Using spring-seeded grass cover crops to reduce herbicide inputs in plasticulture peppers

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Introduction 1

- Weeds can account for significant yield losses in plasticulture vegetable systems.
- Plasticulture provides weed control within the crop row, however, bare soil areas between beds are often exploited by weeds.
- Weeds between plastic beds are managed with herbicides, cultivation, mowing or manually. These tactics are labor intensive, and their use can result in torn plastic and increased soil erosion. Further, applying herbicides after planting is challenging because of the limited number of products registered for vegetable use and the risk of crop injury.
- A solution to these challenges may include growing a cover crop between plastic-mulched beds.
- Cover crops such as spring oats and cereal rye are known to effectively suppress weeds. Research has shown that a spring-seeded cereal rye planted between plastic beds reduced early-season weed density and biomass. However, it didn't suppress weeds the full cropping cycle.

Goal & Objectives 2

- Investigate the use of spring seeded grass cover crops and herbicides to provide season long weed suppression and eliminate the need for further chemical, mechanical or manual weed suppression tactics.
- Evaluate the effects of spring seeded cover crops on:
  1. Weed suppression
  2. Ability to reduce multiple herbicide applications

Hypothesis 3

- Integrated weed management (IWM) can be improved in vegetable plasticulture by planting a cover crop between the plastic-mulched beds and using an effective post-transplant residual herbicide as part of its termination.

Methods 4

Experiment Design

- Two-factor factorial arranged in split-plot design with four replications
- Cover crop termination: paraquat (1.76 L/ha), clethodim (1.17 L/ha), roller crimped
- Cover crop system: oats (310 kg/ha), cereal rye (268 kg/ha), oats + rye (155 + 134 kg/ha), none
- Residual: s-metolachlor (2.35 L/ha) + fomesafen (1.75 L/ha), none

Subplot dimensions:

- 1.22 m x 7.32 m (4 pepper rows).
- 0.31 m pepper spacing
- 1.83 m row centers (plasticulture)

Response Variables

- Cover crop canopy and biomass assessment
- Weed species, abundance and visual control assessments (0-100%)
- Pepper yield

Statistical Analysis

- Data collected were subjected to ANOVA using JMP Pro 16. Treatment means were separated using Fisher LSD (α = 0.05).

Values with the same letter at the same rating time are not significantly different according to Fisher's LSD (α = 0.05)

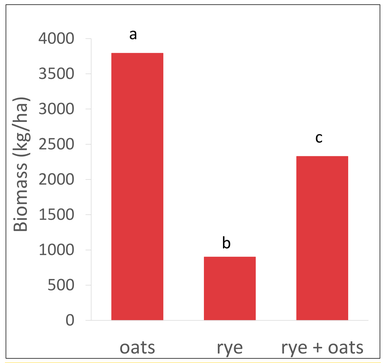


Figure 1. Graph showing cover crop biomass at termination.

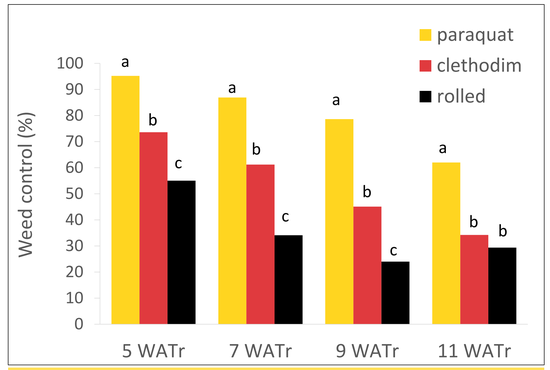


Figure 2. Graph showing weed control at different rating times in response to cover crop termination method.

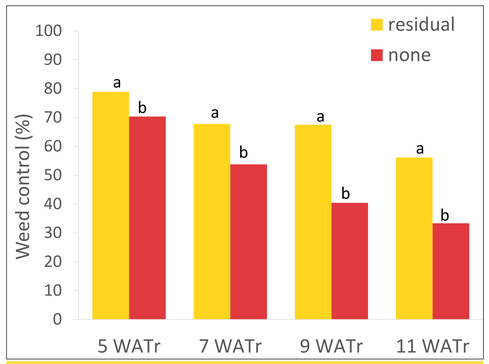


Figure 3. Graph showing weed control at different rating times in response to residual herbicide application.

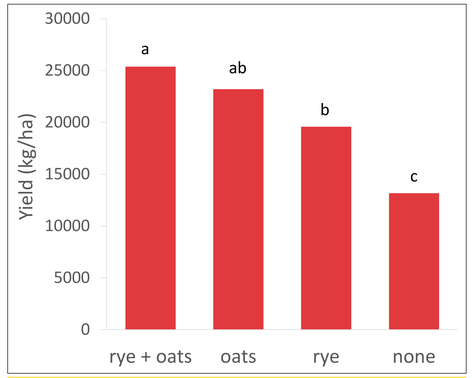
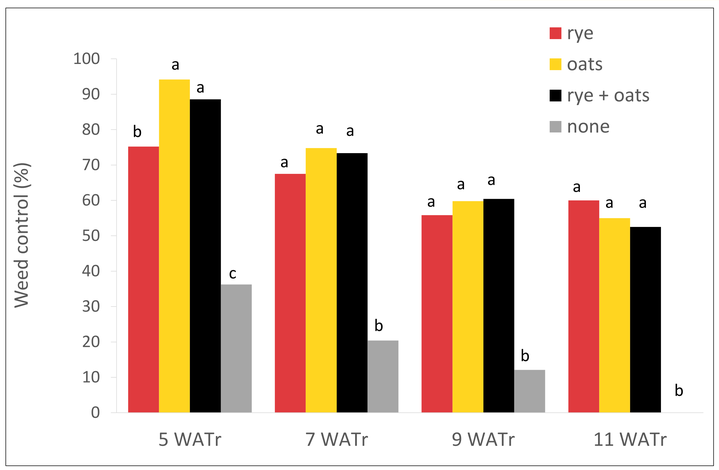
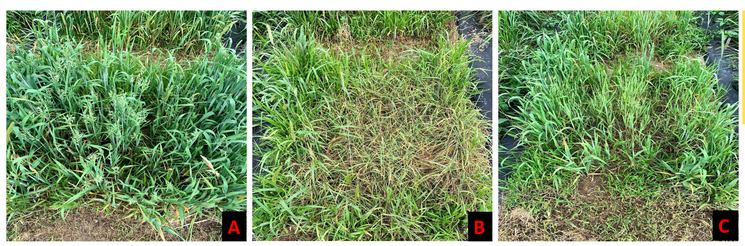


Figure 4. Graph showing pepper yield in response to cover crop type.



← **Figure 5.** Graph showing weed control at different rating times in response to cover crop type.



← **Figure 6.** Picture showing: **A**) spring oats **B**) cereal rye, and **C**) oats + rye, one week before termination

Results 5

Cover Crop Biomass

- Spring oats produced the most biomass at termination (Fig. 1)

Cover Crop Termination Method

- Termination with paraquat offered the best weed control and weed suppression was significantly greater compared with clethodim or crimper rolled treatments at each rating period (Fig. 2).
- Weed control was lowest in the rolled plots (Fig. 2)

Residual Herbicide Application

- A residual herbicide application increased weed control at all rating times (Fig. 3).
- At 9 & 11 weeks after transplant (WATr), there was a 67 & 68% increase in weed control when a residual herbicide was applied (Fig. 3).

Cover Crop Species

- Cover crop presence significantly increased weed control compared to no cover crop. Any species of cover crop increased weed control by more than 100% at all rating times compared to no cover crop (Fig. 5).

Pepper Yield

- Each cover crop treatment had significantly greater pepper yield compared to the no cover crop (none) control (Fig. 4).
- Total pepper yield in rye + oats was significantly greater than rye treatment

Discussion & Conclusion 6

- This study demonstrated that planting a grass cover crop in the spring between plastic-mulched beds can be an effective IWM tool.
- This study also demonstrated that an application of a residual herbicide after cover crop termination is a viable option to increase full-season weed control in plasticulture vegetable systems.
- The presence of a cover crop increased weed control and crop yield compared to when no cover crop was present.
- Cover crop selection was important for maximizing yield. Rye + oats significantly increased pepper yield compared to rye alone.
- There was a steeper decline in weed control in oats compared to rye plots. This may be due to the different mechanisms by which each cover crop suppresses weeds. The initial biomass of oats offered excellent weed suppression. However, as the residue broke down its ability to suppress weeds lessened and by the final rating was similar to rye. Furthermore, there was a slower decline in weed control with rye potentially because it uses allelopathy to suppress weeds. Therefore, a delay in weed control is seen as allelochemicals are slowly released from residue to soil.
- Termination with paraquat offered the best weed control tentatively because it's a non-selective burndown herbicide. Although, clethodim and roller crimping are effective at terminating a grass cover crop, broadleaf weeds present at termination will escape control.

Acknowledgements 7

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