

## Background

- To control insects and slugs, organic growers rely on cropping practices and predation (USDA NASS 2015).
- Tillage aids management of soil-dwelling insects and slugs, weeds, and nutrients but can harm predatory insects and soil health, creating tradeoffs (Cavigelli et al. 2013, Mirsky et al. 2012, Hatten et al. 2007).
- Cover crops facilitate no-till production and sustain insects through increased plant residue on the soil surface (Rivers et al. 2017).
- Interseeding cover crops mid-season helps overcome short fall planting windows but effects on insect pests need more research.

## Objective & Hypotheses

Our objective was to measure the effect of four cropping systems on pest feeding damage throughout the corn growing season.

We expected that:

- the response of pests to cover crops would differ by mixture,
- insect survival would be greater under no-till in System 1, resulting in more damage, and
- predation would increase after interseeding in Systems 2 and 4, resulting in lower pest pressure.

## Cropping Systems Timeline

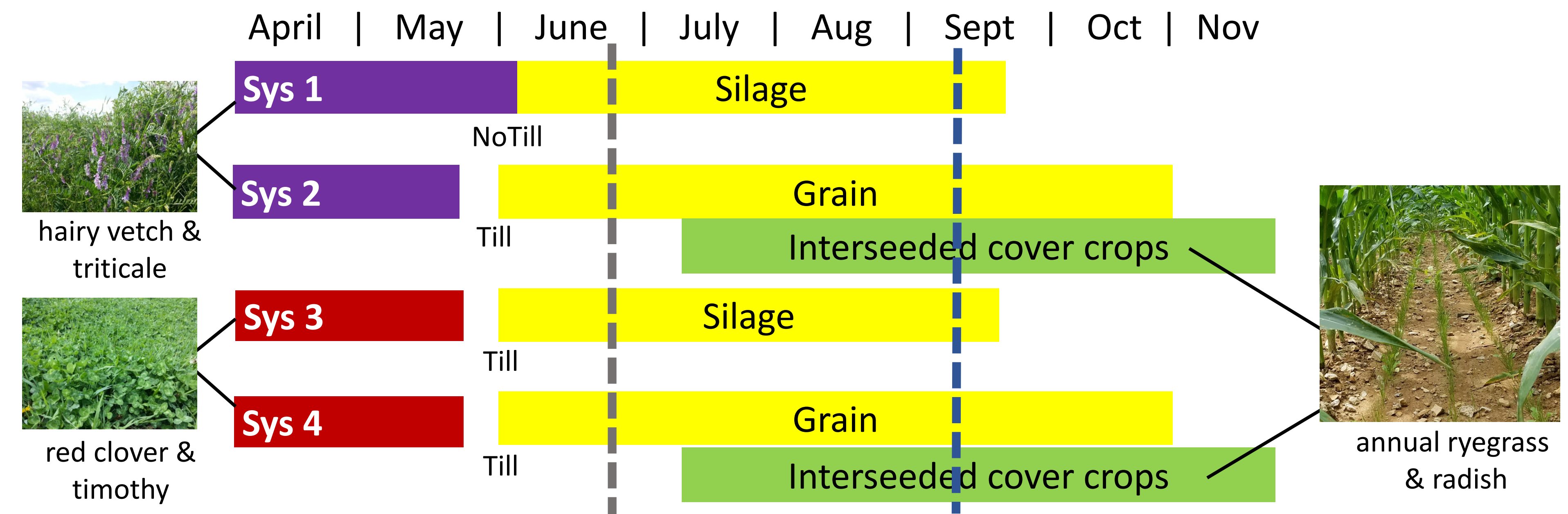


Fig. 1. The cropping systems (1-4) are shown with colored bars representing the cover crop species mixtures. The dashed grey line represents early season damage assessment (6/21/2017) and dashed blue line represents late season damage assessment (9/12/2017). Each cropping system was replicated four times in plots measuring 30' by 160' at the PSU Research Farm in Rock Springs, PA. All tilled systems were moldboard plowed prior to corn planting. See Methods section below for details on cover crop termination in the no-till system and on interseeding.

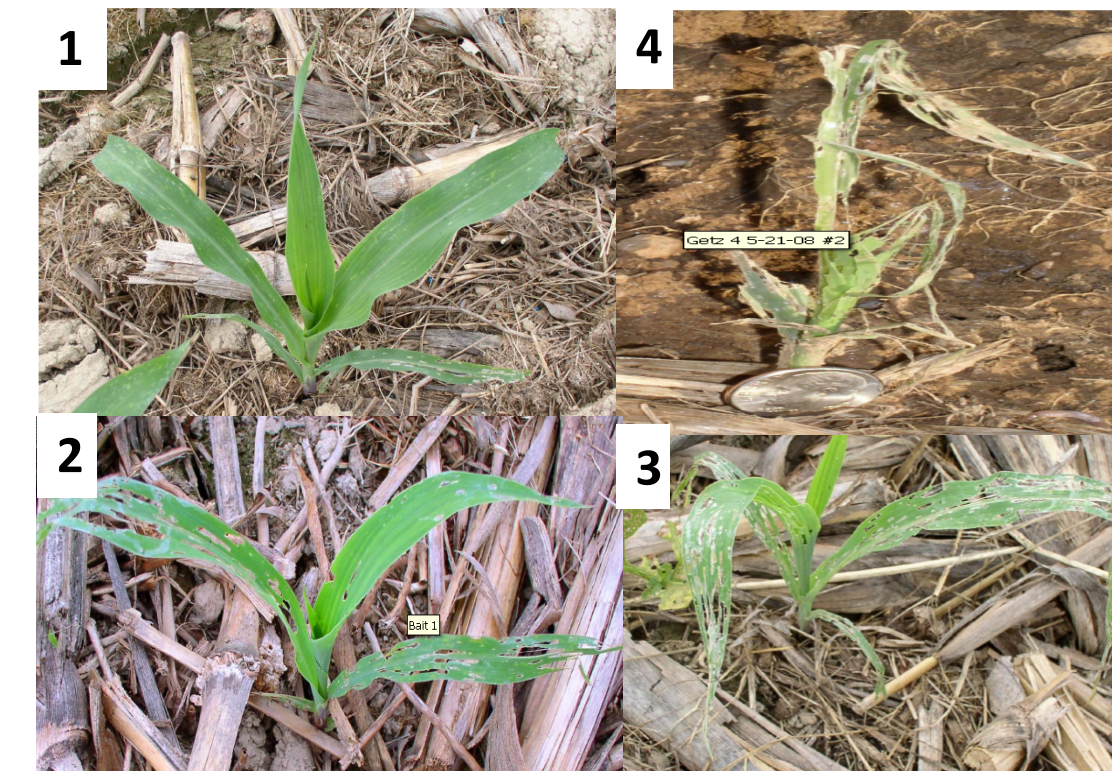
## Experimental Methods



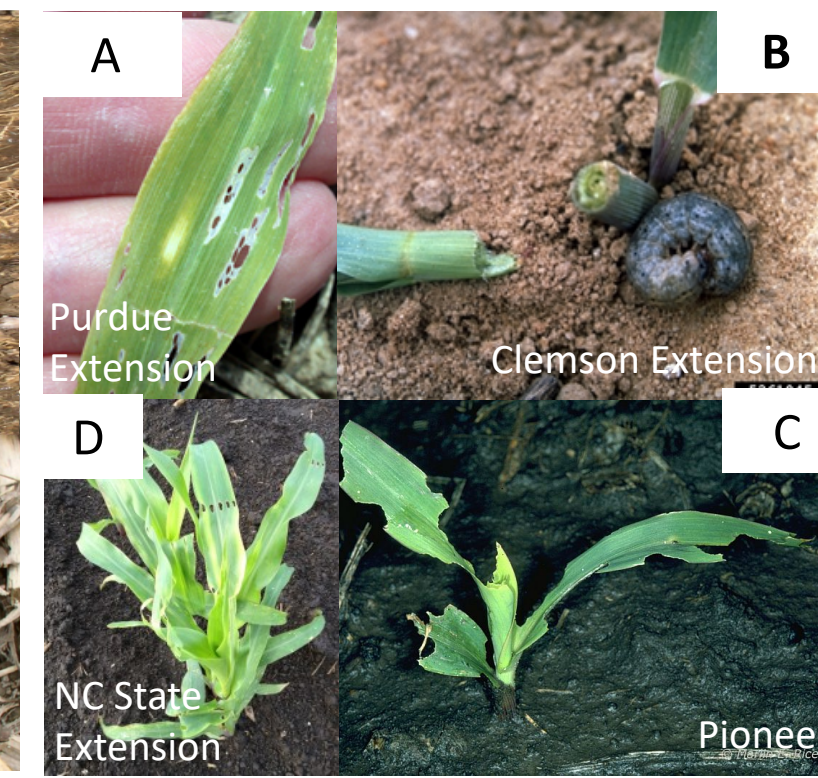
A roller-crimper was used to terminate cover crops and enable no-till planting after cover cropping in System 1(L) while an interseeder was used to drill cover crops between corn rows at the V5 growth stage in Systems 2 and 4(R).

### Early Season Damage

- Two 8.75' transects were used per plot.
- Each plant was examined for common types of early-season damage.
- Damage severity was also assessed using a 0-4 scale.



Damage ratings of 1-4, shown counter-clockwise from top left. Rating Photos by Margaret R. Douglas.



Common damage types. A) Slug feeding, B) cutworm feeding, C) chewing, and D) holes in a line.

### Late Season Damage

- Plants were sampled for feeding damage from European corn borer and corn earworm.
- 12 plants/plot were collected & examined for tunnels and ear feeding.
- Any caterpillars found were collected and identified.



L: European corn borer inside tunnel R: Corn earworm feeding on ear

## Summary of Results

- Systems did not differ in the amount of early-season (Fig. 2a) or late-season (Fig. 3) damage to corn.
- Slugs were the main contributor to early-season damage (Fig 2a) but the severity of damage remained low (Fig 2b).
- Tillage significantly reduced chewing damage while other damage types were unaffected by cropping system (Fig. 2B).
- European corn borer damage was absent during sampling in 2017.

## Conclusions and On-Going Research

- Reducing tillage through the use of cover crops appears not to affect pest pressure in organic corn production.
- Ongoing work is investigating the effects of these systems on predatory insects and estimating the amount of predation they are doing, to understand their potential to control pests.

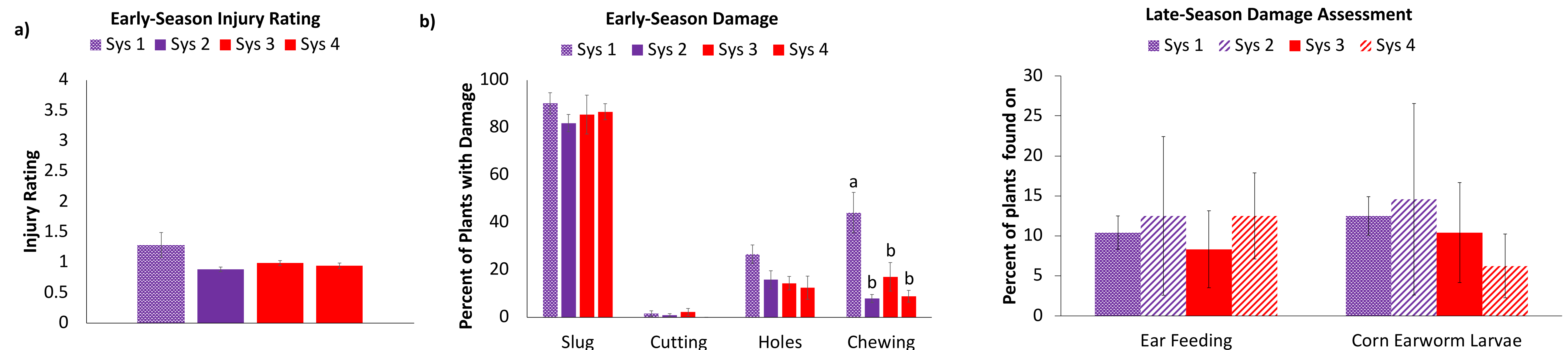


Fig. 2. Early season damage is shown by average damage intensity (a), as well as broken down into common types of damage (b). Colors represent preceding cover crop species and polka dots represent no-till planting, Letters represent significant differences among systems for that damage type at the 0.05 level.

Fig. 3. Late season feeding on ears by corn earworm and corn earworm larva found on plants are shown. Colors represent preceding cover crop species, polka dots represent no-till planting, and dashed bars represent interseeding. No significant differences were observed among systems.

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