

Introduction

- In strip tilled (ST) fields, tillage is limited to the crop row and the rest of the soil is left undisturbed.
- Contributes to soil conservation
- Provides a good seed bed for smaller seeded crops—a good option for vegetable growers to reduce tillage?
- May reduce the number of field passes, saving on fuel costs
- But may complicate weed control by removing cultivation as an option, particularly important for organic growers
- In systems with a cover crop from a weed perspective...
 - The crop row (IR=in row) has tillage, incorporated residues, and crop competition.
 - Between the crop rows (BR=between row), there is no tillage, a surface cover crop mulch, and less crop competition
- Soil parameters, crop growth and yield, and weed emergence and growth are expected to vary with different combinations of these factors and will differ from conventionally tilled (CT) fields.
- This experiment used chemical cover crop burndown and applied synthetic fertilizers, though its findings can be applied to organic systems—cover crops can be mowed and composts can be used.

OBJECTIVES:

- Characterize soil moisture and temperature in and between crop rows in strip tilled and chisel plowed plots with and without cover crops
- Compare cabbage plant growth and yield with those same factors
- Compare weed emergence in and between crop rows

Methods

Four treatments, each replicated 4 times:

- strip tilled with oat cover crop
- strip tilled with no cover crop
- chisel plowed with oat cover crop
- chisel plowed with no cover crop

Each had a weed-free subplot (hand-maintained) and a weedy subplot (containing a fixed density of Powell amaranth.)

Timeline of field operations

Date	Operation
4/20	Oat cover crop established
6/17	Cover crop terminated
6/29	Residue flail mowed
7/1	Fertilizer applied and plots tilled (Figure 1) <ul style="list-style-type: none"> ST plots: 2 row Hiniker strip tiller (Figure 2) CT plots: chisel plow followed by field cultivator Emergence trial #1 started
7/8	Cabbage transplanted—variety Blue Dynasty (Figure 3)
7/9	Emergence trial #2 started
8/12	Nitrogen side dress application
8/18	Mid-season growth assessed on cabbage
10/29	Cabbage harvested (Figure 4)

**overhead irrigation applied as needed;
Dipel® applied twice for cabbage worm control**



Figure 1. Strip establishment with oat cover crop residue on 7/1



Figure 2. Hiniker two row strip tiller



Figure 3. Cabbage transplants in strip tilled cover cropped plot on 7/12—12 days after tillage



Figure 4. The same plot one week prior to harvest. Cover crop residue still visible between rows

Data Collected:

- Soil temperature (continuously) and moisture (biweekly)
- Cabbage plant biomass and yield
- Weed emergence
 - With seeded quadrats in and between row
 - Right after tillage and 9 days later (after cabbage planting)

Results

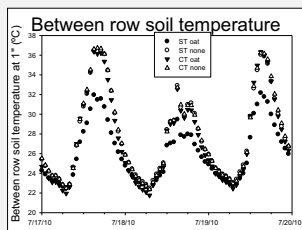


Figure 5. Between row soil temperature from 7/17-7/20—two weeks after tillage. Temperature reduced where a surface cover crop is present. This trend was observed until early August (one month after tillage). A similar effect was observed in the crop row, but the magnitude was lower

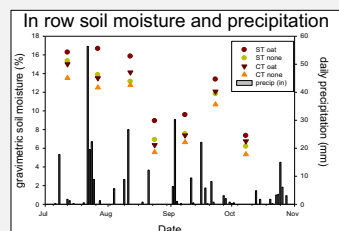


Figure 6. In row soil moisture (left) and daily precipitation (right). Soil moisture is consistently higher in ST plots with a cover crop. Similar trends seem for between row soil moisture (not shown).

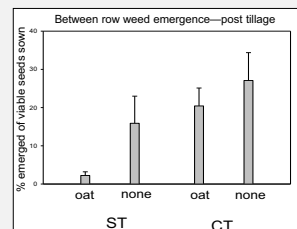


Figure 7. Post-tillage, there was less weed emergence in ST BR compared to CT BR ($p=0.0043$) but cover crop effect was NS. The largest reduction was observed with a surface cover crop residue. Bars are mean \pm SE. There were no differences in IR emergence.

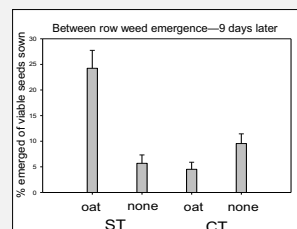


Figure 8. For BR weed post-planting (9 days after prior trial), emergence in ST was higher following oat compared to no oat ($p=0.0123$), but CT emergence did not differ. For cover cropped plots, emergence was higher in ST than CT ($p=0.0132$). Bars are mean \pm SE. Similar trends were observed for IR emergence (not shown).

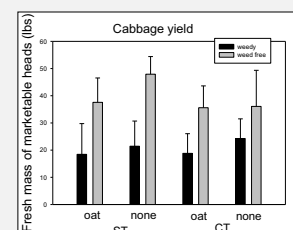


Figure 9 Total marketable cabbage head biomass (lbs). Within each weed category, there were no significant differences between treatments

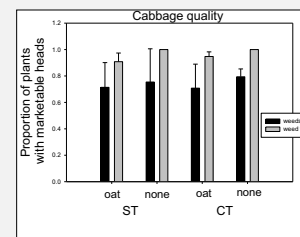


Figure 10 Proportion of cabbage plants that produced a marketable head. When weeds were not present, there was a slight reduction in the proportion of plants with a marketable head following the cover crop.

Summary and Next Steps

- There are clear differences in soil physical characteristics like temperature and moisture content (Figures 5, 6)
 - In strip tilled plots with a cover crop, lower soil temperature may decrease germination of weeds between row... but higher soil moisture may help those that do successfully germinate and emerge.
 - Can these practices also increase organic matter? We hope to determine if these can contribute to long-term carbon sequestration and quality improvements
- Suppression of weed emergence by tillage and cover cropping was clearer immediately after tillage (Figure 7) compared to nine days later (Figure 8).
 - Trend of increasing emergence with surface cover crop residue in the second trial—suggests that residue improved soil moisture or fertility over time? Or was soil temperature more important?
 - We plan to correlate weed emergence (and growth) with soil physical and chemical parameters.
- In both weedy and weed free conditions, cabbage yield was similar among treatments.
 - Though more data are needed before solid recommendations can be made, these data suggest that these practices can be adopted without sacrificing yield.
 - If strip tillage can reduce the number of field passes needed, can these practices improve the profitability of cole crop production? Budgets will be created to explore this possibility.

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