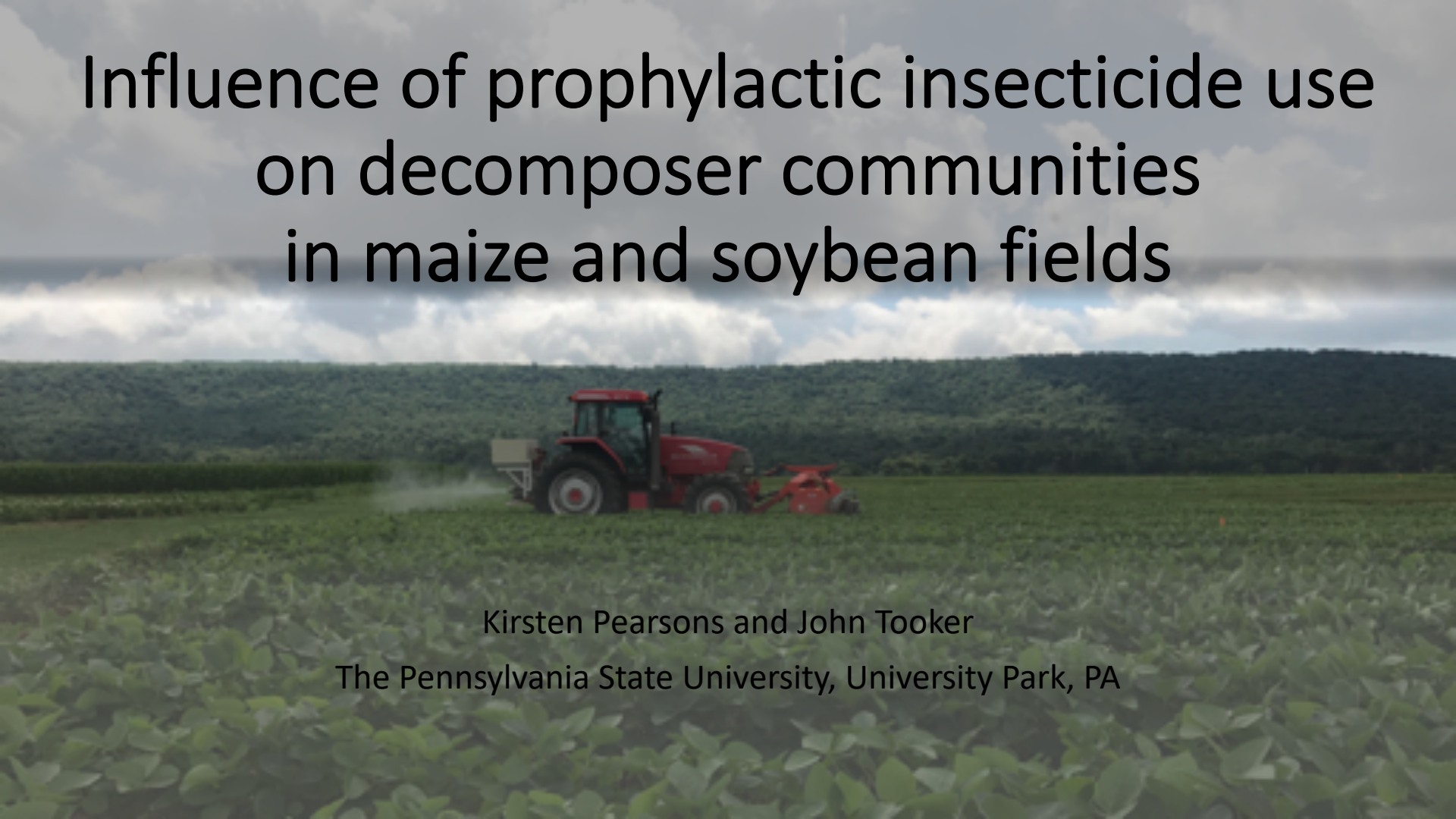
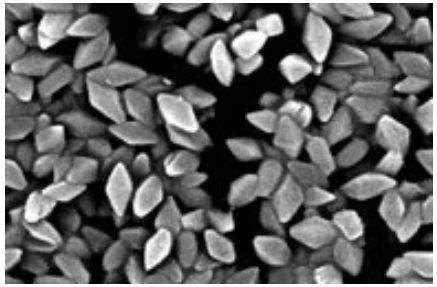
Influence of prophylactic insecticide use on decomposer communities in maize and soybean fields



Kirsten Pearsons and John Tooker

The Pennsylvania State University, University Park, PA

Prophylactic insecticides use is exceedingly common in corn and soy production



May Improve Yield

Can Reduces Labor Input

Insurance

Secondary Pest Outbreaks

Insecticide Resistance

Harm to people/wildlife

Disrupt Ecosystem Functioning

http://www.chslarsencooperative.com/wp-content/uploads/2015/03/Tkd-051.jpg
https://upload.wikimedia.org/wikipedia/commons/f/fc/Bt-toxin-crystals.jpg

Douglas & Tooker 2015

Decomposer communities perform ecological functions critical to agriculture

High exposure to soil applied insecticides

Wolkovich et al. 2014; Agusti et al. 2003, Grandy et al. 2016; David 2014

Objectives Expectations

Investigate if prophylactic insecticide use affects arthropod decomposers.

Reduction in activities and densities

Investigate if this affects decomposition rate.

Reduced decomposition rate

Field experiment in maize and soy

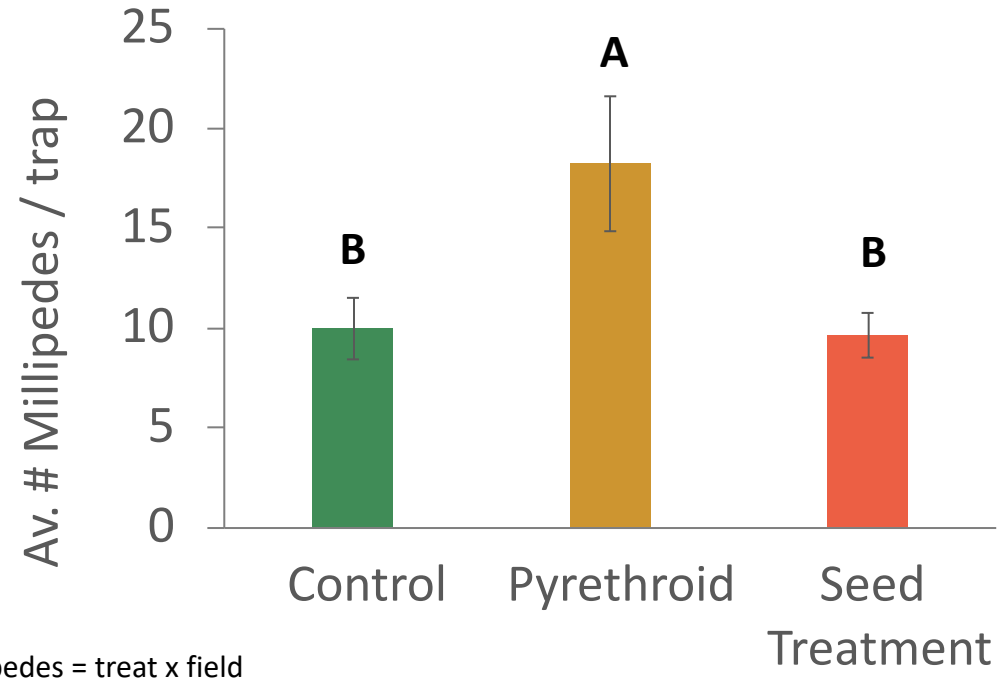
Untreated

Pyrethroid

Seed Coating

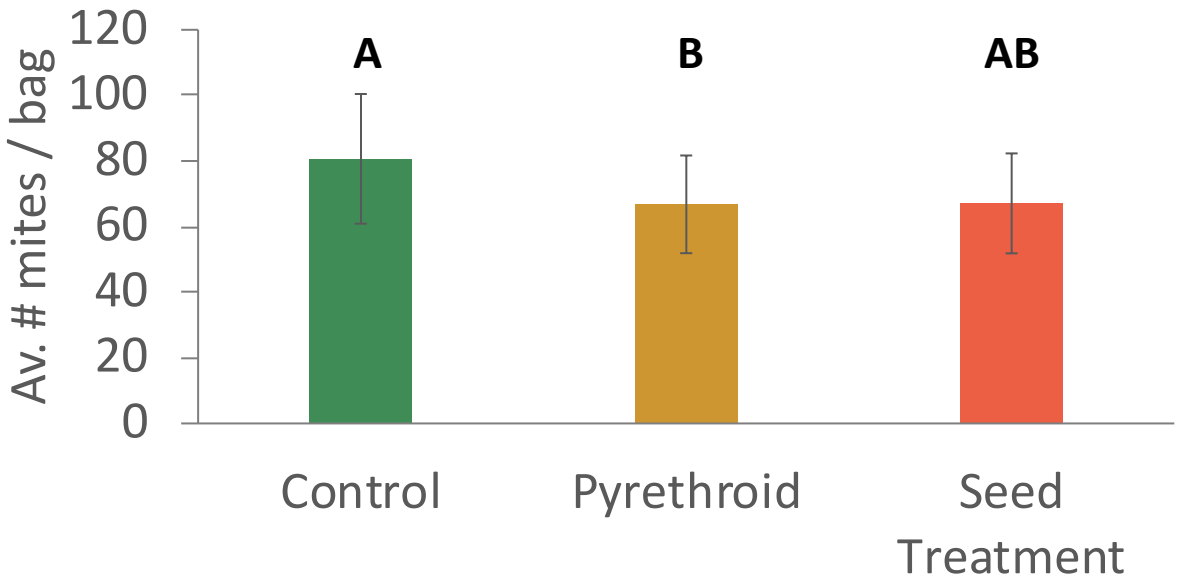
Methods: Pitfall sampling and litterbags

Macroinverts: Pyrethroid increased millipede activity-density



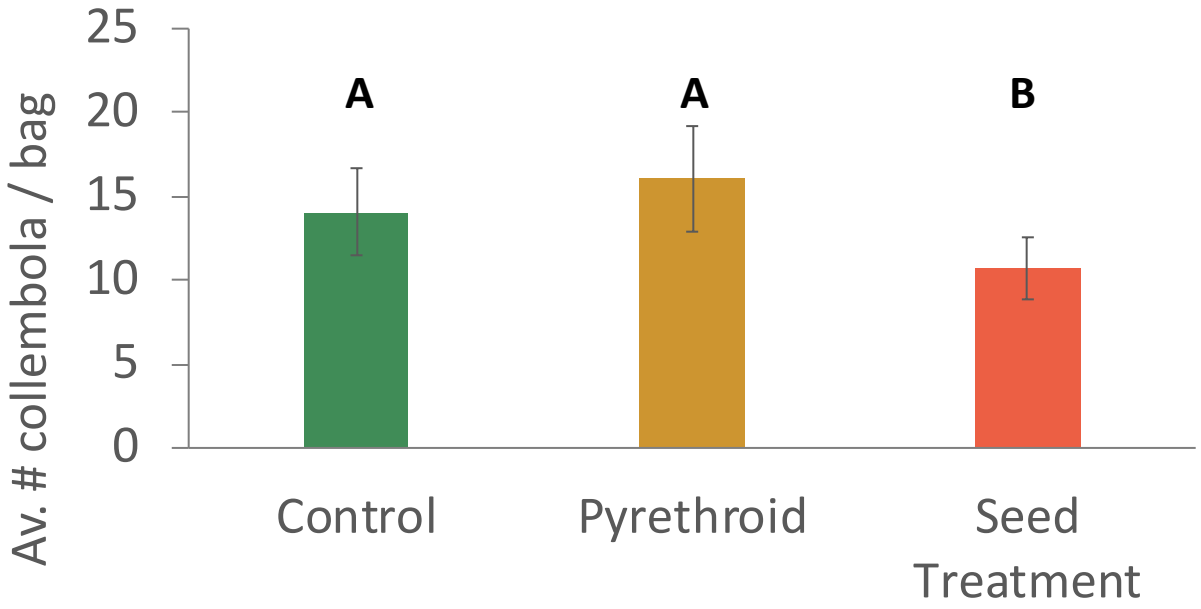
Mixed Model: millipedes = treat x field
treat: ***P* = 0.0004** treat*field: *P* = 0.0018
n=233

Mesofauna: Pyrethroid decreased mite density



Negative Binomial Mixed Model: mites = treat x date
treat: *P* = 0.026 date: *P* < 0.0001 no interaction
n=72

Mesofauna: Seed treatment decreased collembola density



Poisson Mixed Model: collembola = treat x date

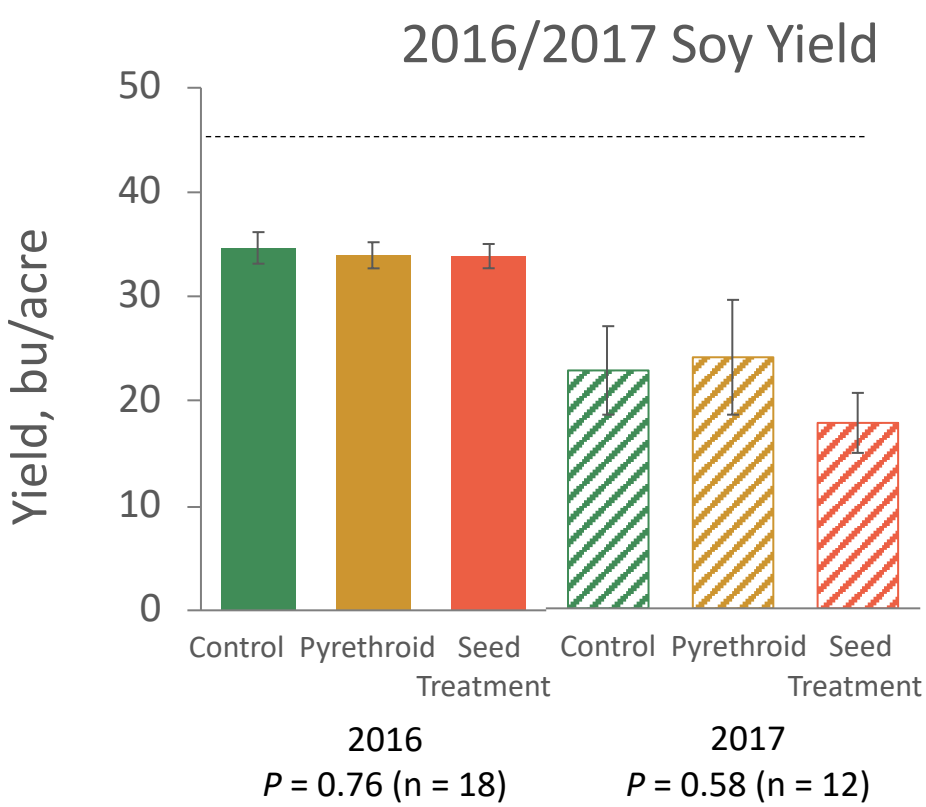
treat: *P* < 0.0001 date: *P* < 0.0001 treat*date: *P* < 0.001

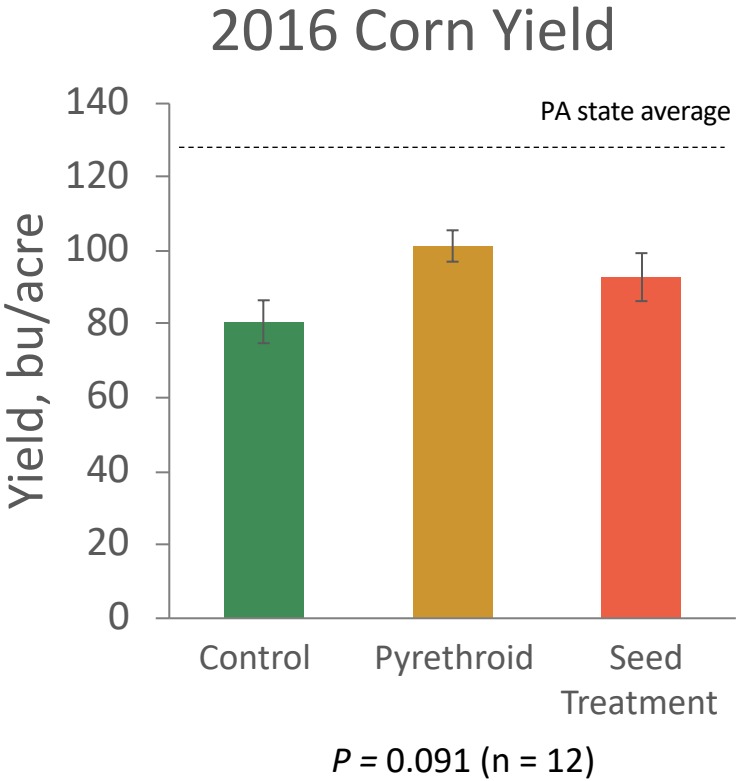
n=72

Seed treatments can increase decomposition

Repeated Measures Model: %remaining = treat x meshsize x date
treat: *P* < 0.079 meshsize: *P* = 0.0006 date: *P* < 0.0001
treat*date: *P* = 0.028 meshsize*date: *P* < 0.0001
n=140

No yield advantage to using these insecticides





Conclusions / Next Steps

Does prophylactic insecticide use affect arthropod decomposers?

Yes

Possible Mechanisms

Direct toxicity - **Toxicity Assays**

Predator influence - **Predation Assays**

Does this affects decomposition rate?

Possibly

2 more batches of litterbags to analyze

Nutrient Dynamics – **litter & soil analysis**

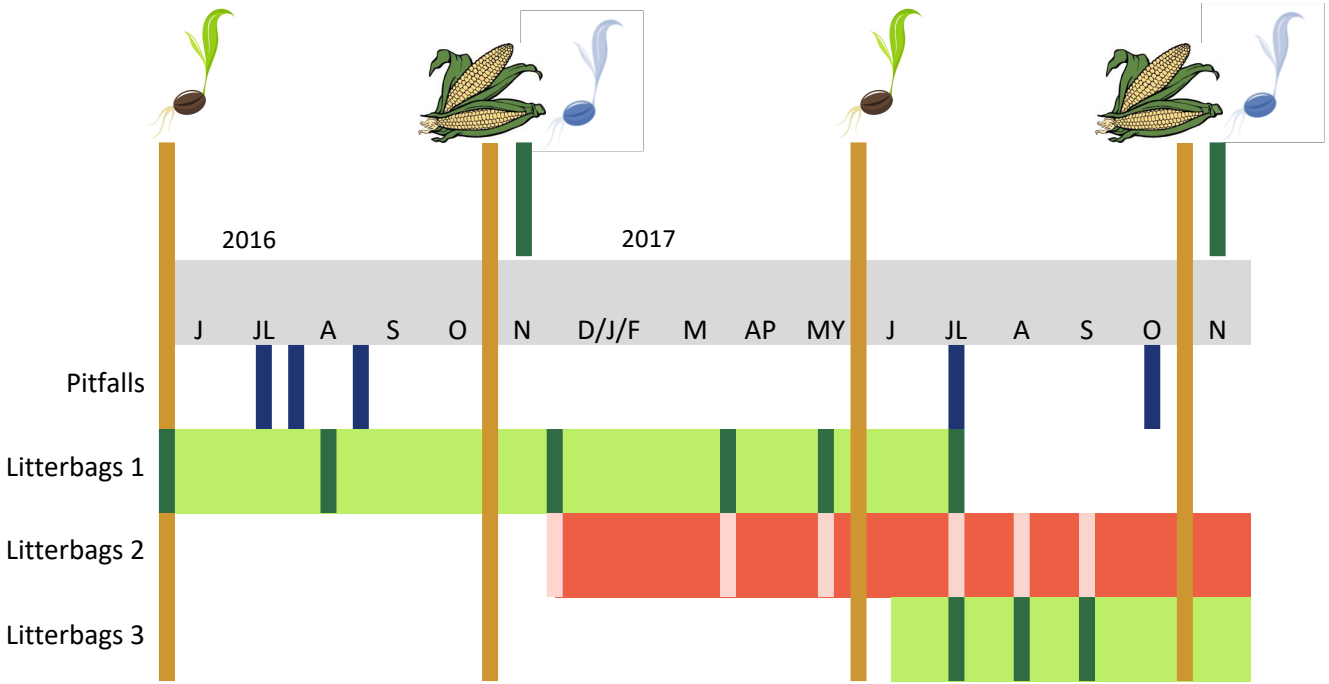
Thank You! - Questions?


PennState College of Agricultural Sciences

NORTHEAST SARE Sustainable Agriculture Research & Education

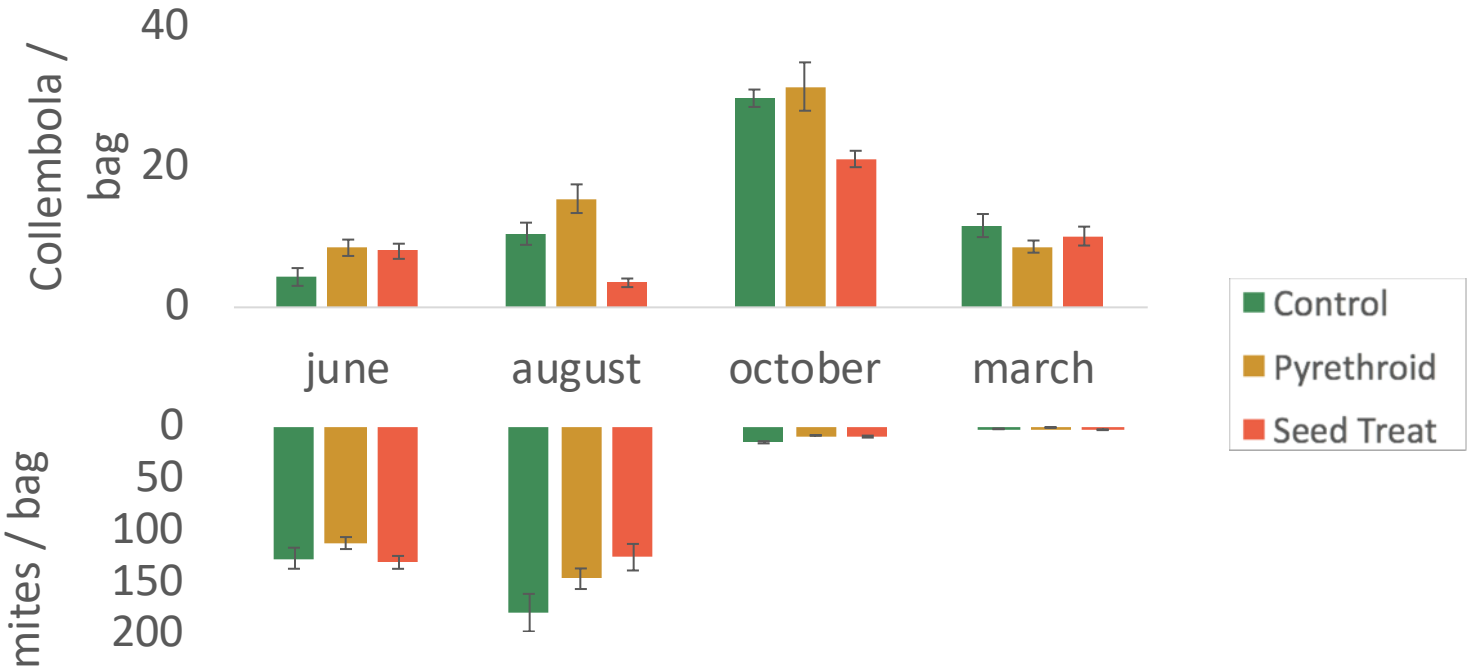



2nd Year of 3 year Experiment



Mesofauna sampling method

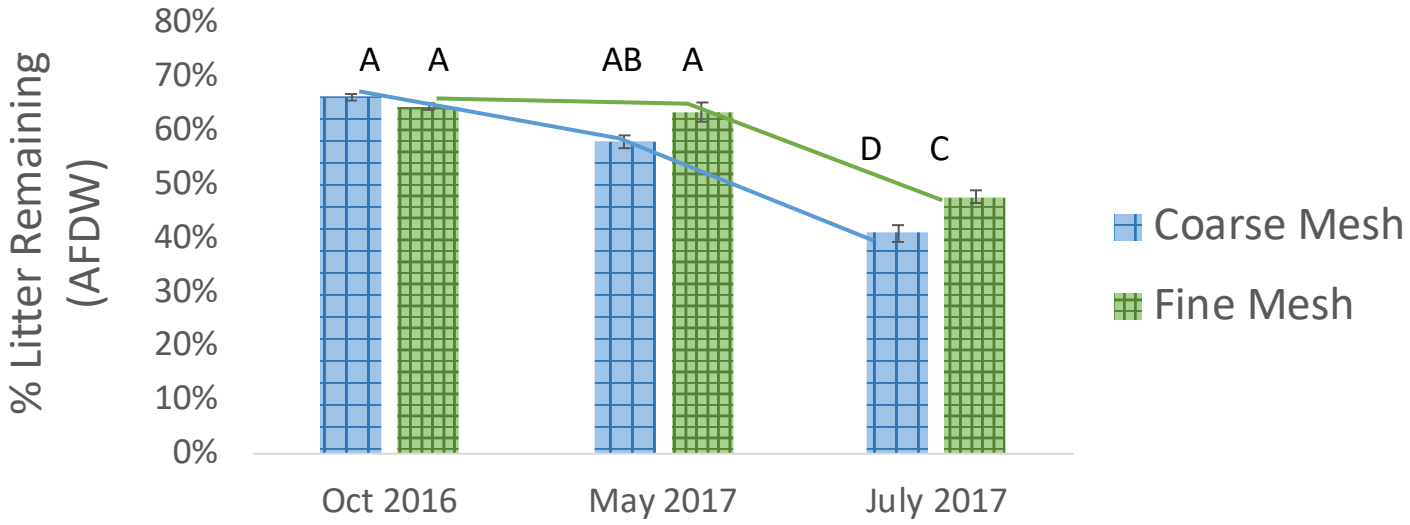
Mesofauna Population Dynamics



Poisson Mixed Model: collembola= treat*date
treat: $p < 0.0001$ date: $p < 0.0001$
itreat*date: $p < 0.001$
n=72 ; soy plot only

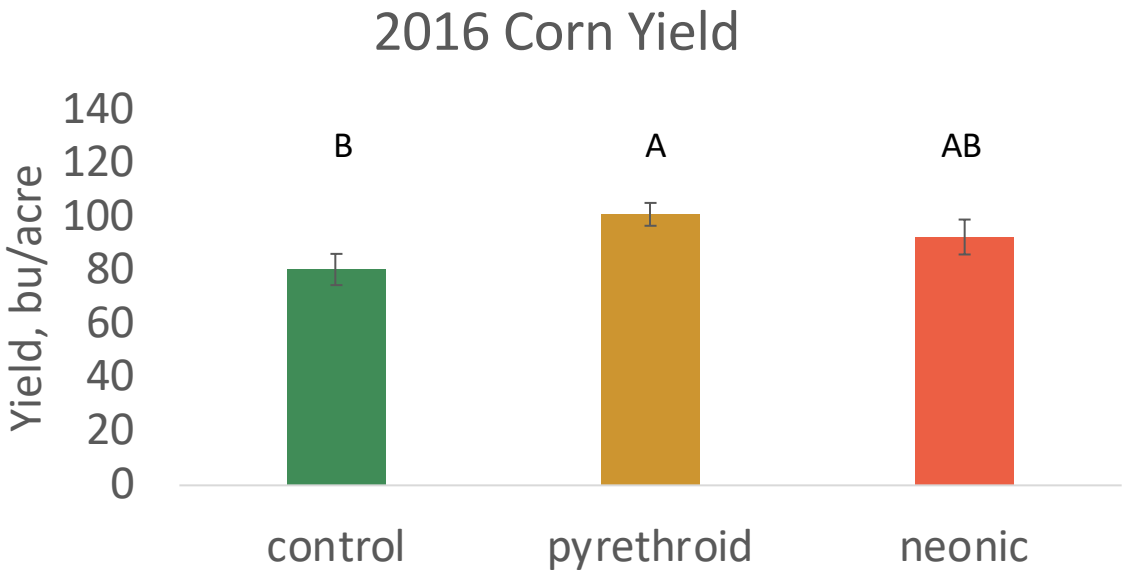
Negative Binomial Mixed Model: mites = treat*date
treat: $p=0.0264$ date: $p < 0.0001$
no significant interaction
n=72 ; soy plot only

Macrofauna exclusion decrease decomposition rate



Repeated Measures Model: %remaining = treat*meshsize*degreedays
treat: p <0.0790 meshsize: p=0.0006 degreedays: p<0.0001
treat*degreedays: p=0.0281 meshsize*degreedays: p<0.0001
n=140 ; soy 2016 plot only

Agronomic significance: No effect of pesticide treatments on yield



Tukey groupings with α=0.10

treatment: p=0.0911
n=12

Objectives

Investigate if prophylactic pesticide use affects arthropod decomposers

Investigate if this affects decomposition rate.

Additional factors

- Crop type
- Role of macroinvertebrate
- Crop residue age/seasonality