Impacts of Rye Cover Crop on Ground-Dwelling Beneficial Arthropods

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Img. 2

Abstract

Corn (*Zea mays* L.) and soybean (*Glycines max* L.) are widely produced in the United States, both experiencing increaing demand and value rising threefold throughout the last decade. Increased production poses significant environmental concerns as both corn and soybean require large inputs for cultivation. Alternative management strategies, such as the planting of a rye (*Secale cereal* L.) cover crop, may decrease the impact of production by reducing soil erosion and decreasing pest pressure. We hypothesize that a rye cover planted within a corn-soybean annual rotation will positively increase abundance of ground-dwelling, beneficial arthropods compared to corn-soybean rotations without a rye cover crop. We measured the ground-dwelling arthropod community in two states over a two year period. In 2011, we used pitfall traps to measure the activity/density of ground-dwelling arthropods in corn and soybean plots grown with and without a rye cover crop at two locations within Iowa at five times throughout the growing season. In 2012, we expanded our investigation to include a third location in Missouri and sampled with pitfall traps four times throughout the growing season. Arthropods captured were identified, quantified, and assigned to feeding guilds. We detected significant differences in the arthropod activity/density among sampling locations, but did not observe any differences between plots growth with or without a rye cover crop. Rye cover crops provide agronomic advantages when incorporated in conventional corn or soybean production, but how this cover crop is managed may alter rye's benefits to the arthropod community.

Objective

Measure impact of rye cover crop on beneficial, ground-dwelling arthropod abundance and diversity

- Measure effects across time (2011, 2012, and 2013 [in progress])
- Measure effects at multiple locations
- Explore effects on various components of the community, such as predators

MATERIALS & METHODS

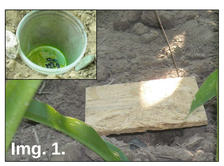
Locations and Treatments

- 2011 Sampled 5 times at Gilmore and ISU AG CSCAP locations
- 2012 Sampled 4 times at Gilmore, ISU AG, and Freeman CSCAP locations

- Plots sampled at each location included treatments of:
1) Corn, 2) Soybean, 3) Corn w/ rye cover crop, 4) Soybean w/ rye cover crop

Capturing Arthropods

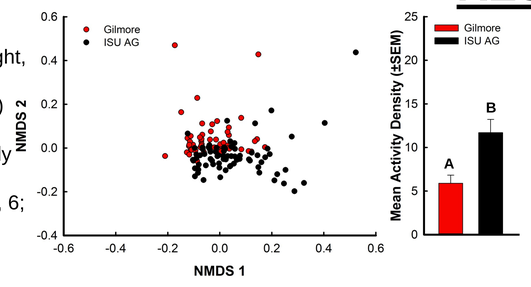
- Pitfall traps (**Img.1**) were placed within plots for a 24 hr period
- Measured activity/density, as only active arthropods are captured
- Beneficial-arthropod taxa included in the analyses were:
  1. Class Chilopoda (centipedes, predators)
  2. Class Diplopoda (millipedes, detritivores)
  3. Order Isopoda (pill bugs, detritivores)
  4. Order Opilions (harvestmen, predators)
  5. Family Lycosidae (wolf spiders, predators)
  6. Family Carabidae (ground beetles, predators)
  7. Family Cicindelidae (tiger beetles, predators)(**Img. 2**)
  8. Family Formicidae (ants, predators)
  9. Family Gryllidae (ground crickets, weed seed predators)
  10. Family Staphylinidae (rove beetles, predators)


Img. 1.

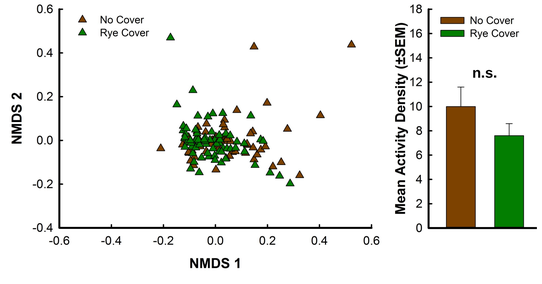
- Difference in activity/density were measured for both the whole community and the predatory taxa
- Differences in community composition were visualized using non-metric multidimensional scaling (NMDS)

RESULTS

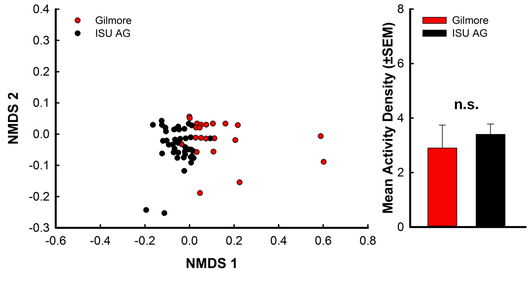
Beneficial arthropod community composition (right, NMDS scatter plot) and abundance (left, histogram) by location in 2011. Abundance was significantly different between the two locations (F = 12.1; DF = 1, 6; P = 0.01).



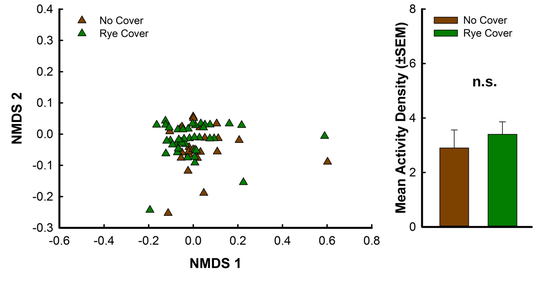
Beneficial arthropod community composition (right, NMDS scatter plot) and abundance (left, histogram) by treatment in 2011. Abundance did not differ significantly between treatments (F = 1.99; DF = 1, 133; P = 0.65).



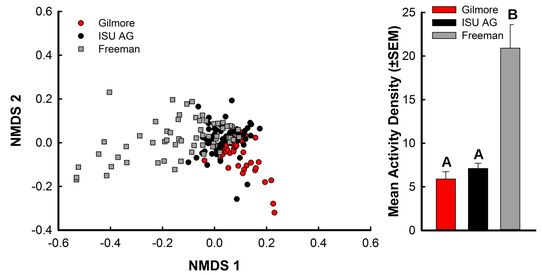
Predatory arthropod community composition (right, NMDS scatter plot) and abundance (left, histogram) by location in 2011. Abundance did not differ significantly between locations (F = 0.21; DF = 1, 6; P = 0.66).



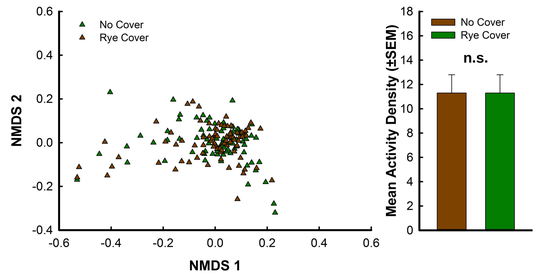
Predatory arthropod community composition (right, NMDS scatter plot) and abundance (left, histogram) by treatment in 2011. Abundance did not differ significantly between treatments (F = 0.21; DF = 1, 133; P = 0.65).



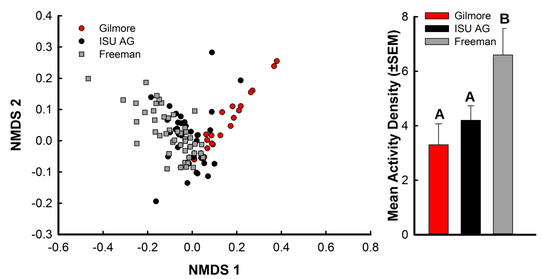
Beneficial arthropod community composition (right, NMDS scatter plot) and abundance (left, histogram) by location in 2012. Abundance was significantly different between Freeman and the 2 Iowa locations (F = 9.26; DF = 2, 9; P = 0.007).



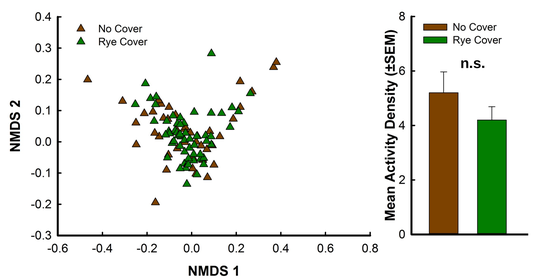
Beneficial arthropod community composition (right, NMDS scatter plot) and abundance (left, histogram) by treatment in 2012. Abundance did not differ significantly between treatments (F = 0.01; DF = 1, 165; P = 0.98).



Predatory arthropod community composition (right, NMDS scatter plot) and abundance (left, histogram) by location in 2012. Abundance was significantly different between Freeman and the 2 Iowa locations (F = 3.59; DF = 1, 9; P = 0.07).



Predatory arthropod community composition (right, NMDS scatter plot) and abundance (left, histogram) by treatment in 2012. Abundance did not differ significantly between treatments (F = 1.67; DF = 1, 165; P = 0.20).



DISCUSSION

- Detected differences among arthropod communities by location

- No observable differences in arthropod communities between rye cover and no cover treatments

- We observed no increased benefits to ground-dwelling arthropods in the presence of rye cover crops, but there were also no negative impacts
- Rye cover crop does not reduce the benefits provided by the ground-dwelling arthropods community

ACKNOWLEDGEMENTS

Thanks to Ignacio Alvarez-Castro for statistical consulting and Claire Brown, Oliver Dion, and Mitchel Manning for their invaluable assistance in the field and laboratory.

This research is part of a regional collaborative project supported by the USDA-NIFA, Award No. 2011-68002-30190 "Cropping Systems Coordinated Agricultural Project (CAP): Climate Change, Mitigation, and Adaptation in Corn-based Cropping Systems" sustainablecorn.org

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