Arthropod Response to Cover Crop-Based Reduced Tillage Organic Cropping Systems

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Background

- Due to lack of chemical options, organic growers rely on cropping practices and predation to control invertebrate pests (USDA NASS 2015)
- Tillage aids weed and nutrient management, but harms soil and predatory arthropods (Cavigelli et al. 2013, Mirsky et al. 2012, Hatten et al. 2007)
- Cover crops facilitate no-till production and sustain arthropods (Rivers et al. 2017)

Objectives & Hypotheses

Assess the effect of four cropping systems on pest feeding damage and predation rate:
We hypothesize that:
1) response of arthropods to cover crops will be species mixture -specific
2) tillage will lead to higher predation rates and lower pest damage in System 1 than in other systems
3) interseeded cover crops in Systems 2 and 4 will provide enhanced predation and reduced pest pressure later in the season

Cropping Systems Timeline

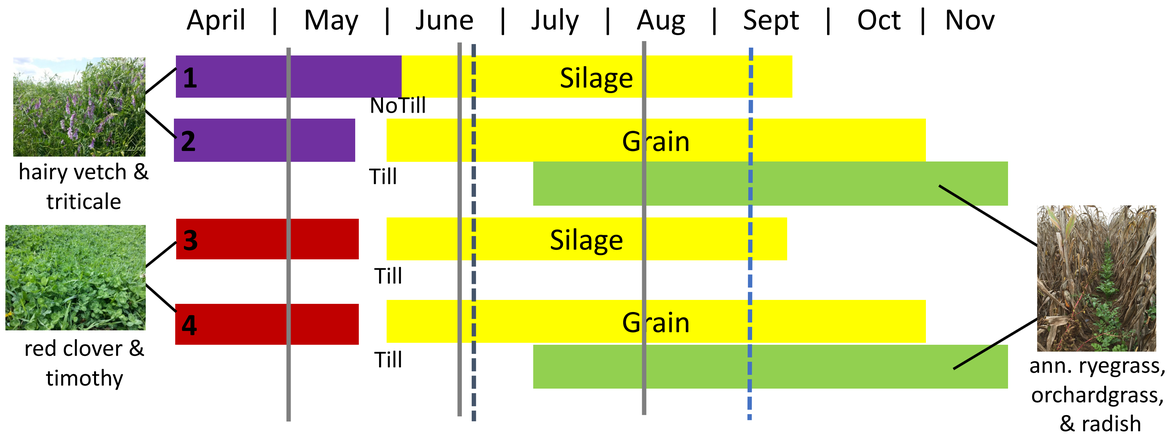
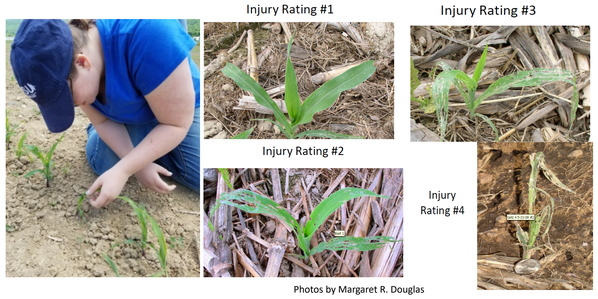


Fig. 1. The cropping systems studied (1-4) are shown with colored bars representing the cover crop species mixtures. Grey lines represent sentinel predation assay (May 5, June 27, Aug 15, 2016). Dashed navy line represents early season damage assessment (June 25, 2016) and dashed teal line represents late season damage assessment.(September 9, 2016) ****double-check dates***

Sampling Methods

Sentinel Predation Rate
Five *Galleria mellonella* per index card
Cage w/ lid to exclude vertebrates
Amount eaten is recorded after 24 hours
Three dates per year (gray lines in Fig 1.)



Photos by Margaret R. Douglas

Early Season Damage
Two 8.75' transects per plot
Each plant examined for damage type & overall intensity
Intensity scored on 0-4 scale

Late Season Damage
12 plants/plot collected & examined for tunnels and ear feeding
Caterpillars collected and identified

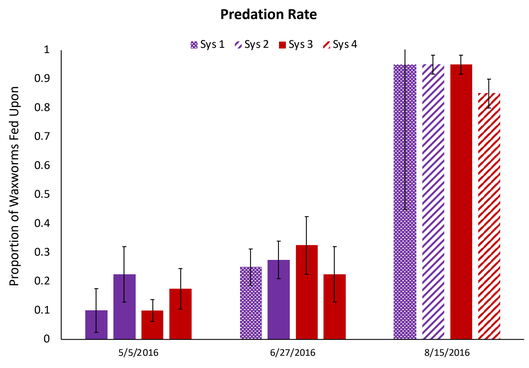


Fig. 2. The average predation rate of waxworms in each system at each sampling date. Colors represent preceding cover crop species, polka dots represent no-till planting, and dashed bars represent interseeding.

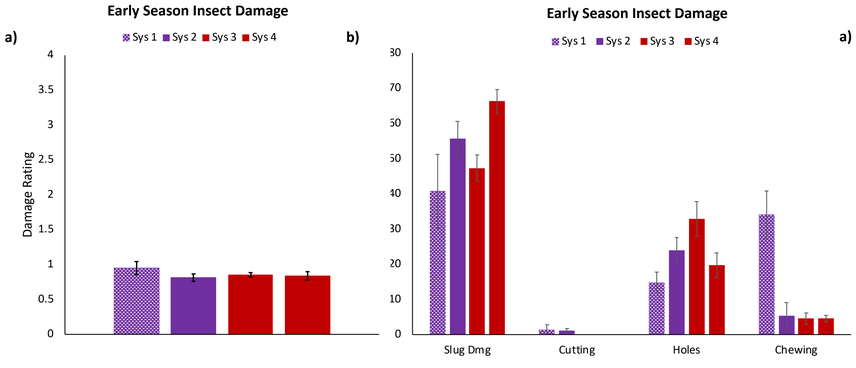


Fig. 3. Early season damage is shown by average damage intensity (a), as well as broken down into common types of damage (b). Colors represent preceding cover crop species and polka dots represent no-till planting, Letters represent significant differences among systems for that damage type at the 0.05 level.

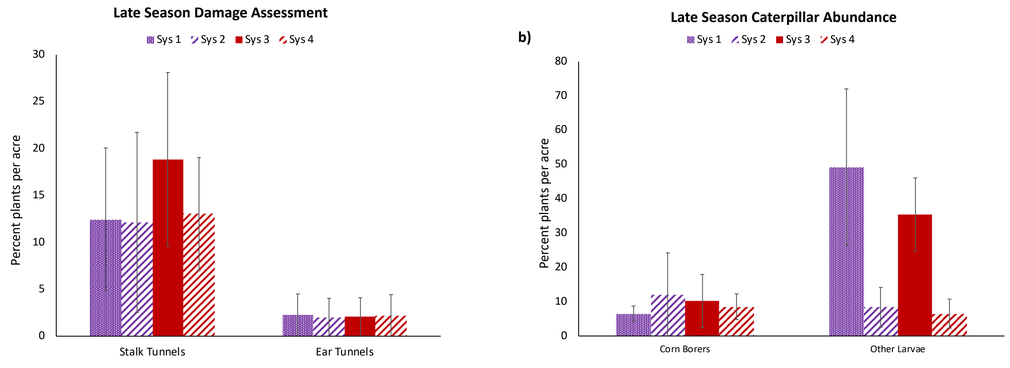


Fig. 3. Late season damage included tunnels from European corn borer, as well as ear damage from various caterpillars, particularl corn earworm. (a) The number of caterpilllars found in or on plants was also recorded (b). Colors represent preceding cover crop species, polka dots represent no-till planting, and dashed bars represent interseeding, Letters represent significant differences among systems for that damage type at the 0.05 level.

Summary of Results

- Systems did not differ in early-season (Fig. 2a) or late-season (Fig. 2b) feeding damage to corn
- Caterpillars such as corn earworm were less prevalent in interseeded plots, but this did not translate to ear damage
- Predation rate did not differ by system

Conclusions and Future Plans

- Contrary to our hypotheses, tillage and cover crop species mixture did not affect herbivory or predation by arthropods in corn
- Interseeding may affect the prevalence of caterpillars, but this does not necessarily translate to increased damage
- Testing effect of tilled vs no-till planting at one time in rotation may fail to capture disturbance over three-year rotation
- Quantifying disturbance over time might yield better insights
- Further work will address specific arthropods contributing to predation in each system