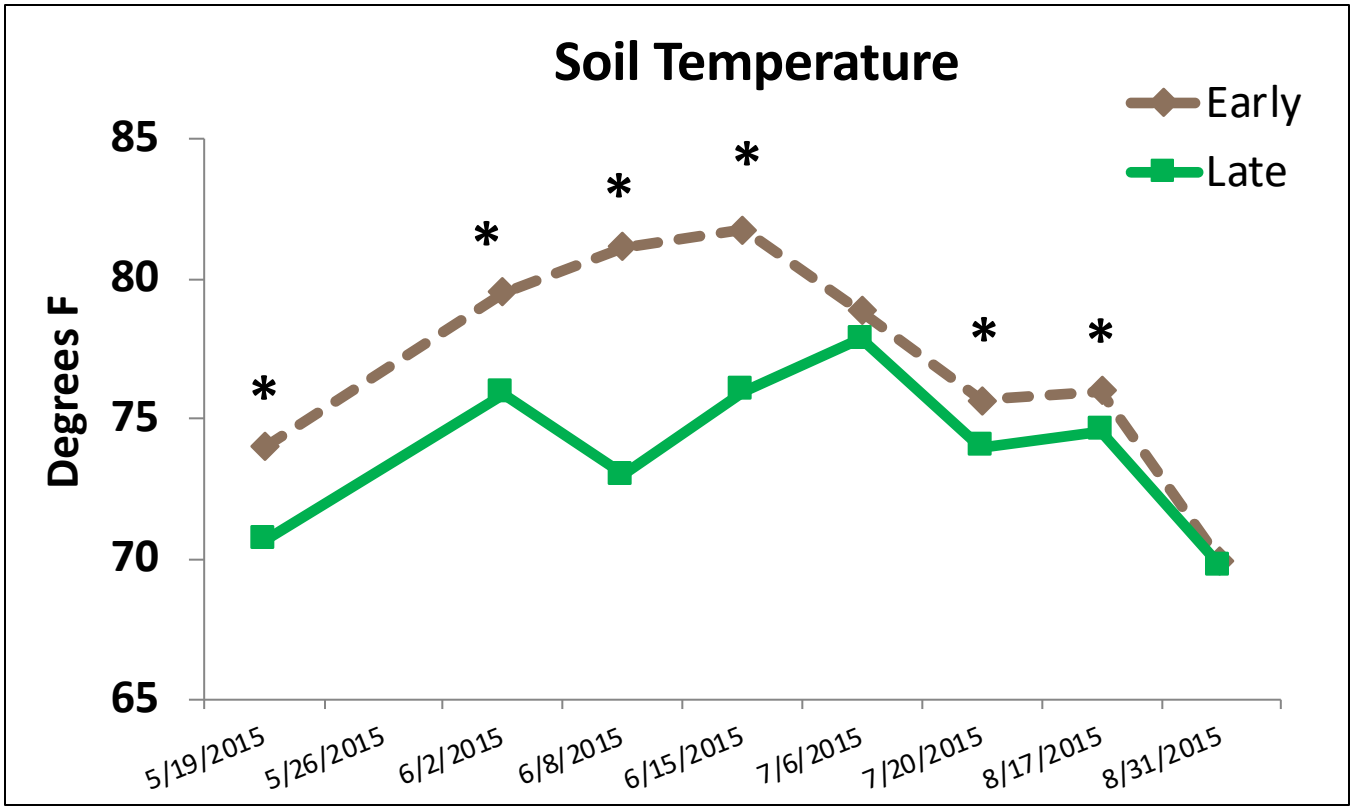
Planting Green for Soybeans …

- Allows for more rye biomass accumulation
- Increased beneficial predator activity in one year
- Reduced slug damage in soybeans (2016) and corn (2017)
- Dried soil at planting, conserved moisture later
- Soybeans yielded the same or more than early-kill at 12/14 site years
- **Can plant lower rye seeding rate with little effect**
- **Caution when applying fertility to rye cover if planting green**

Planting Green Effect on Corn

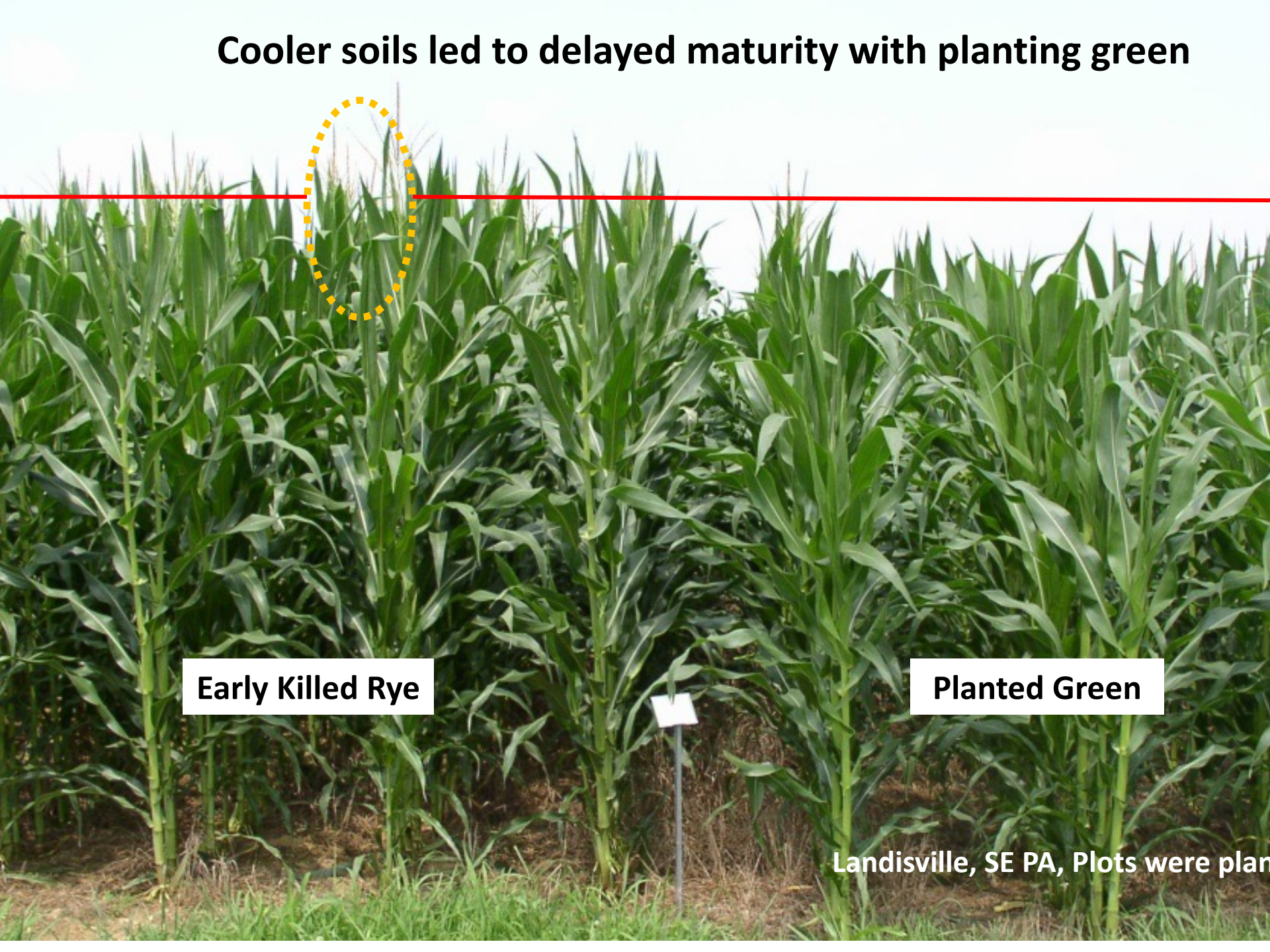


Soil temperature was several degrees cooler in planted green corn for most of the growing season

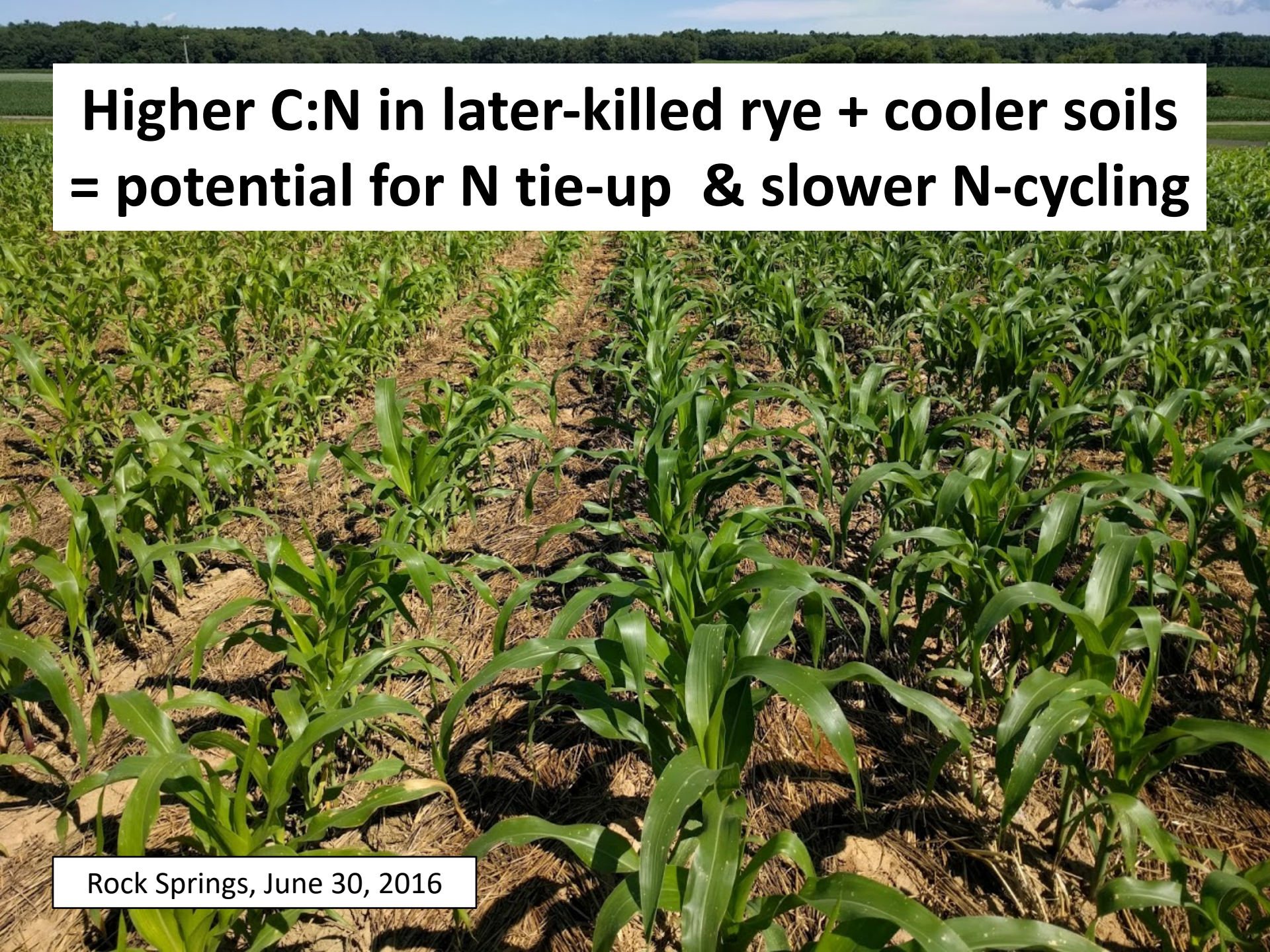


Landisville

Cooler soils led to delayed maturity with planting green



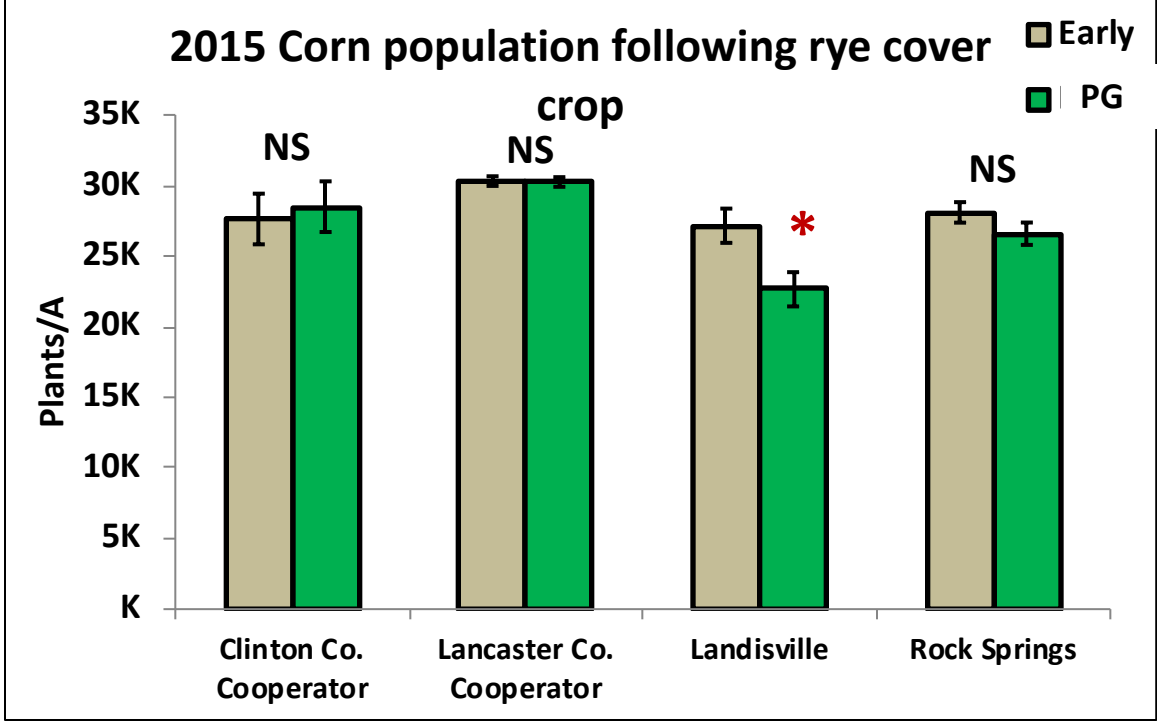
Higher C:N in later-killed rye + cooler soils = potential for N tie-up & slower N-cycling



Rock Springs, June 30, 2016

2015

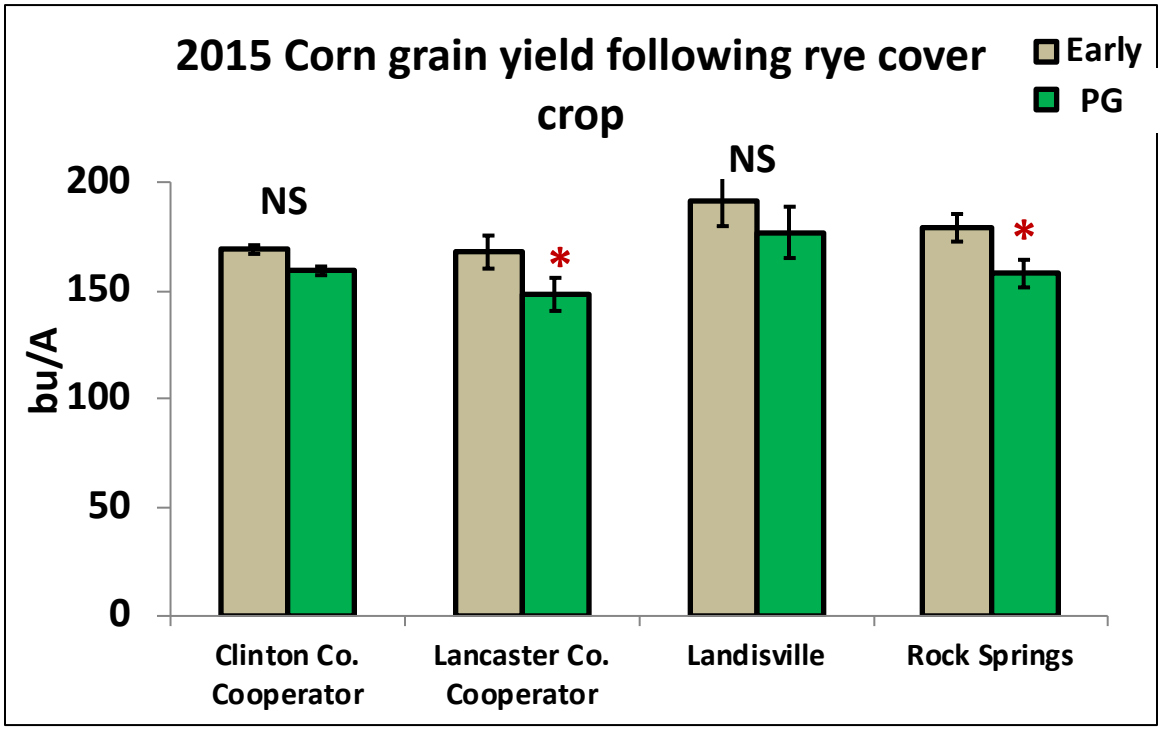
- **Very dry soils at planting (ex. Rock Springs avg. 15% moisture), difficulty achieving 2” planting depth**




Poor stand establishment due to dry soil at planting, cover crop interference, insects(?)
Landisville, June 2015

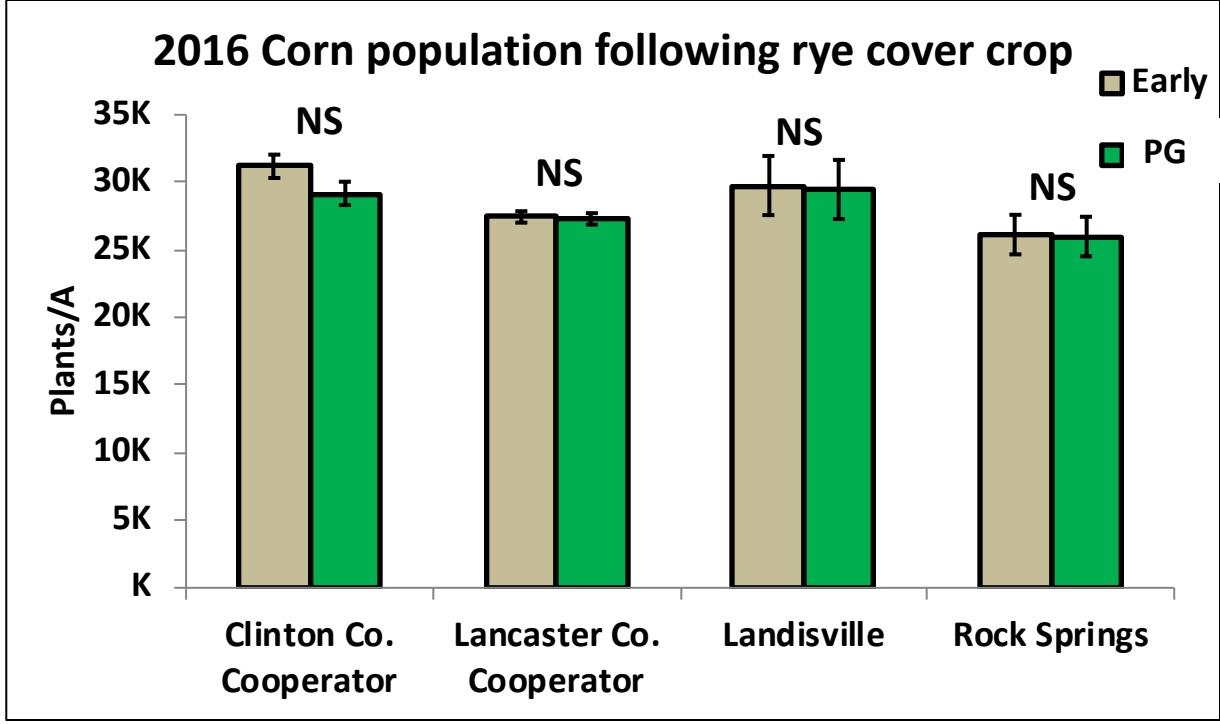
2015 – dry spring

- Half of sites had **10% corn yield reduction** when planted green



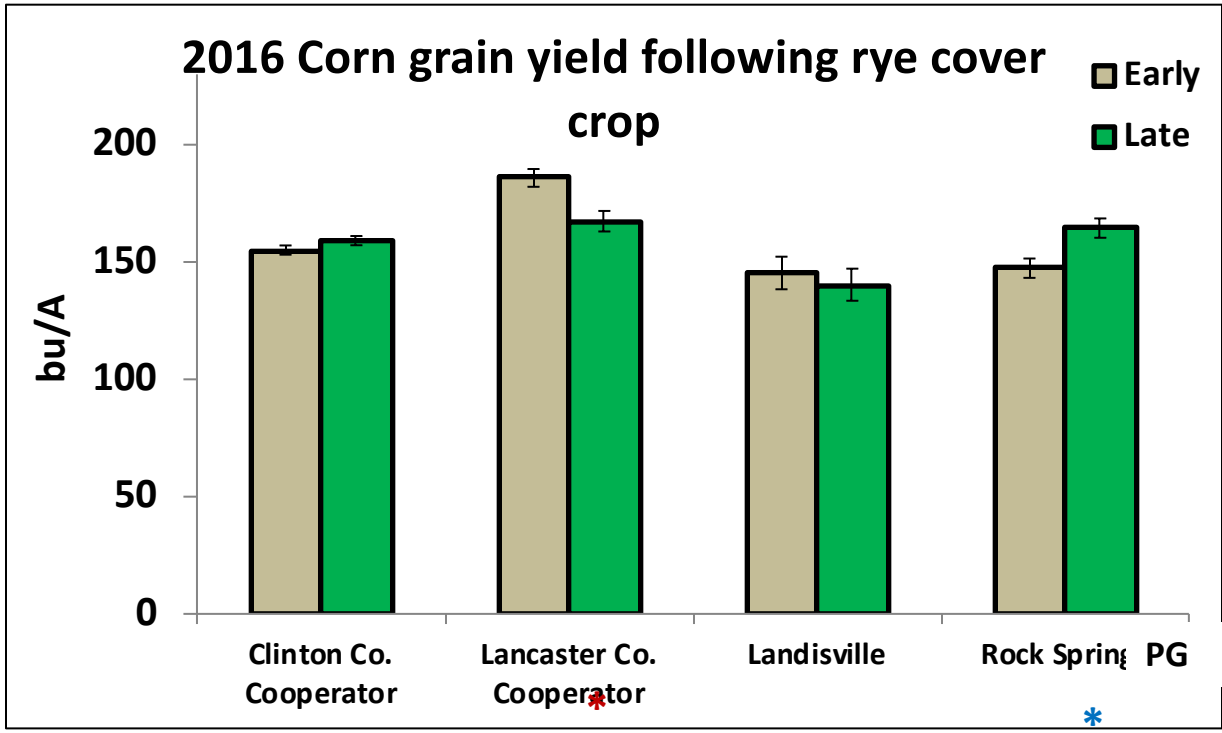
2016 - ample spring moisture

provided good planting and establishment conditions



2016 – moist spring

- **10% yield loss at one location** likely due to slug damage followed by drought stress



2016 - Moist Spring

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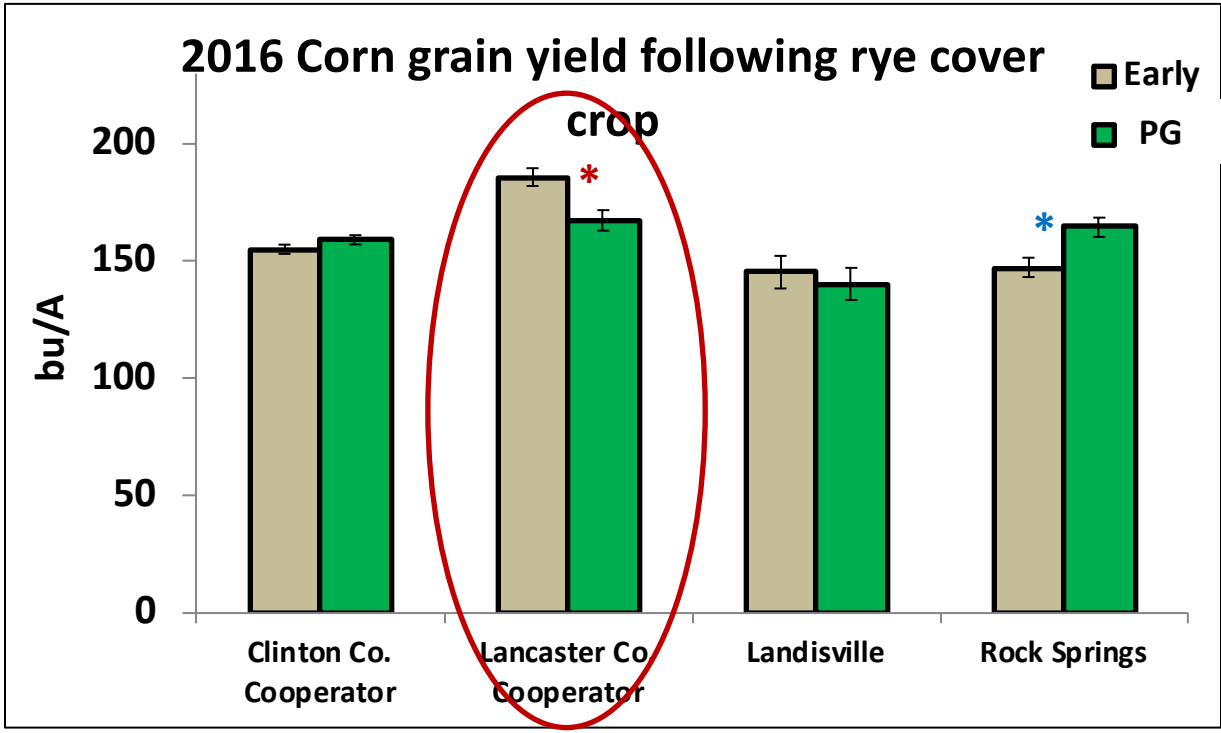
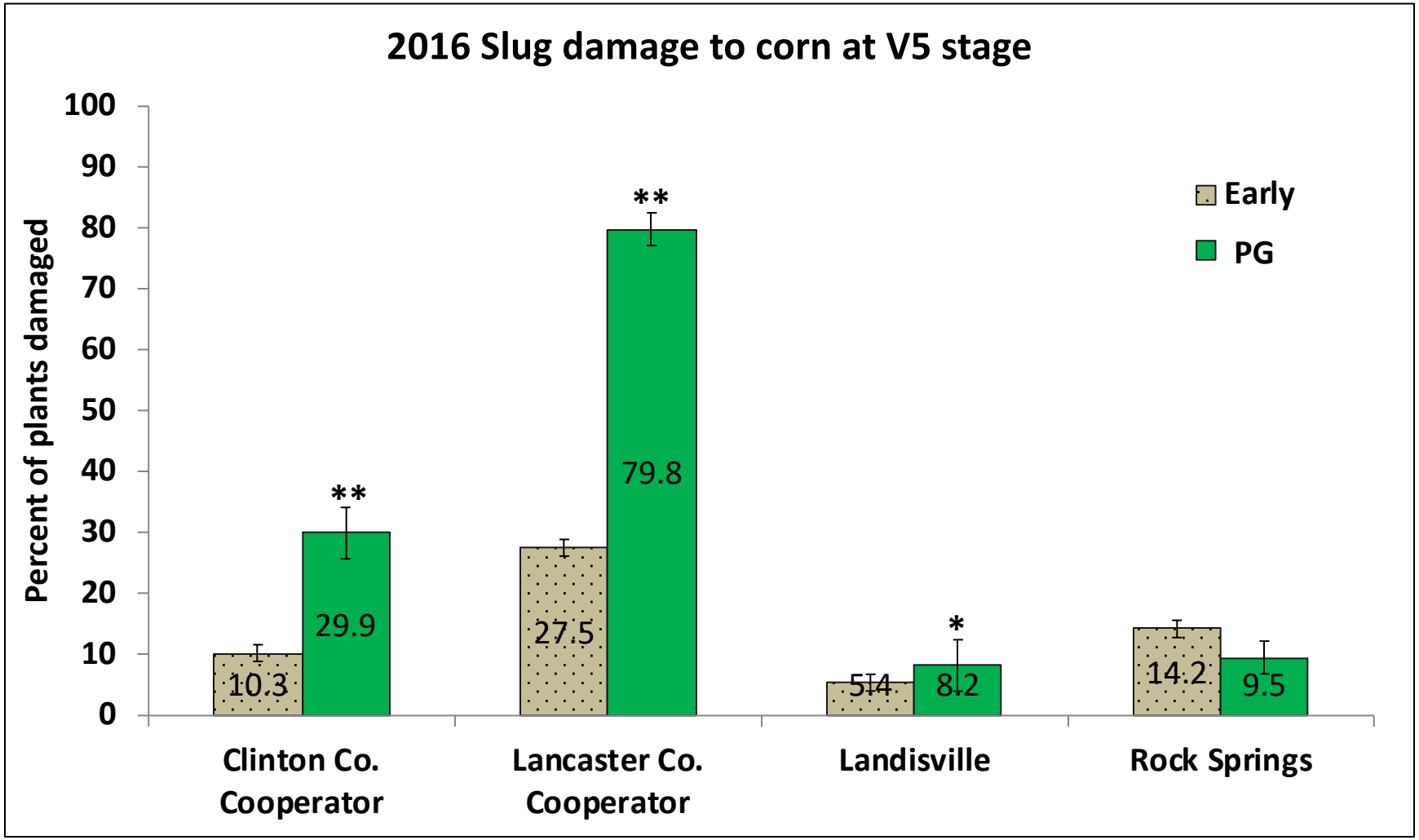


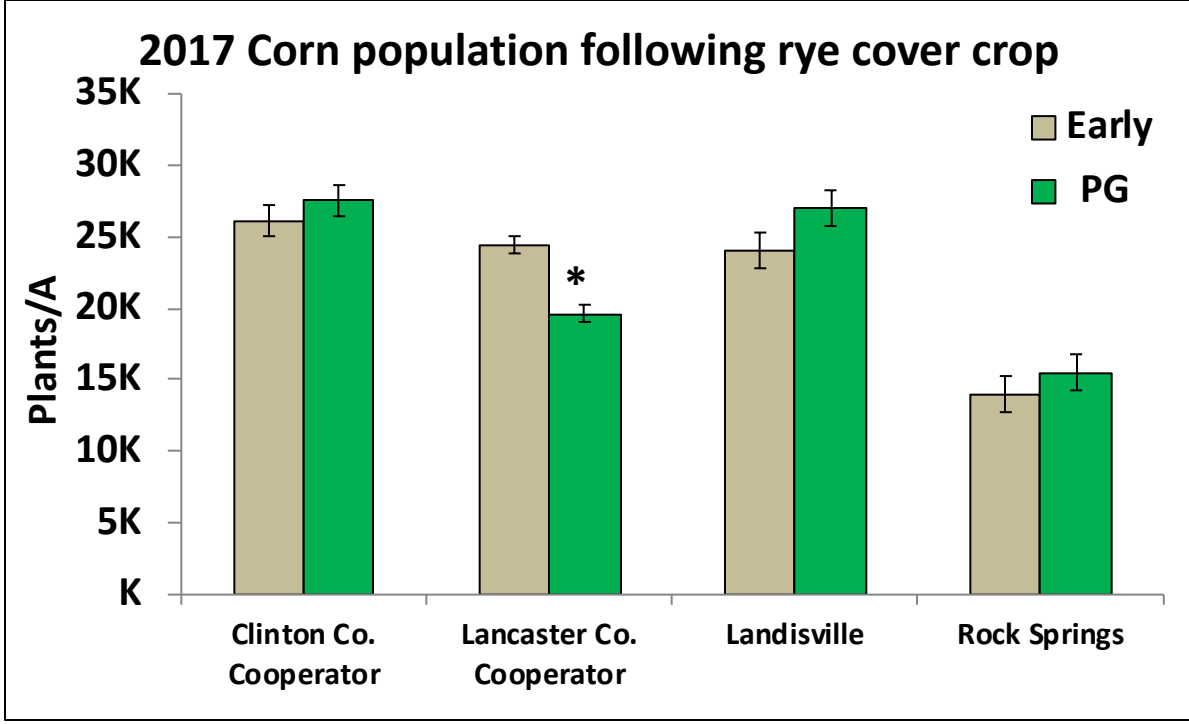
2016: Slug feeding on V5 corn increased by 144% when corn was planted green into rye (3/4 sites)



Increased slug damage was seen when corn was planted green. Lancaster County cooperator site. July 2, 2016.

2017 ample spring moisture but cold,

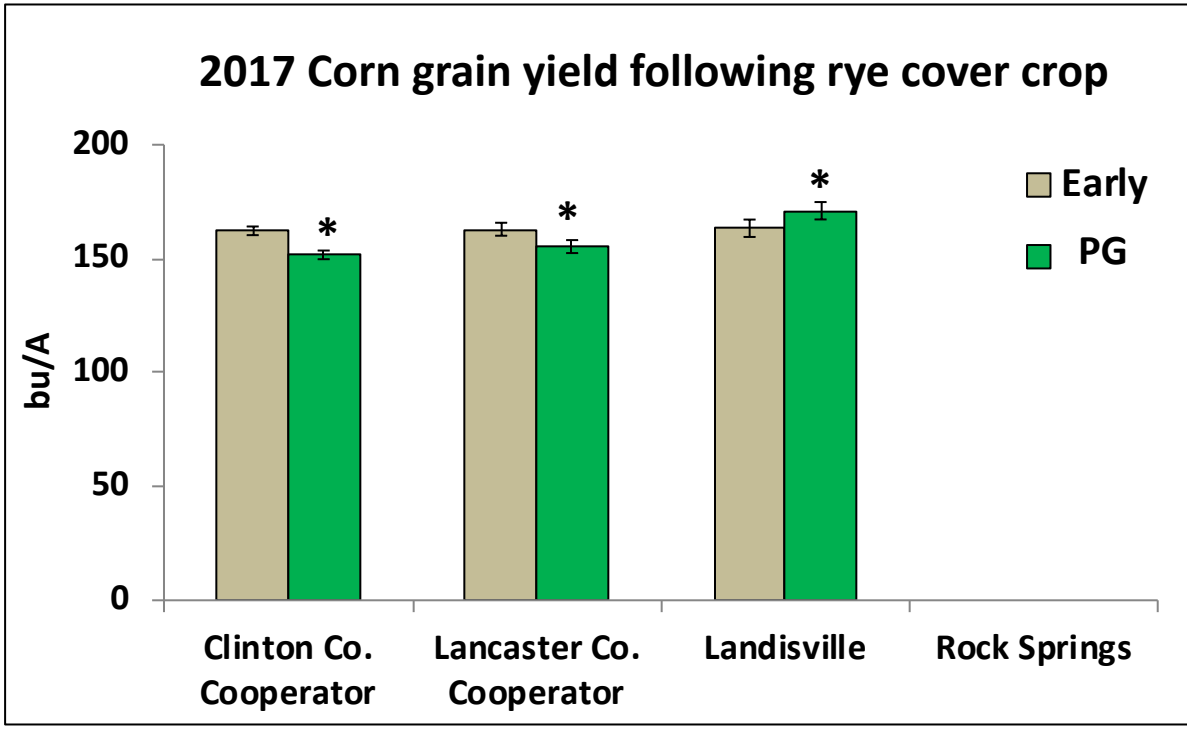
lowering overall populations



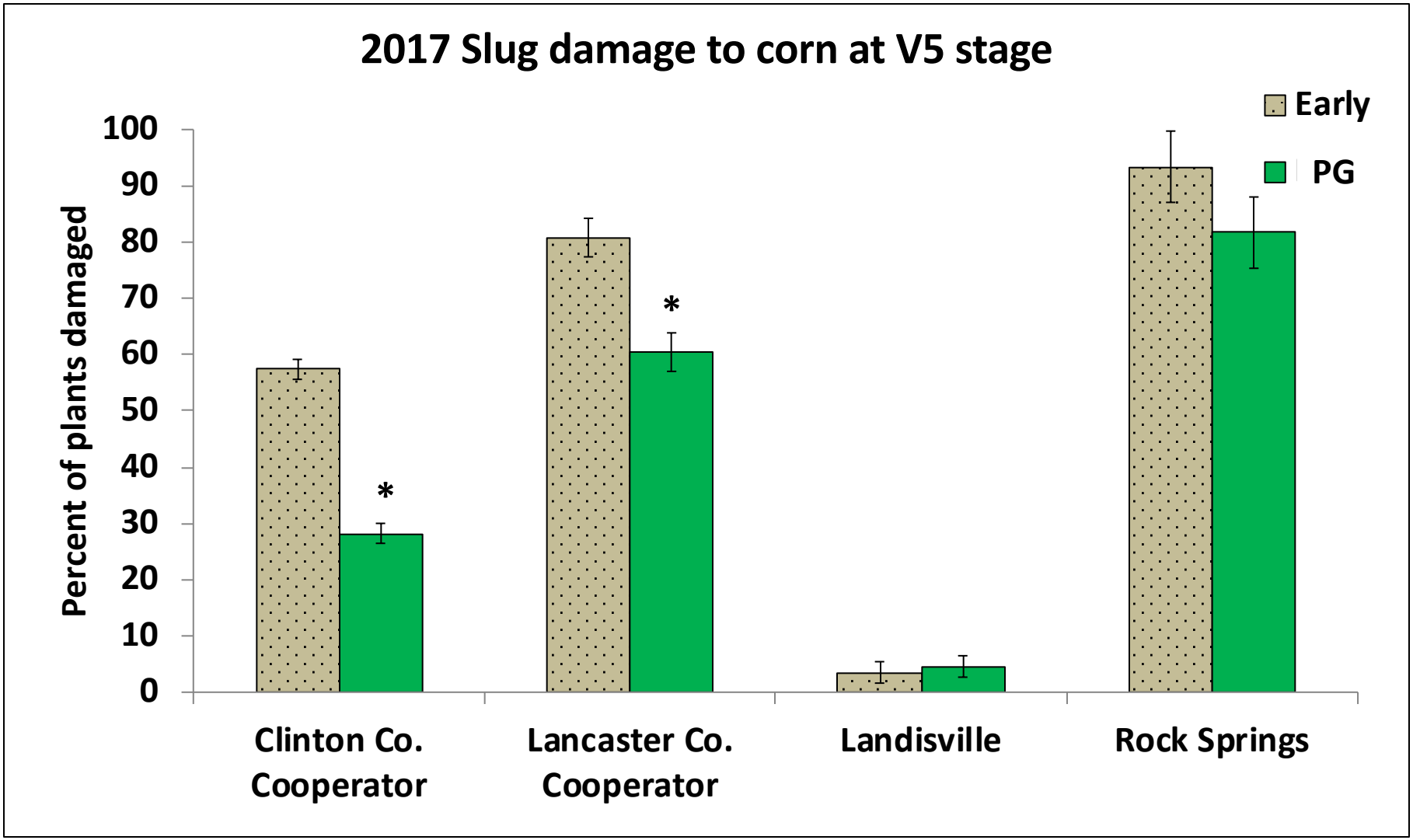
2017 – moist spring, cold

- 5% yield loss at two locations, yield 5% increase at one

- Corn grain yield was not different or higher when planted green 6/11 site years



2017: Slug feeding on V5 corn was reduced from 25-50% when planted green into rye (2/4 sites)




Crimson clover and stinkbug damage
Landisville, June 2015

Planting Green Challenges

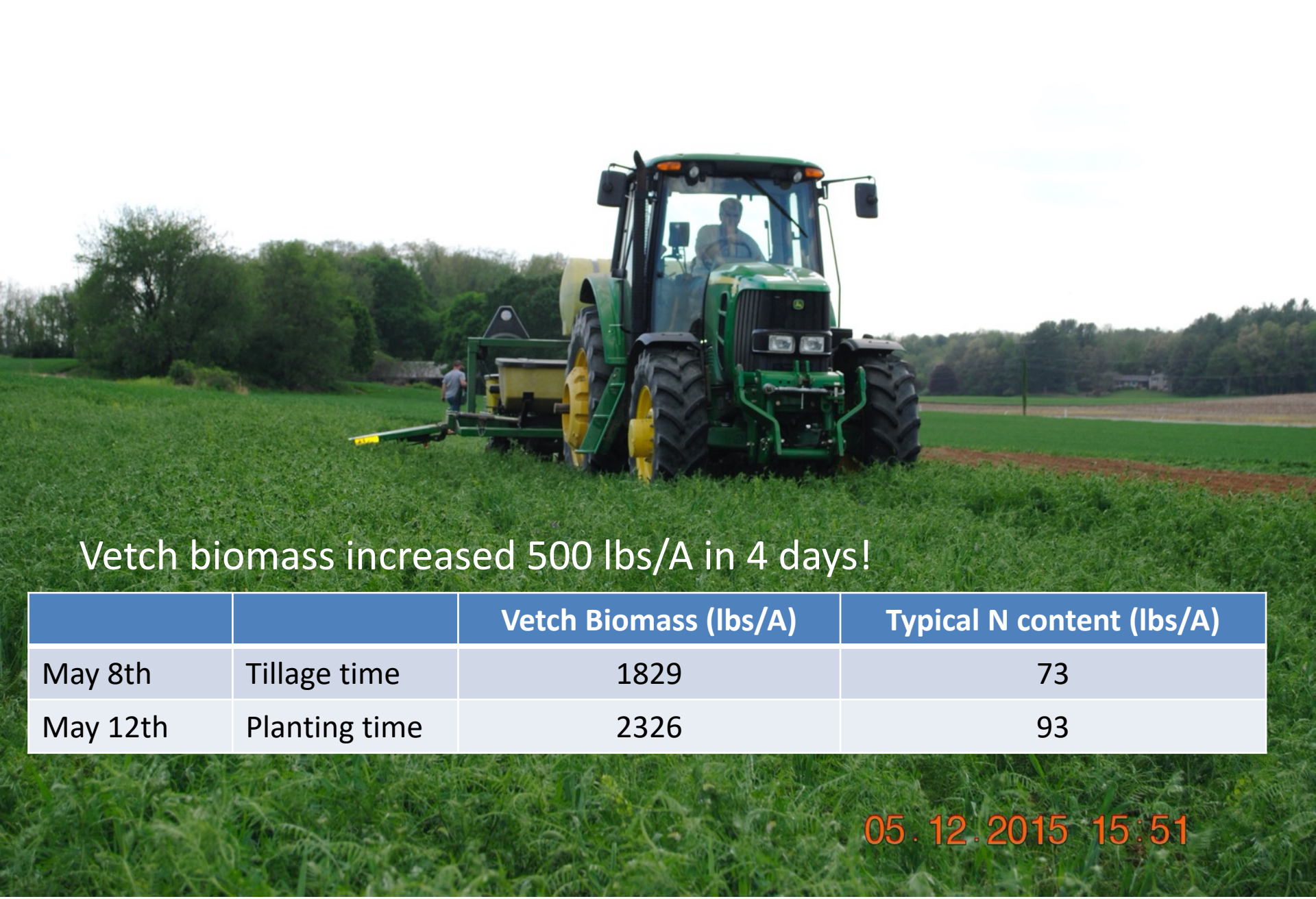
- **Cools soil throughout the growing season can delay cash crop emergence and maturity, slow N cycling**
- **Dry spring → kill cover crop early (don't plant green)**
- **Focus on achieving optimum planting depth and achieving good corn populations**
- **N management is complicated by planting green, we're still figuring it out**
- **Use IPM to manage pests**

Some Planting Green Experiences

‘Planting Green’ – attachment

Designed and developed by farmer and engineer, Charles Martin, Perry County, Pennsylvania


Planting corn into hairy vetch in a 3-year corn-soybean-wheat/vetch rotation
05.12.2015 16:15



Vetch biomass increased 500 lbs/A in 4 days!

		Vetch Biomass (lbs/A)	Typical N content (lbs/A)
May 8th	Tillage time	1829	73
May 12th	Planting time	2326	93


Planting Green – corn into 1 ton hairy vetch DM
Herbides: glyphosate, Lexar, 2,4-D May 18th
05.12.2015 15:52


Visual soil
improvement
with hairy vetch
05 12 2015 16:12

Vetch plowed in with moldboard plow

Vetch plowed in with chisel plow


After plowing you also need to disk harrow
05.11.2015 10:03

And harrow some more

Field cultivator presents some challenges in heavy cover crop


Moldboard/disk/harrow
Planted green
06 12 2015 14 15


Soil after MB/disk/harrow
06.12.2015 14:15


Soil after Planting Green
06 12 2015 14 16

After Moldboard/disk/harrow – harvest time

fter Planting Green – harvest time

Corn Yields 2015

	Yield (bu/a)
Moldboard/disk/harrow	187 a
Chisel/disk/harrow	211 b
Planted Green	203 b

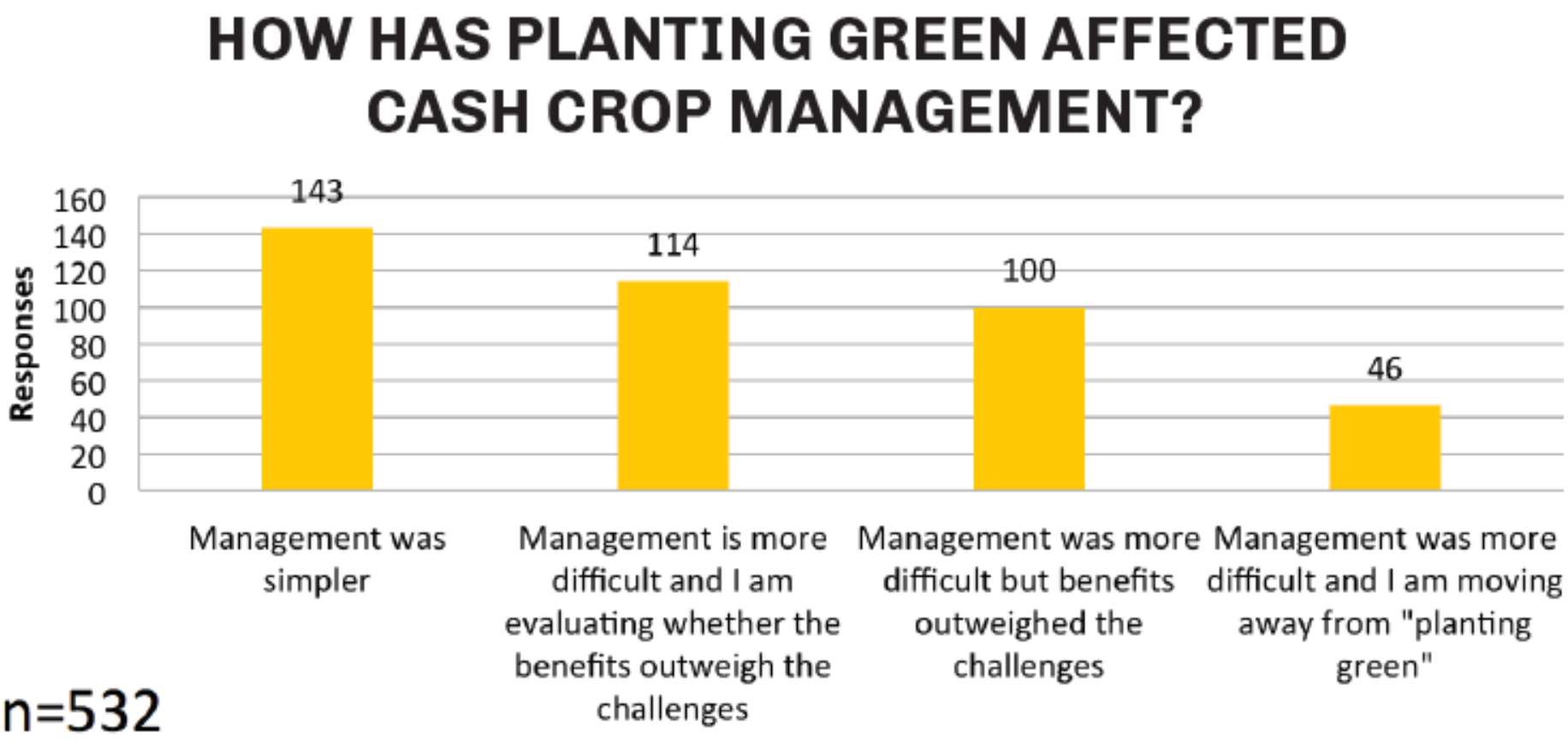
Used 90 lbs/A Nitrogen fertilizer

05 : 12 : 2015 16 : 16


Planting Green into Crimson Clover/Cereal mix
05.15.2015 09:58


05.11.2015 09:06

SARE Cover Crop Survey 2016-2017



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Soybeans highly plastic, adaptable to planting green –start here!

Corn promising but poses more management challenges

Thank You!

This work was supported by

- NESARE: The USDA Northeast Sustainable Agriculture Research and Education Program
- NIFA: The USDA National Institute of Food and Agriculture and McIntire-Stennis Appropriations under Project #PEN04600 Accession No. 1009362.