# Weed management with cover crops

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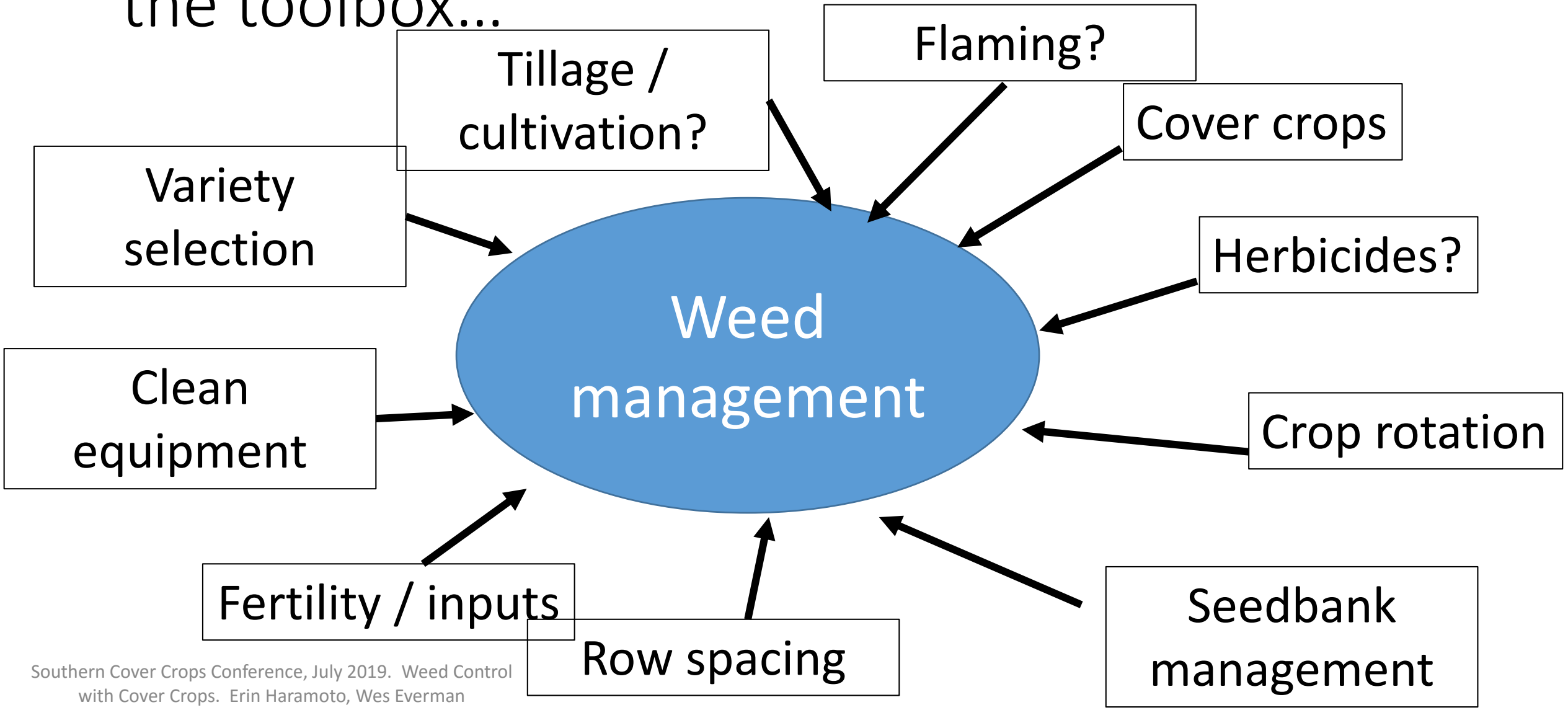
# Plan for this session

- *Throughout – we want to hear from you!*
  - *What are your major crops, and when do you use cover crops?*
  - *What works for you? What does not work? What questions do you have?*
- Basics of how cover crops contribute to weed management
- Our experiences with terminating cover crops (keeping them from becoming weeds!)
- Different models of using cover crops to manage weeds
  - And supporting research

# Remember that cover crops are one tool in the toolbox…



# And that maximizing cover crop biomass for weed suppression (and other benefits) may lead to other challenges

Weed management
Soil health
Root growth

Excessive spring growth
Hard to terminate
Lots of residue—planting issues

???

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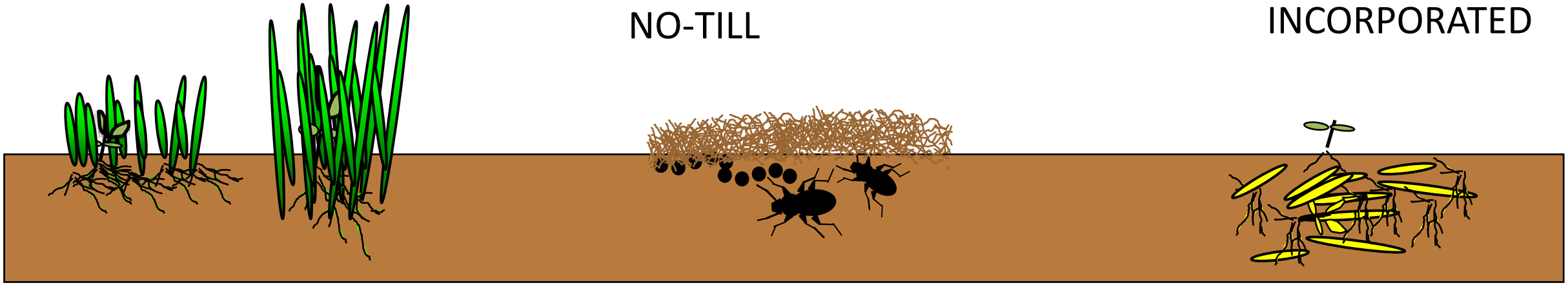
# How do cover crops suppress weeds?

WHILE ACTIVELY GROWING

AFTER TERMINATION

NO-TILL

INCORPORATED



- Suppress germination and emergence (light)
- Use resources and compete with weeds, lower seed production

- Suppress germination, emergence (light)
- Immobilize N (for some)
- Physical barrier
- Enhance seed predation? Seed decay? Disease? [seed size!]

- Suppress germination, emergence
- Immobilize N (for some)
- Allelopathy (for some)
- Enhance seed decay? Seedling disease?

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# What weeds are best suppressed by cover crops and their residues?

- Smaller seeds more than larger seeds
- Annual weeds more than perennials reproducing from vegetative structures
  - *Why?*
    - *Larger seeds and perennial structures often have no light requirement for germination,*
    - *Have more reserves so they're more competitive and can germinate from deeper in the soil*
    - *Can detoxify allelochemicals*
- Broadleaves more than grasses
  - *Grass seeds also may not require light to germinate*
  - *Not physically impeded*

# A couple of growers using cover crops for weed management

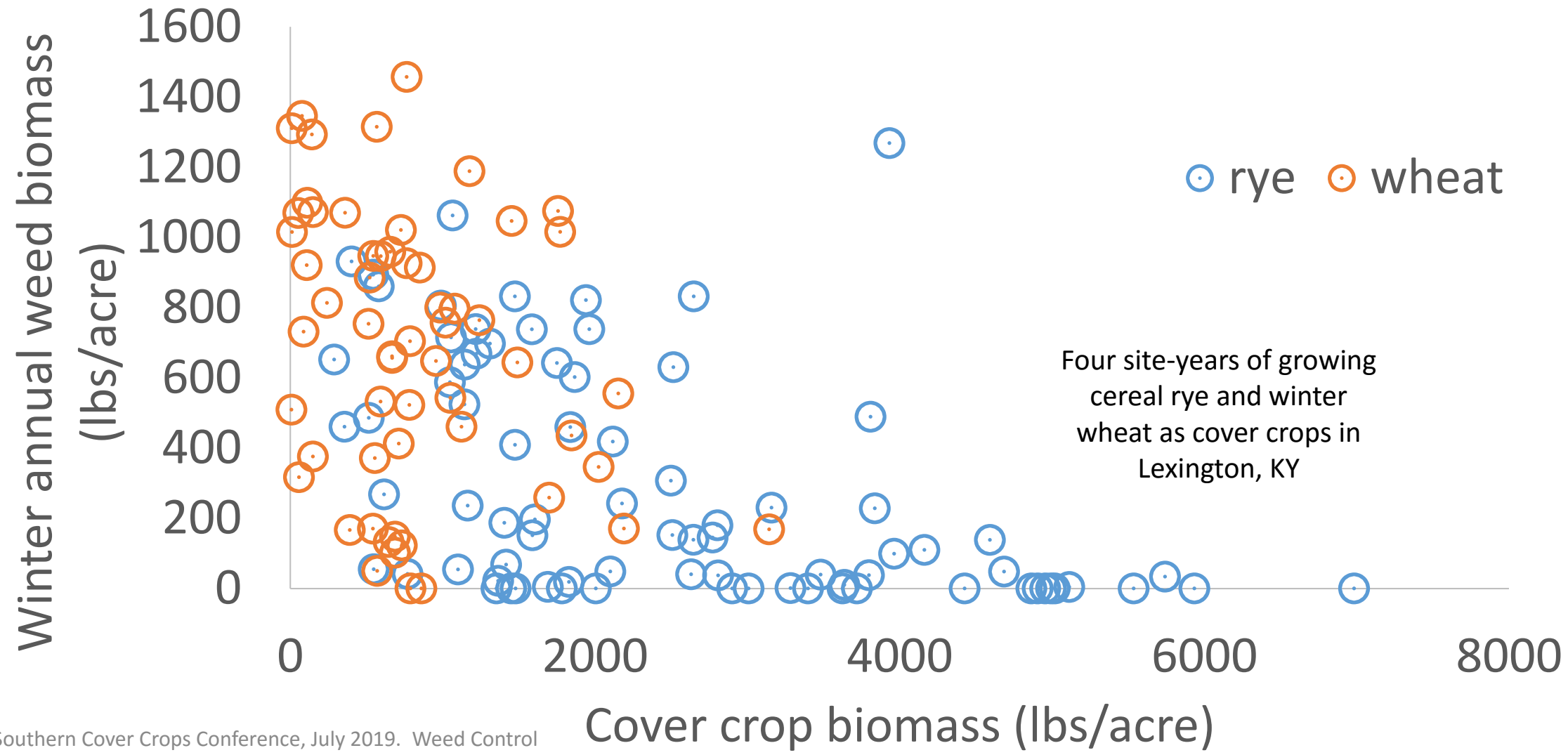
See video at:

https://integratedweedmanagement.org/index.php/2019/06/05/weed-management-with-cover-crops-taylor-clarke-va-farmer-shares-his-experiences/

- Taylor Clarke, Farmer and Extension Agent from Brunswick County, VA
- Started cover cropping and no-tilling on former tobacco ground, now in soybean ~5 years ago
- Part of video series on

integratedweedmanagement.org (Getting Rid Of Weeds)

# More cover crop biomass → less winter annual weed biomass

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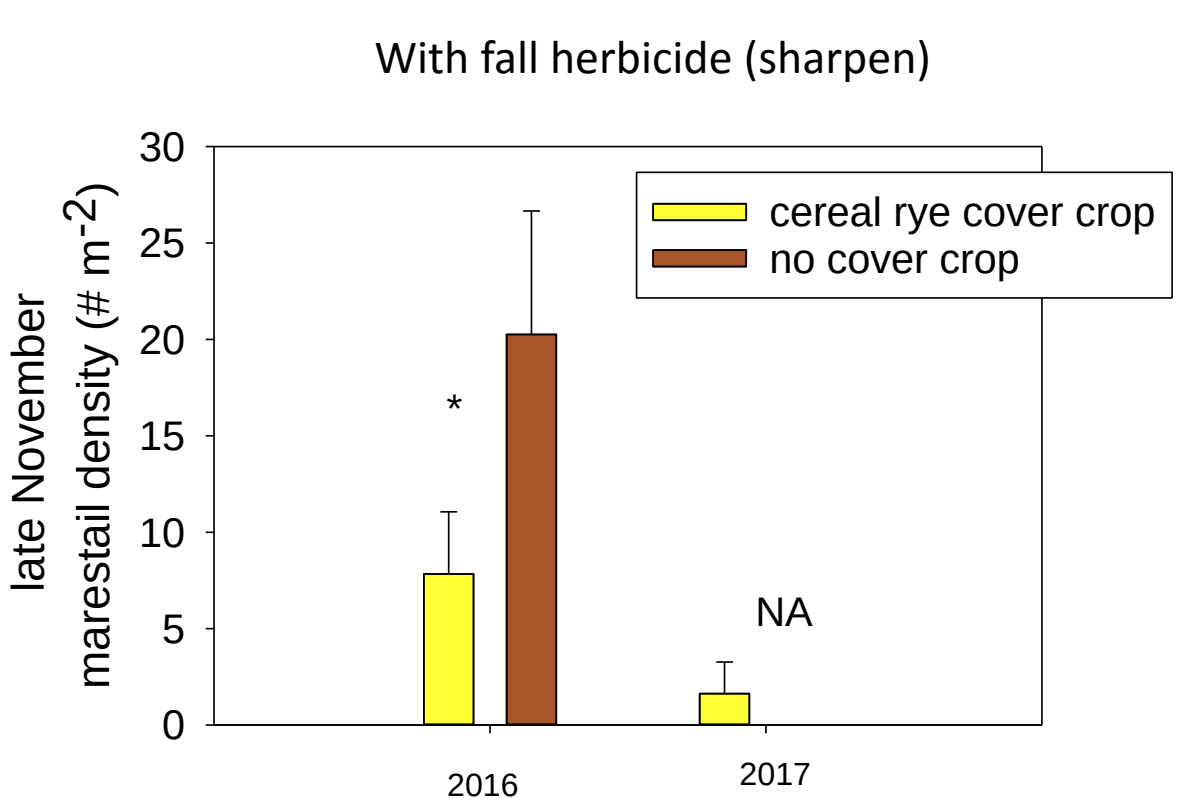
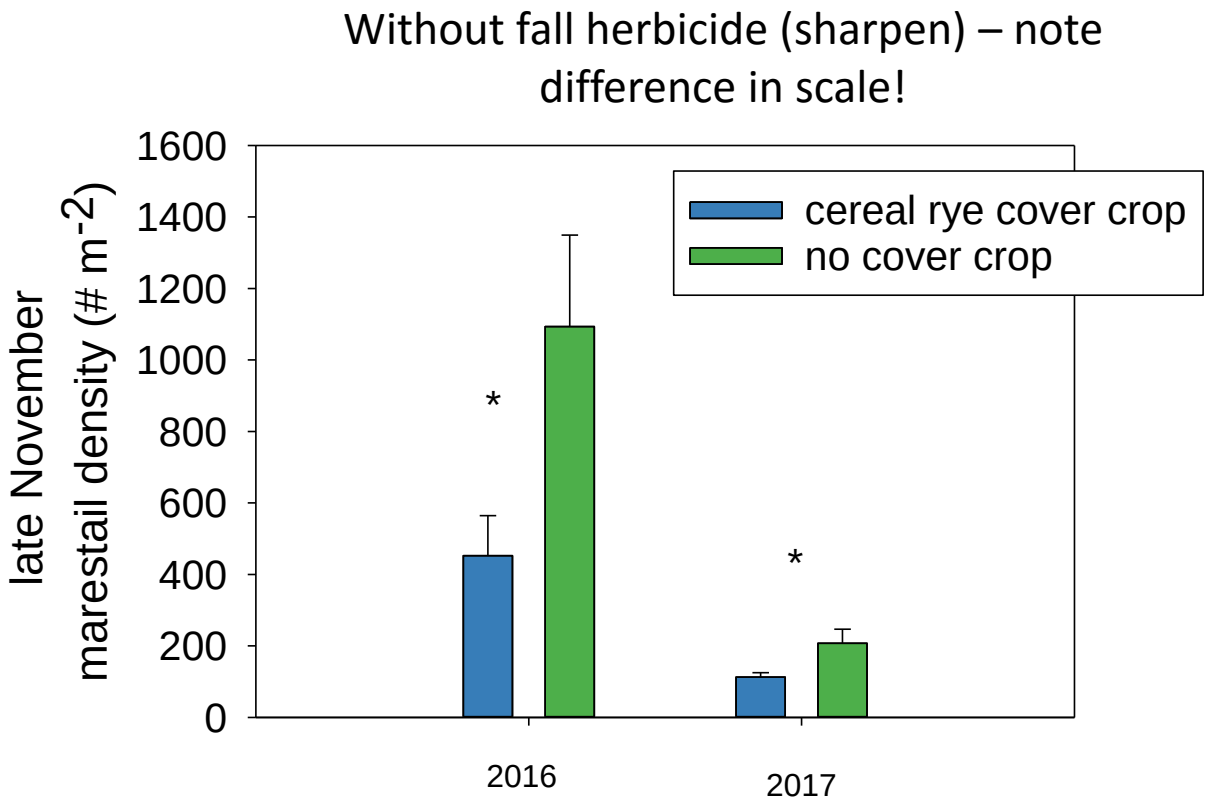
# Managing problem weeds like marestail / horseweed

- We did an experiment with the following:
  - Cereal rye cover crop, planted late October
  - Fall-applied herbicide (Sharpen®, also in late October / early November)
  - Spring-applied herbicides (2,4-D or dicamba, in March or April, depending on that year's spring flush)
  - Prior to soybean

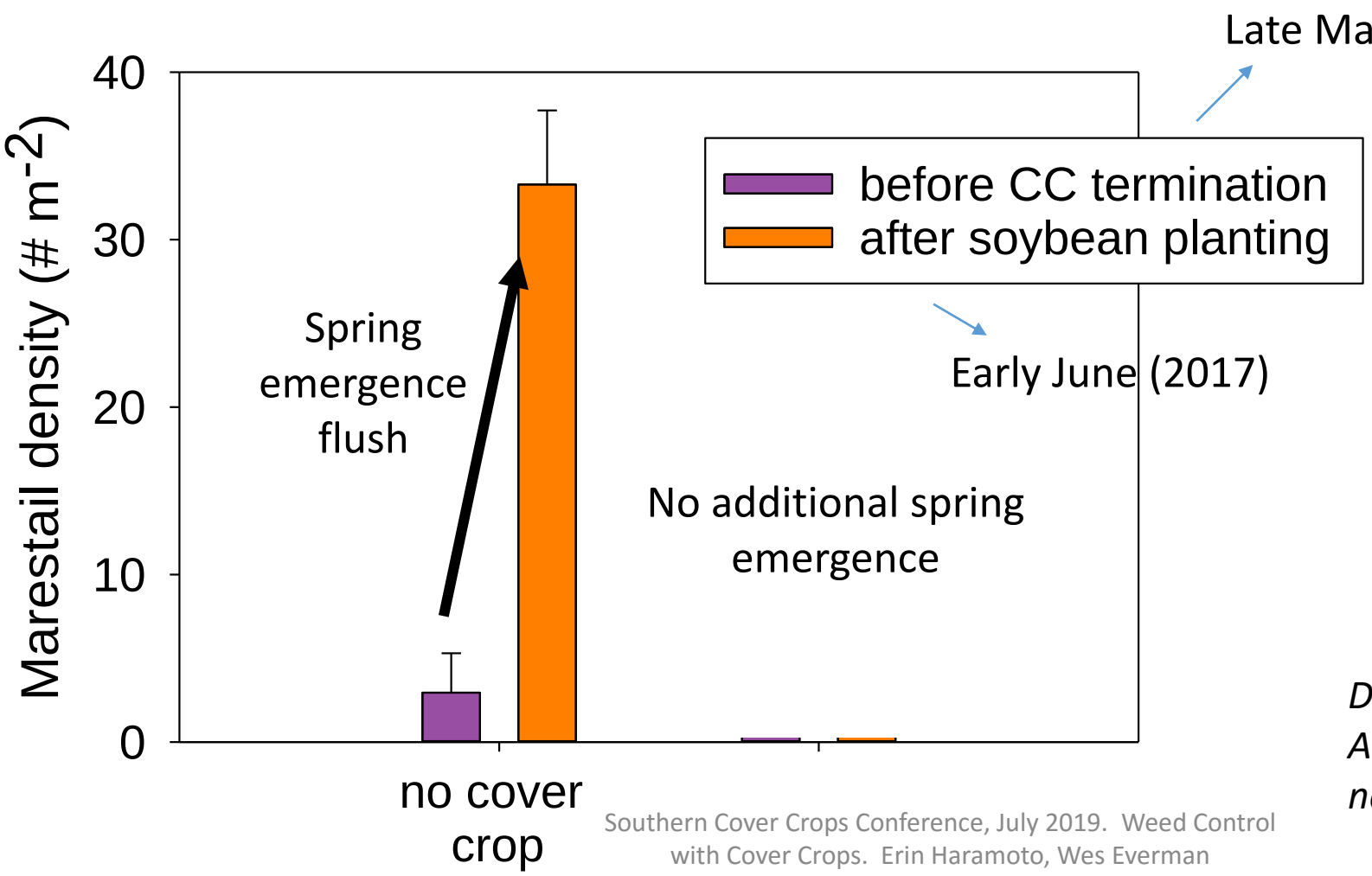
Lots of fall-emerged seedlings! > 3000 plants/m2 prior to treatments in Fall 2016!

# Large reduction in fall marestail density with a cover crop, regardless of whether a fall herbicide was applied



# With spring 2,4-D (and dicamba), cover crop reduces /eliminates spring flush of emergence




About 3000 lbs/acre of cereal rye biomass

*Density still too high??? Additional management needed.*

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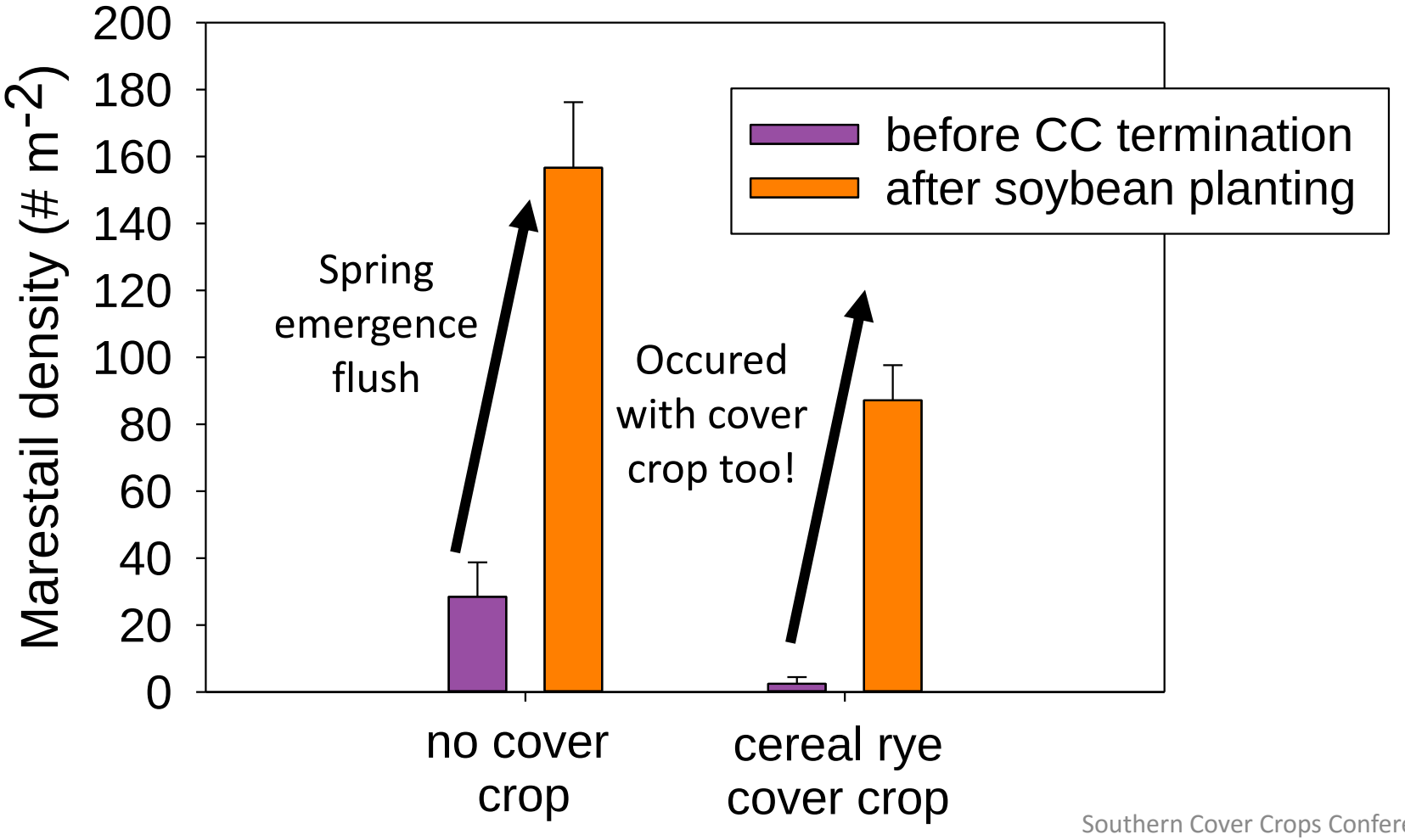
# Not always the case… second year results




What's the difference?

- Half as much cover crop biomass this year – hard winter in 2017-18 relative to 2016-17
- Much more spring emergence (max ~35 plants / $m^2$ in previous year relative to > 150 plants / $m^2$ this year)

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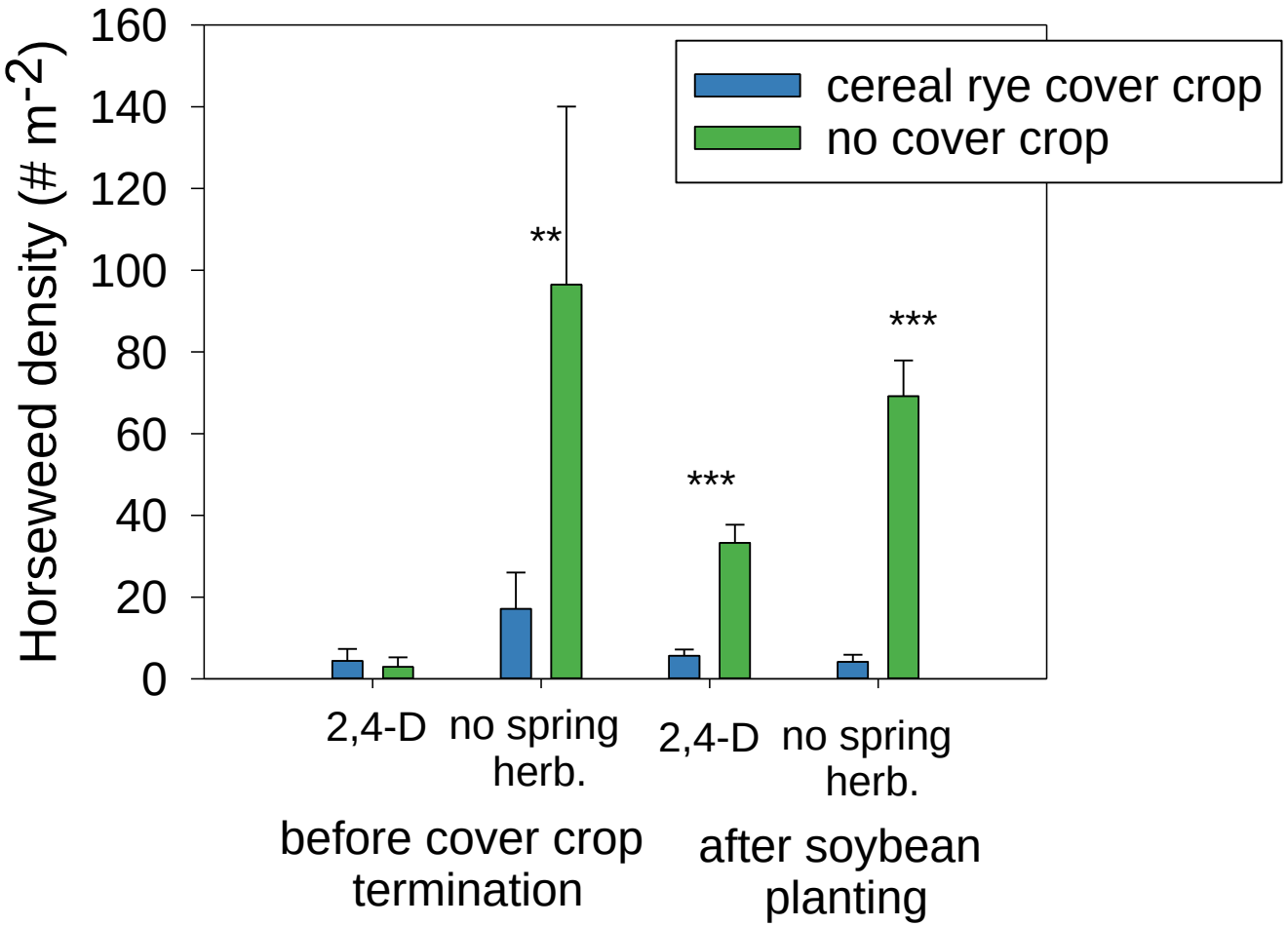
# And helps reduce marestail density both with and without spring 2,4-D or dicamba

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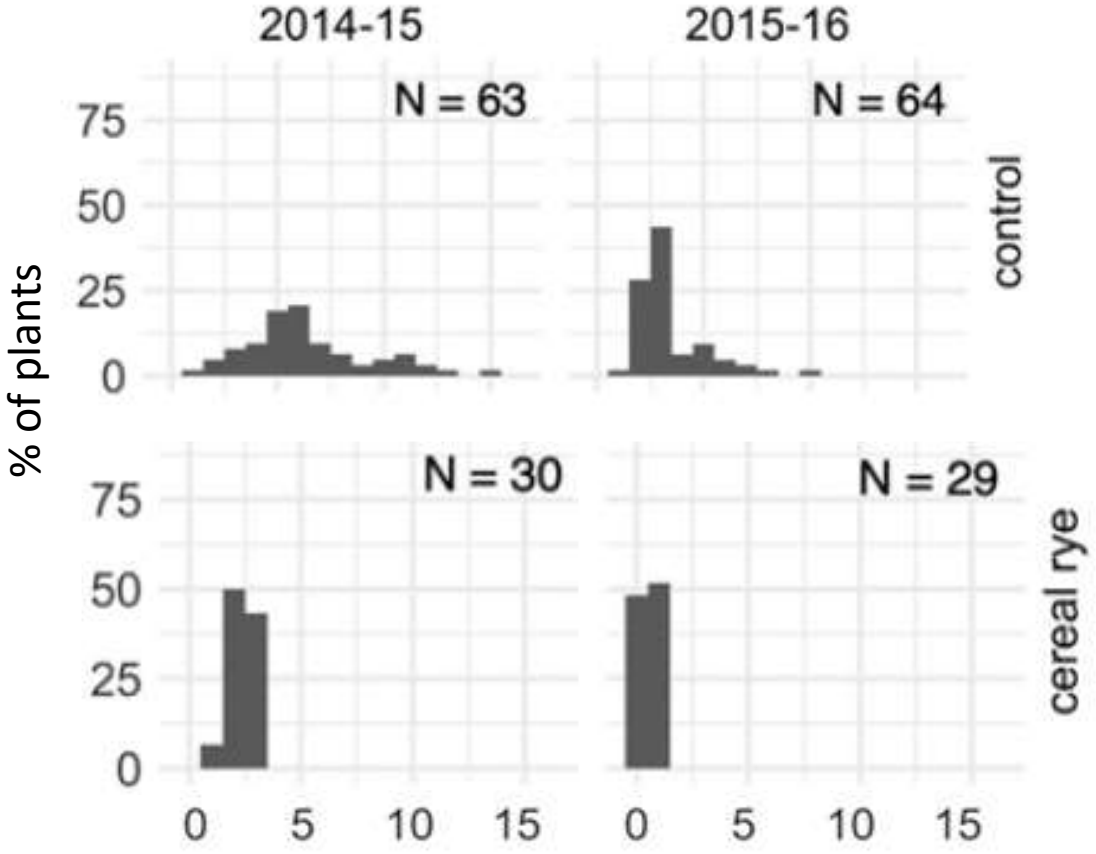
# Other research … marestail plants are also smaller with cover crops at spraying time




Rosette size (cm) at pre-plant herbicide application

'allace et al. 2019; Weed Science 67

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# So if marestail is your problem, is a cover crop the solution?

| | Mostly fall emergence, lots of cover crop residue | Mostly spring emergence, less cover crop residue |
|---|---|---|
| | Density at soybean planting (# plants / m-2) | |
| No treatment | 81 | 121 |
| Fall Sharpen only | 57 | 294 |
| Spring 2,4-D only | 24 | 124 |
| Sharpen + 2,4-D | 43 | 190 |
| Cereal rye only | 6 | 97 |
| Sharpen + cereal rye | 2 | 133 |
| 2,4-D + cereal rye | 4 | 76 |
| Sharpen + 2,4-D + cereal rye | 7 | 99 |

Cover crop *can* be the solution with adequate biomass, less spring emergence. Future research: lots of spring emergence + lots of biomass

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# Importance of adequate biomass

See video at:

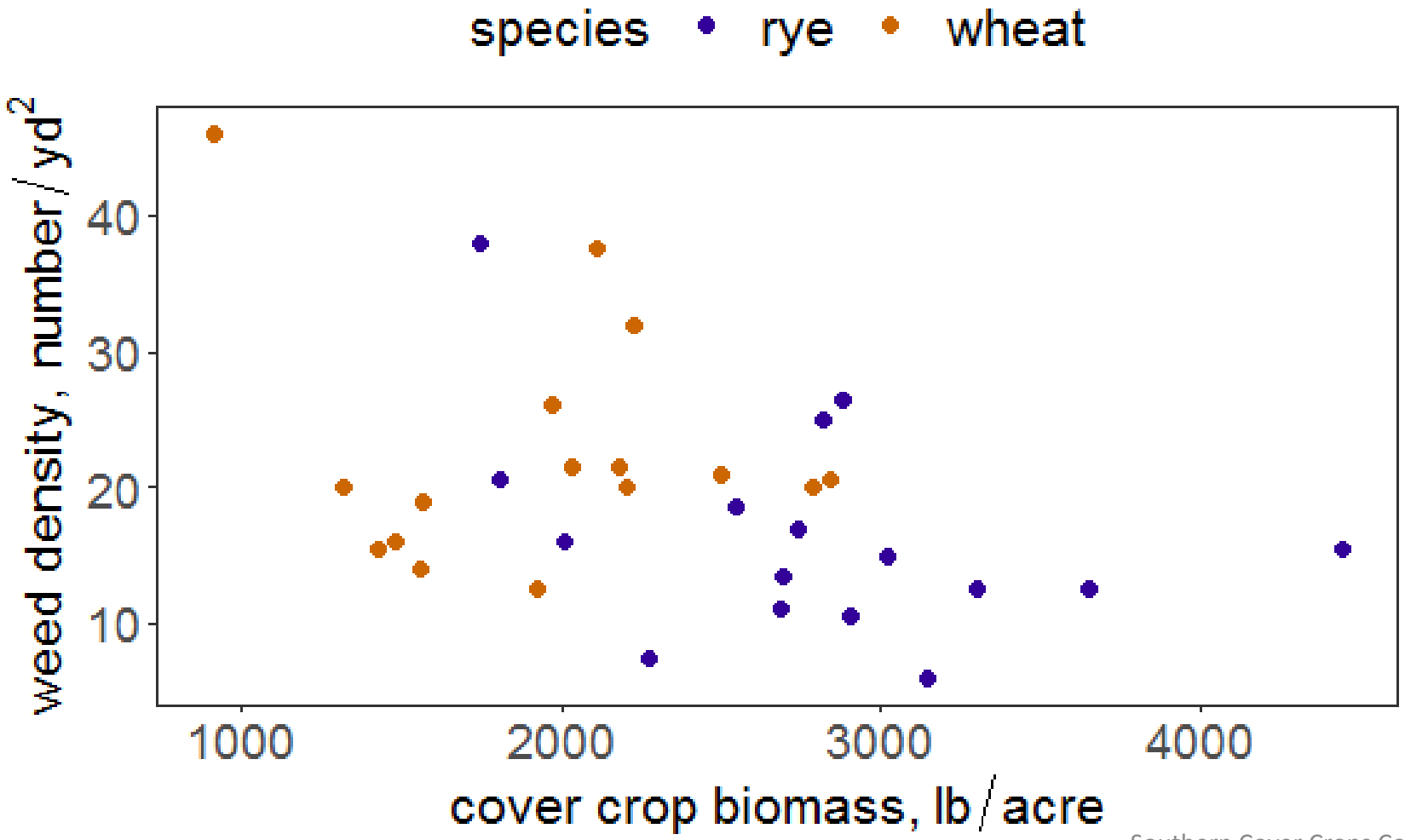
https://integratedweedmanagement.org/index.php/2019/06/12/using-planting-green-to-help-manage-weeds/

- Trey Hill, Rock Hall, MD
- (Eastern Shore)
- Talking about planting green
- Skip to 2 minutes if time is limited
- Good segue for Wes to talk about cover crop termination… what would be best for this cover crop mixture?

# Two points re. summer weed control

- What if you don’t want all of that biomass?
- What happens if you use residual herbicides?

# Our data on summer annual control with herbicides




- Flexstar GT applied at soybean planting
- These weeds measured prior to POST (about 4 weeks later)
- Not sufficient control (still need the POST), but every little bit helps w/ resistance management
- 2-3-4 times this much biomass used by organic growers for season-long suppression without herbicides

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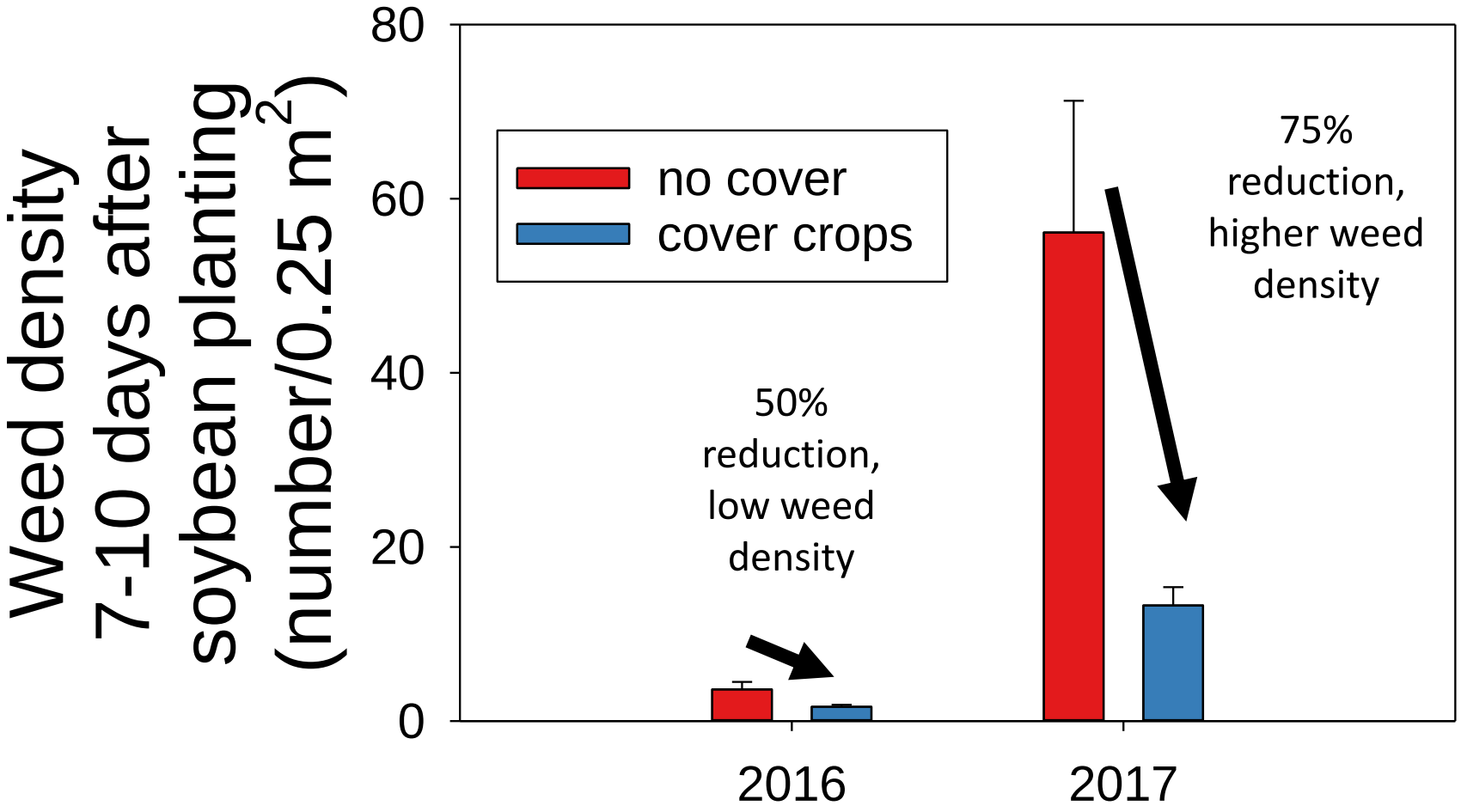
# Fewer weeds to kill with POST application

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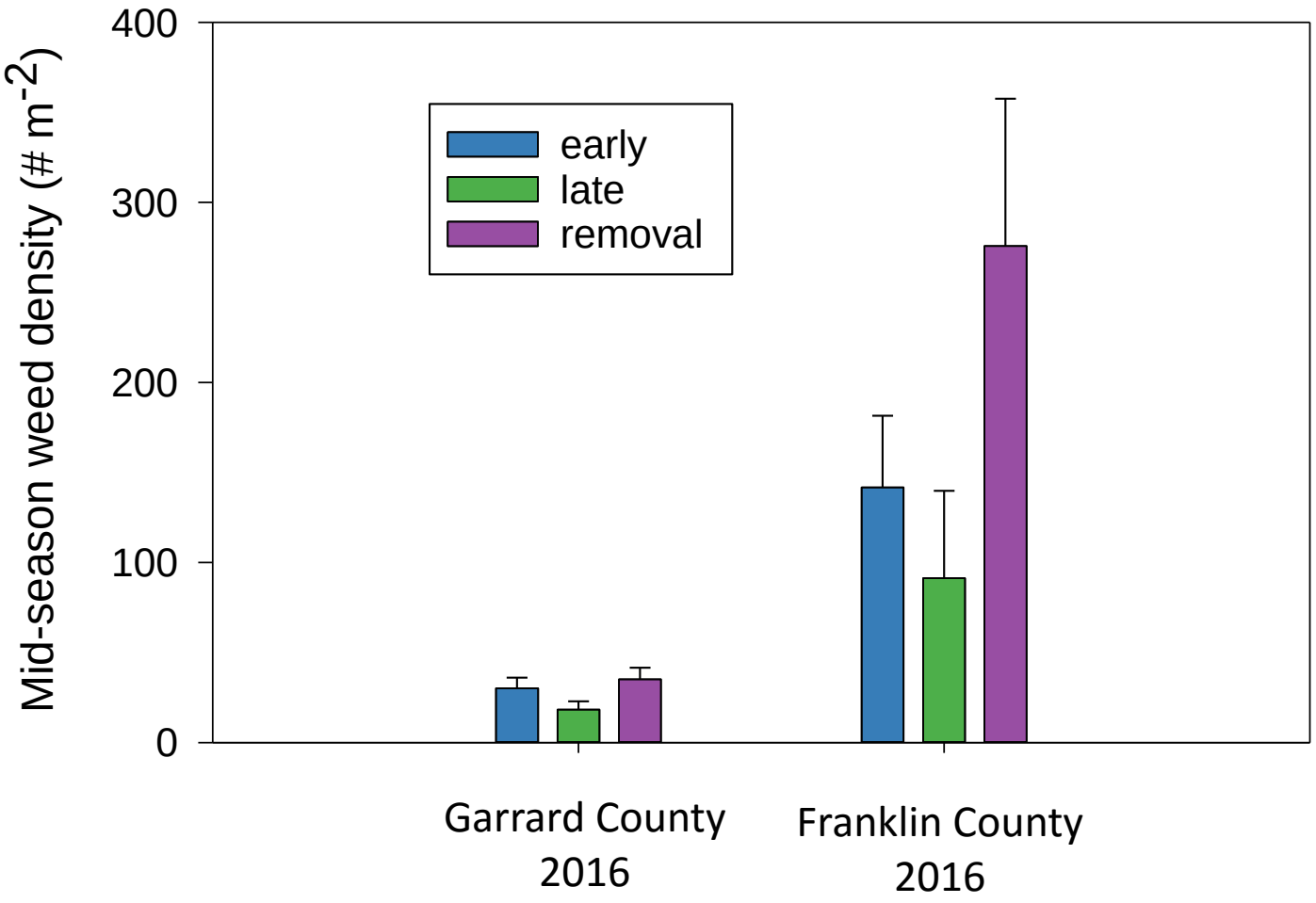
# How do cover crops influence use of soil residual herbicides?

- We compared cover crop use, species, and +/- soil residual herbicides
  - Species
    - Wheat only
    - Rye + crimson clover + hairy vetch (+ canola in one year)
  - early terminated, late terminated, and forage harvest
  - With and without Spartan Charge (= two PPO inhibitors used in tobacco)
- If the residues intercept herbicides, then early terminated and forage harvest should lead to improved control

# Other relevant details

- No-till tobacco transplant
- Heavy N rates (200-250 lbs N/acre)
- > 1” rain within 3 days of residual herbicide application
- No POST weed control
- All on-farm trials, with variable weed seedbanks

# At most sites, no interaction between residue and the soil residual herbicide




- The cover crop residue did not intercept herbicide, though this could differ in dry conditions
- We also found fewer weeds with more residue compared to where it was removed
- But this wasn't consistently observed

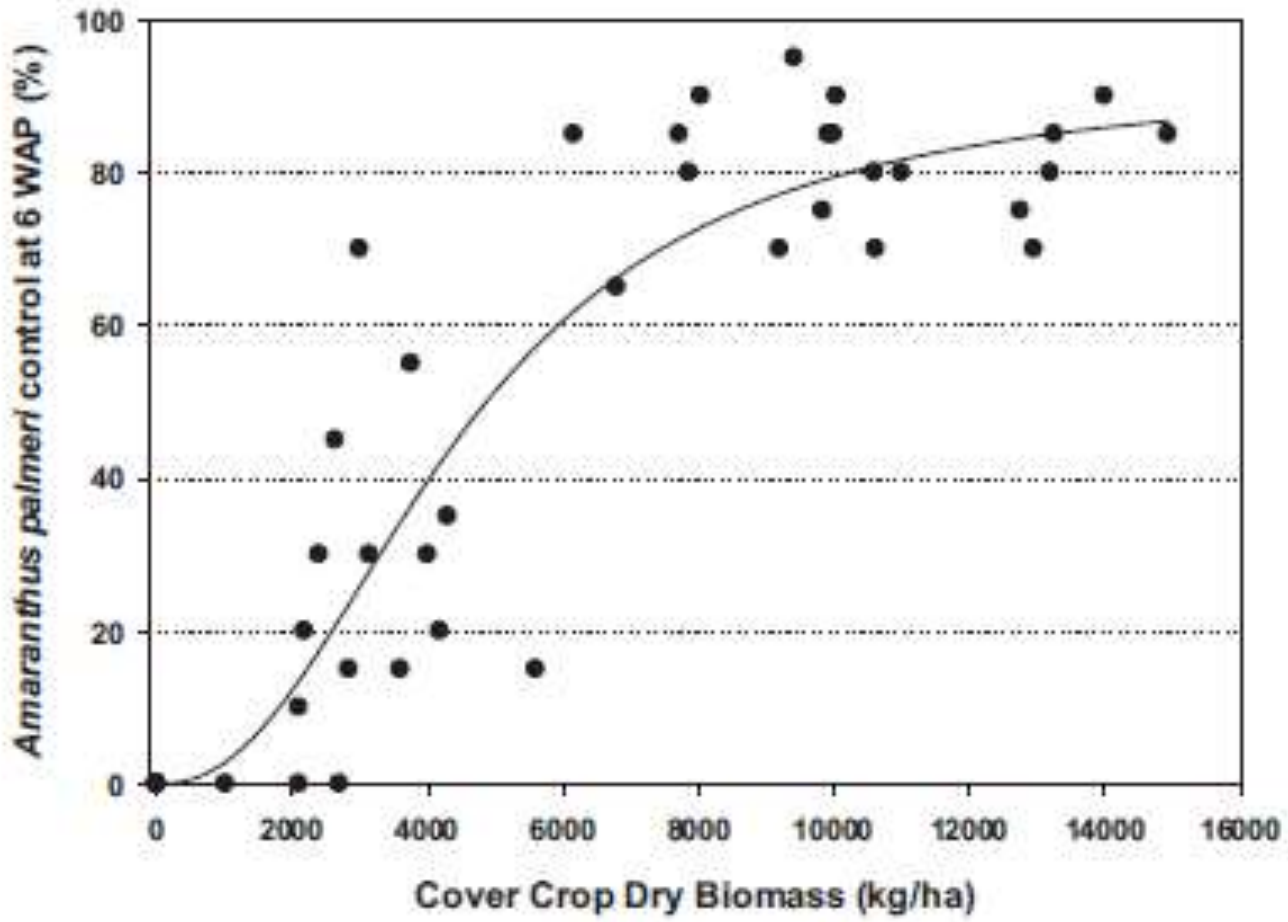
# Other cover crop based models for weed management

- Strip-tilled cotton with and without herbicides
- No-till soybean with heavy cereal rye residue (“high rye”)

# Strip tilled cotton research results

- Cover crop mixtures, legumes with and without cereal rye
- Moderate to high biomass, roller crimped
- With and without herbicides
  - PRE pendimethalin + fomesafen
  - FB glyphosate and s-metolachlor
  - FB directed MSMA and diuron
- Focus on glyphosate resistant Palmer amaranth

# Relationship between cereal rye biomass and Palmer amaranth control 6 WAP




- Undisturbed row middles
- No herbicide areas
- Average of all cover crops

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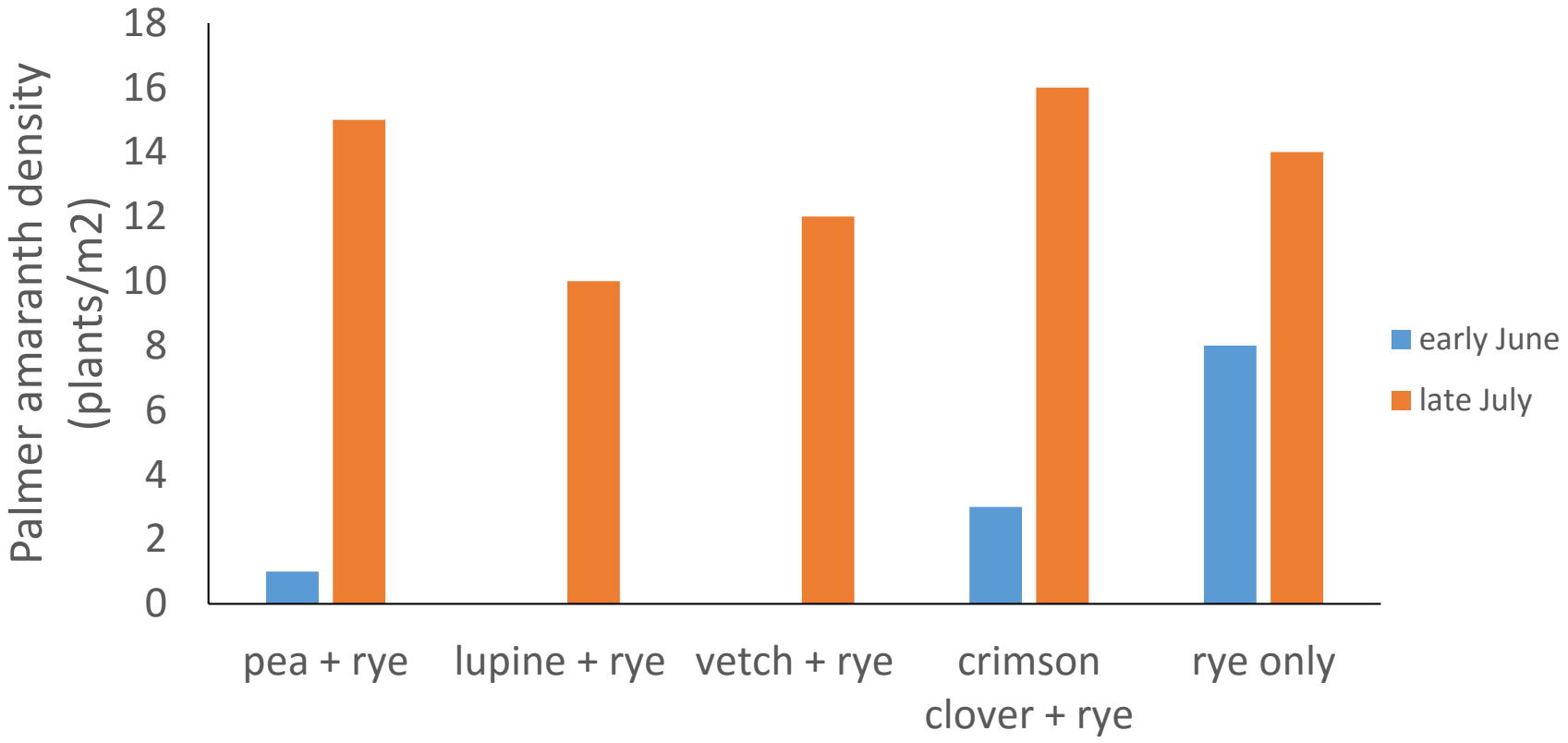
Webster et al. 2013; Crop Protection 52

# No herbicides, Palmer amaranth density in undisturbed row middles

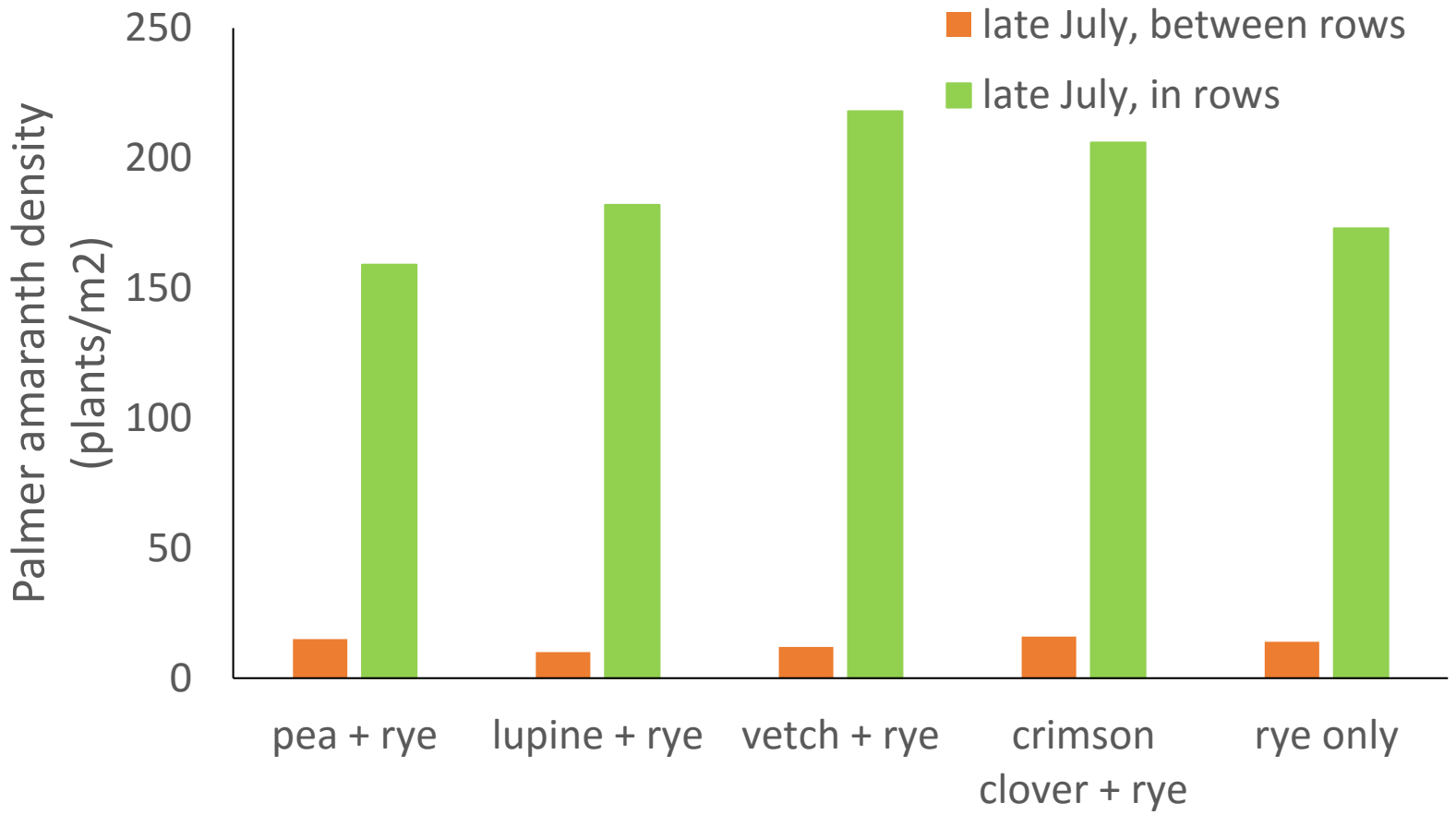



8000-10000 lbs/acre biomass needed



Webster et al. 2013; Crop Protection 52

# In-row emergence much worse—tillage induces emergence, and no mulch to suppress




Webster et al. 2013; Crop Protection 52

# Their conclusions…

- Plant early and terminate later to maximize cereal rye biomass
- Also apply some N?
  - Grow the cover crop as a crop!
- Banding herbicides in strip till?

# No-till soybean with “high rye”

- Also manage the cereal rye as a crop
  - Plant early
  - Terminate late
  - Fertilize
  - Select the right variety
- Roller crimper for termination
- Heavy duty planters

# How to maximize cereal rye biomass?

| Planting date | Biomass (kg/ha) |
|---|---|
| 8/25 | 7900 |
| 9/5 | 7900 |
| 9/15 | 7200 |
| 9/25 | 7000 |
| 10/5 | 6300 |
| 10/15 | 5100 |

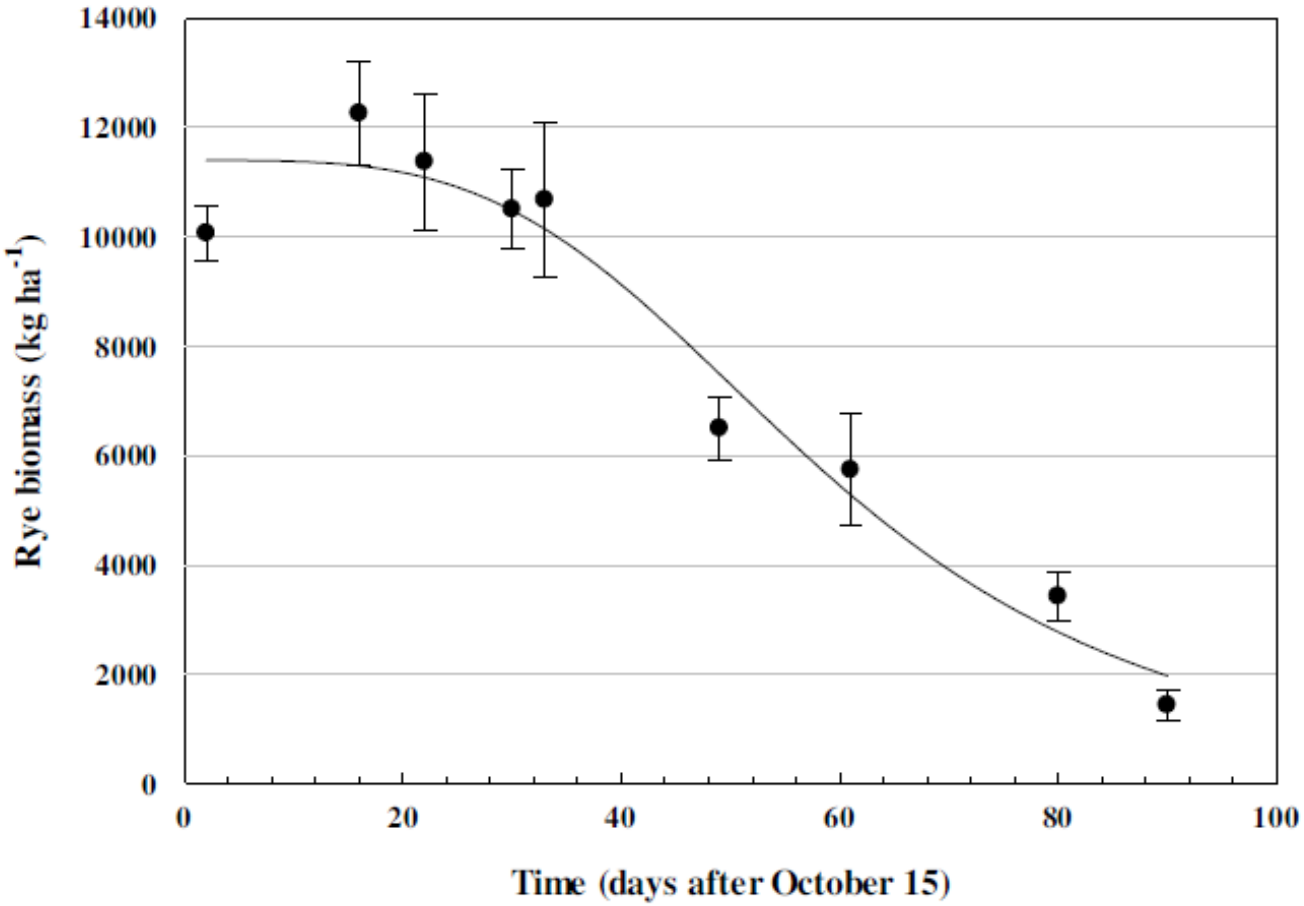
| Termination date | Biomass (kg/ha) |
|---|---|
| 5/1 | 4000 |
| 5/10 | 5800 |
| 5/20 | 7600 |
| 5/30 | 10000 |

Terminating later matters more than planting earlier, at least in PA!!!



Mirsky et al. 2011; Weed Science 59

# We have more biomass potential in the south




- Terminated w/ roller crimping in mid or late April
- Greater amounts of biomass
- Can plant later in the fall



Webster et al. 2016; Field Crops Research 192