Expanding the IWM Toolbox: Evaluating IWM approaches for Maryland and Mid-Atlantic Vegetable Production Systems

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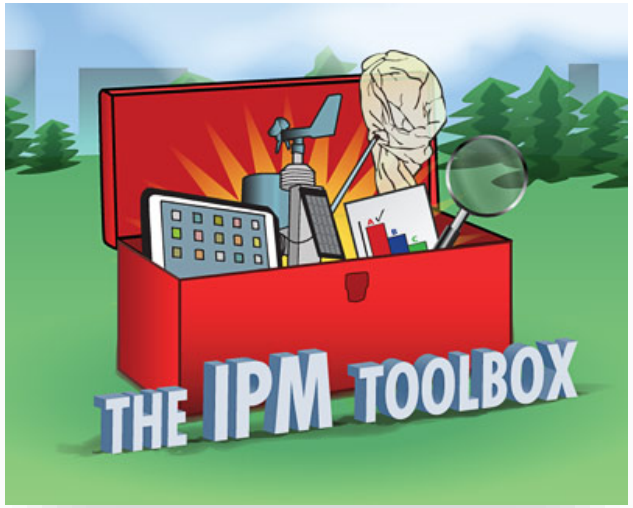


Northeastern IPM Center

USDA United States Department of Agriculture National Institute of Food and Agriculture

September 12, 2022

Webinar Details

Welcome

A recording of this webinar will be available within a week at

http://www.neipmc.org/go/ipmtoolbox

We Welcome Your Questions

Please submit a question **at any time** using the Q&A feature to your right at any time

If you'd like to ask a question anonymously, please indicate that at the beginning of your query.

Webinar Presenter

- Dr. Dwayne Joseph

Some Questions for You

Outline

I. Introduction

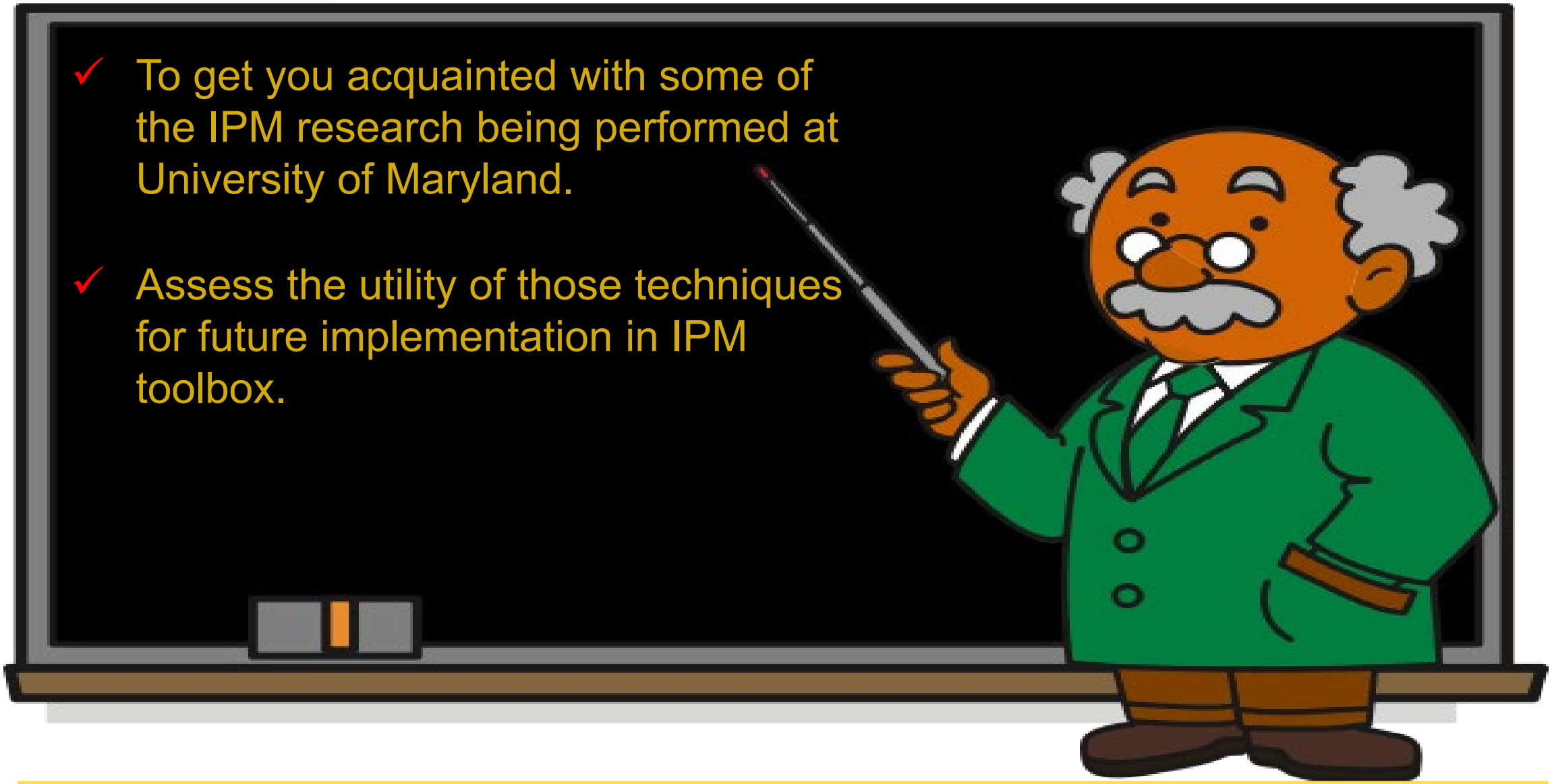
II. Field Study- Plasticulture/Cover Crop

III. Field Study- Biosolarization

IV. Conclusion/Summary

Expectations

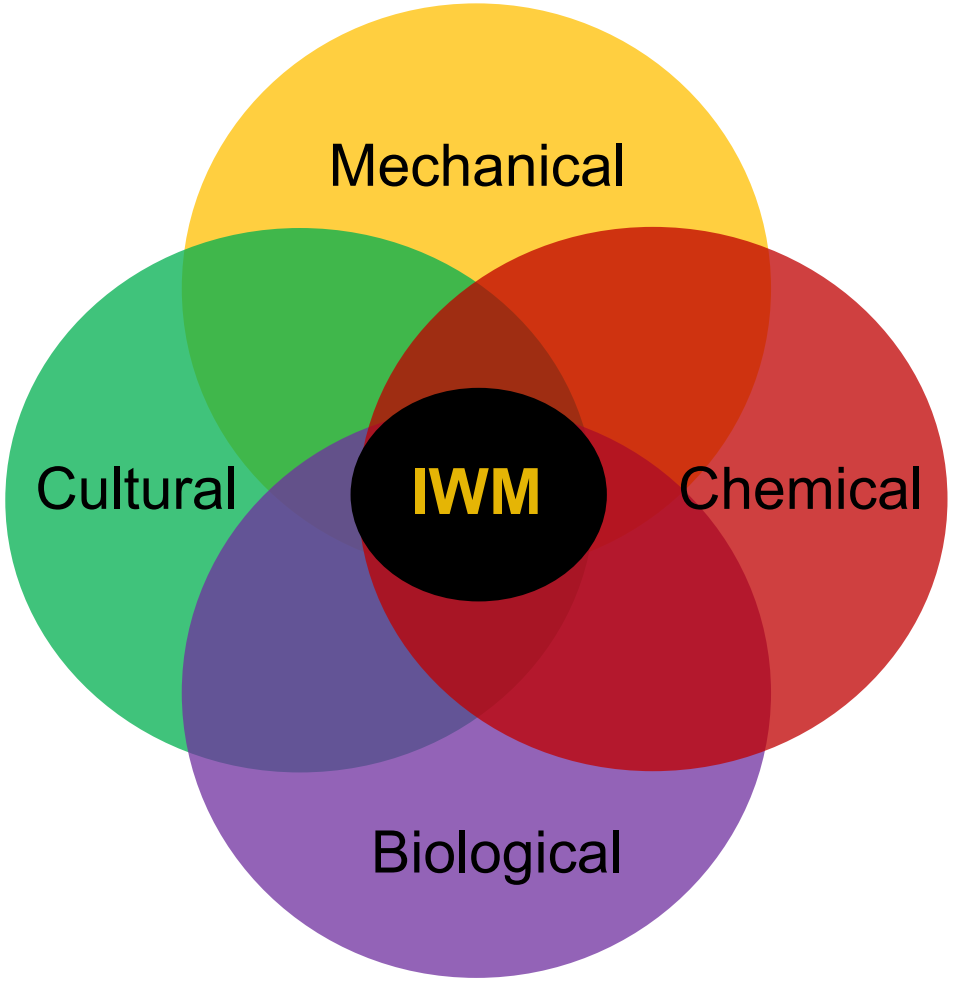
- ✓ To get you acquainted with some of the IPM research being performed at University of Maryland.
- ✓ Assess the utility of those techniques for future implementation in IPM toolbox.



Integrated Weed Management

What is IWM?

- "An approach to managing weeds using multiple control tactics." (growiwm.org)
  - The purpose of IWM is to use many techniques to best manage/control weeds in a growing season.



Plasticulture

- Earlier production
- Weed suppression
- Reduced evaporation
- Improved crop quality
- Reduced leaching of fertilizer
- Reduced soil compaction
- Better surface water drainage

Cover Crops

- Prevent soil erosion
- Improve soil tilth & biological properties
- Add C to soil, increasing soil organic matter
- Suppress weeds
- Improve the availability of soil water
- Break pest cycles
- Fix N for the subsequent crop (legumes)
- Take up N & P that would run off or leach into water bodies

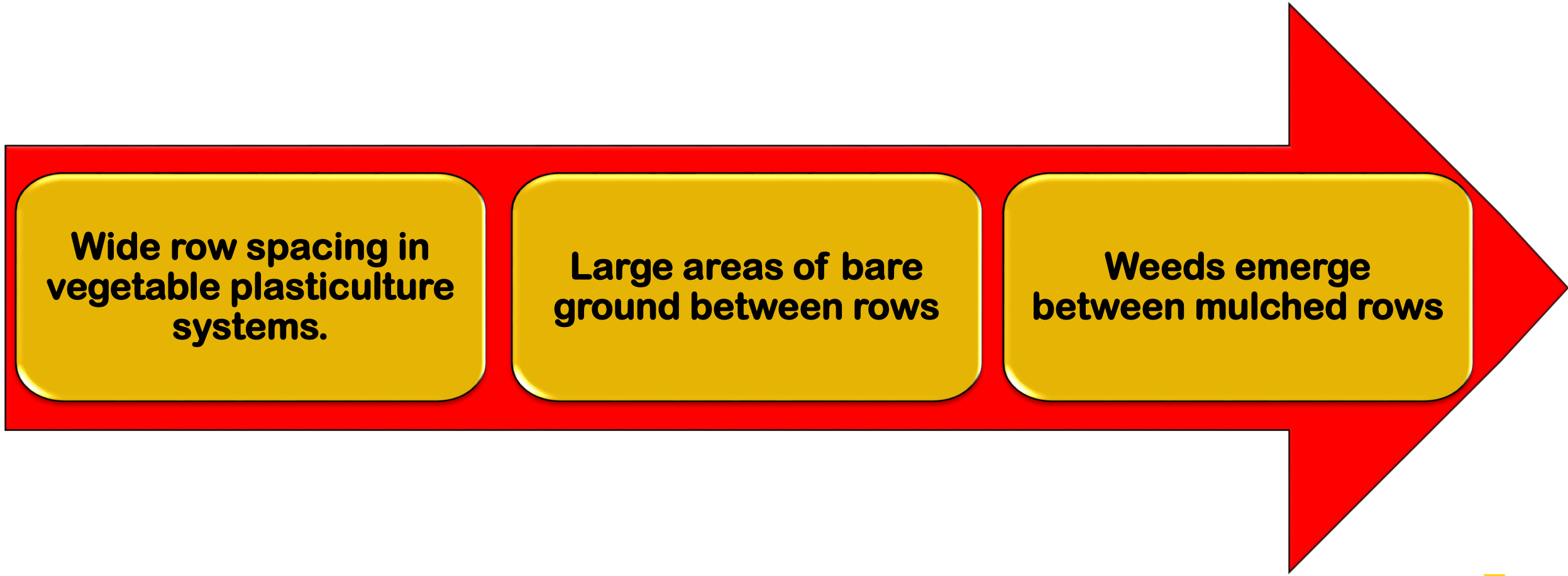
Cover Crops

- Suppress weeds

  - **Light Interception**: cover crop residue covers the soil surface blocking sunlight to weed seed and preventing germination.

  - **Allelopathy**: some cover crops produce allelochemicals (root/shoot exudates) that inhibit weed seed germination and growth.

Problem


Wide row spacing in vegetable plasticulture systems.
Large areas of bare ground between rows
Weeds emerge between mulched rows

Problem

- Weeds emerging between mulched rows:
  1. Compete with the crop
  2. Interfere with harvest
  3. Impeded herbicide spray deposition
  4. Produce weed seed that will affect subsequent crop
  5. Serve as host for pathogens and other pests
  6. Interfere with mulch removal

Problem

Between-row Cover Crop

- Viable option for weed management.
- Less expensive & labor intensive than POST herbicide applications.

Spring-seeded Cover Crops in Plasticulture

Field Study

Goal

- To use spring seeded grass cover crops & herbicides to reduce herbicide use while eliminating the need for residual mechanical or manual weed control tactics.

Objectives

- Evaluate the effects of spring seeded cover crops on:
  1. Weed suppression
  2. Reducing herbicide applications
  3. Insect populations

Study Design

Cover crop: spring oats, cereal rye , oats + rye, none

Termination: paraquat (1.2 pt a^{-1}), clethodim (1 pt a^{-1}), rolled

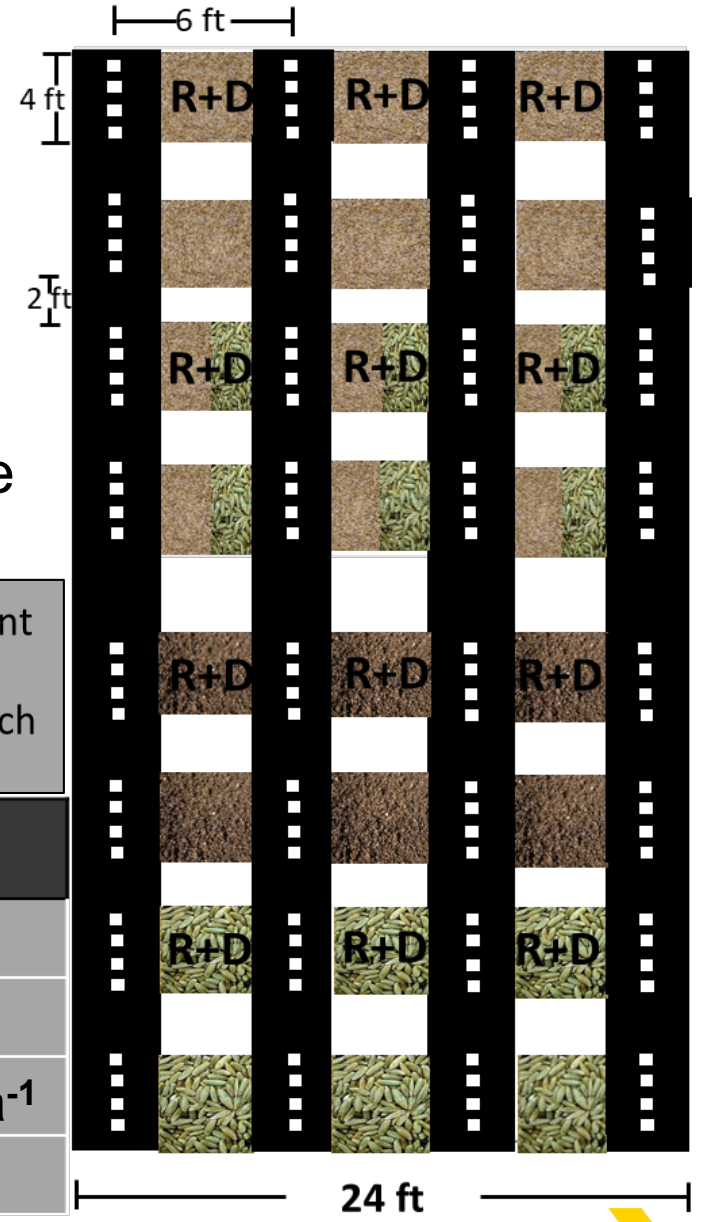
Residual: fomesafen (1.5 pt a^{-1}) + s-metolachlor(1.67 pt a^{-1}), none

Subplot dimensions

4 ft x 24 ft

6 ft row centers

1 ft pepper spacing



Species	
oats	277 lbs a^{-1}
cereal rye	240 lbs a^{-1}
oats + rye	138 + 120 lbs a^{-1}
none	

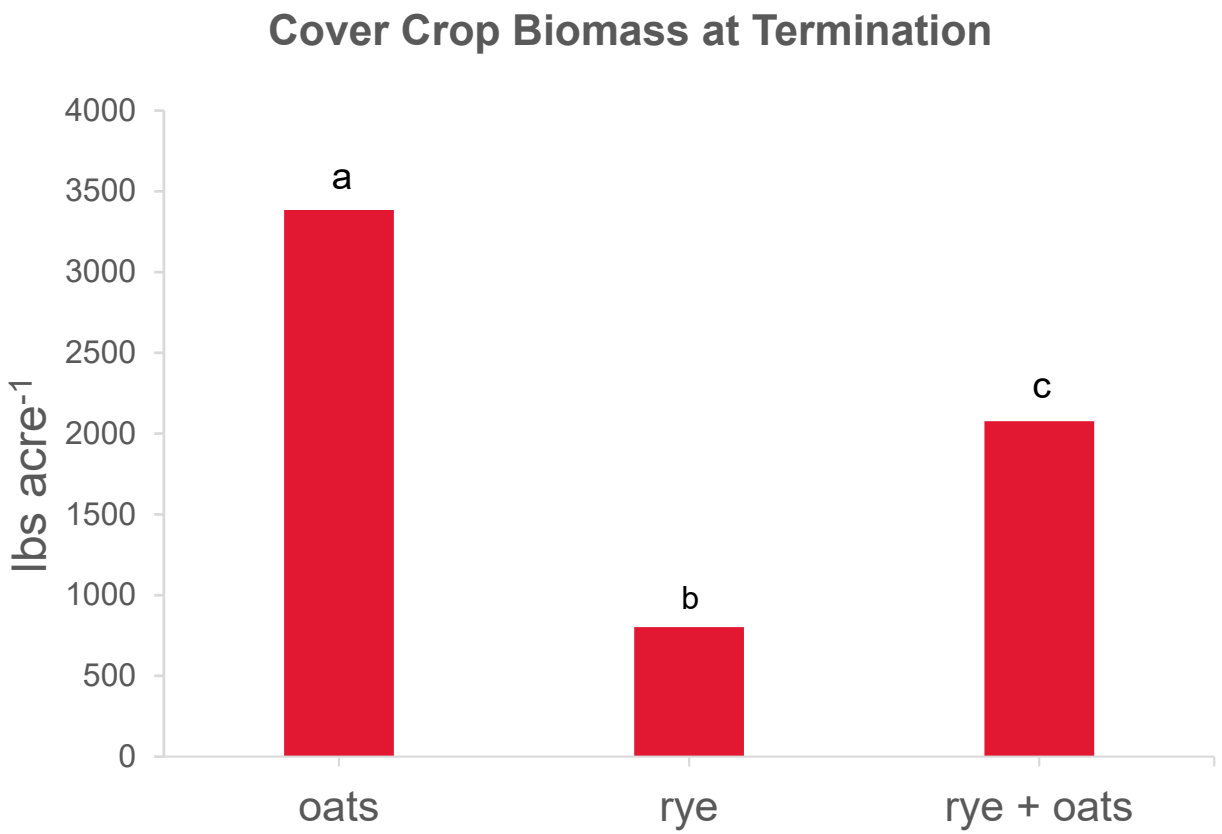
Data Collection

- Cover crop canopy & biomass
- Weed species & abundance
- Insect species & abundance
- Visual weed control ratings
- Crop growth
- Yield

Results

Cover Crop Biomass

- Oats produced the most biomass

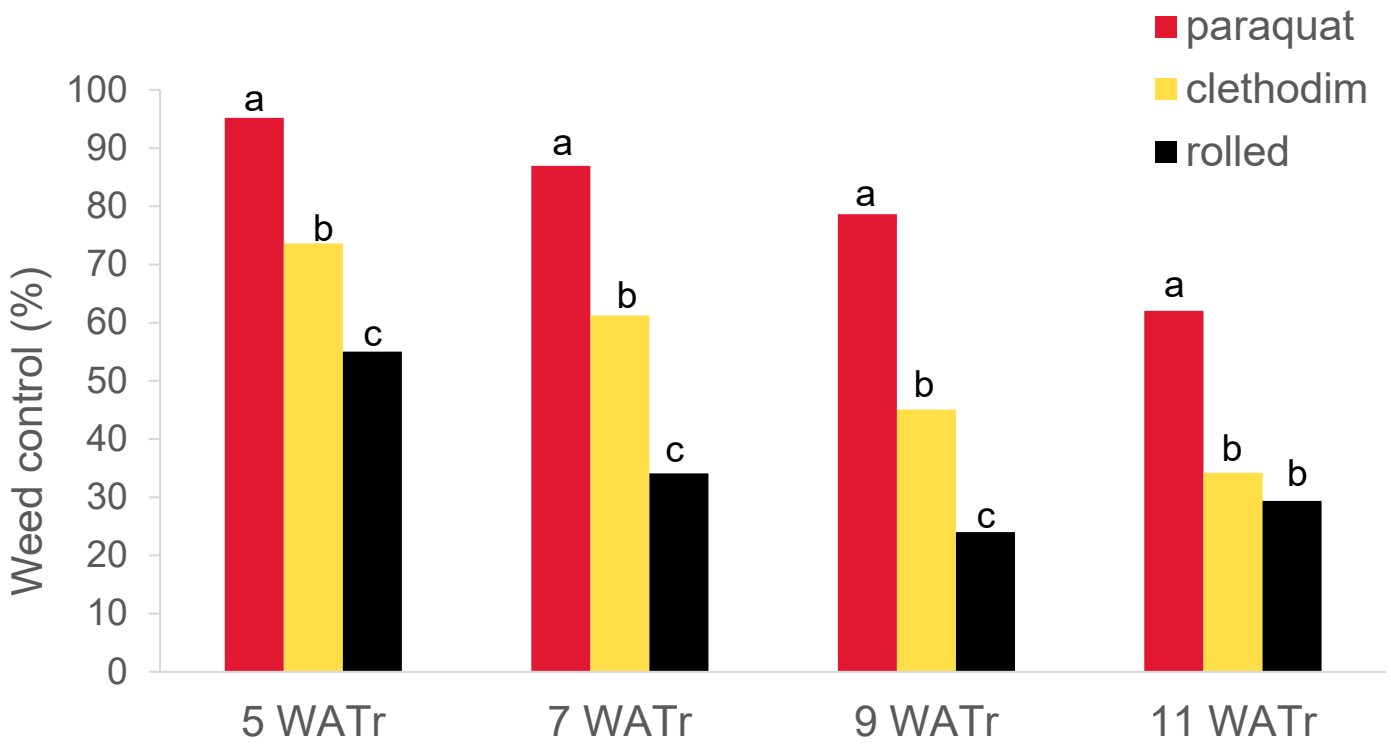


Values with the same letter are not significantly different according to Fisher's LSD (α = 0.05)

Results

Cover Crop Termination Method

- Termination with paraquat offered best weed control
  - >100% weed control compared to rolled at 7, 9 & 11 WATr (weeks after transplant)

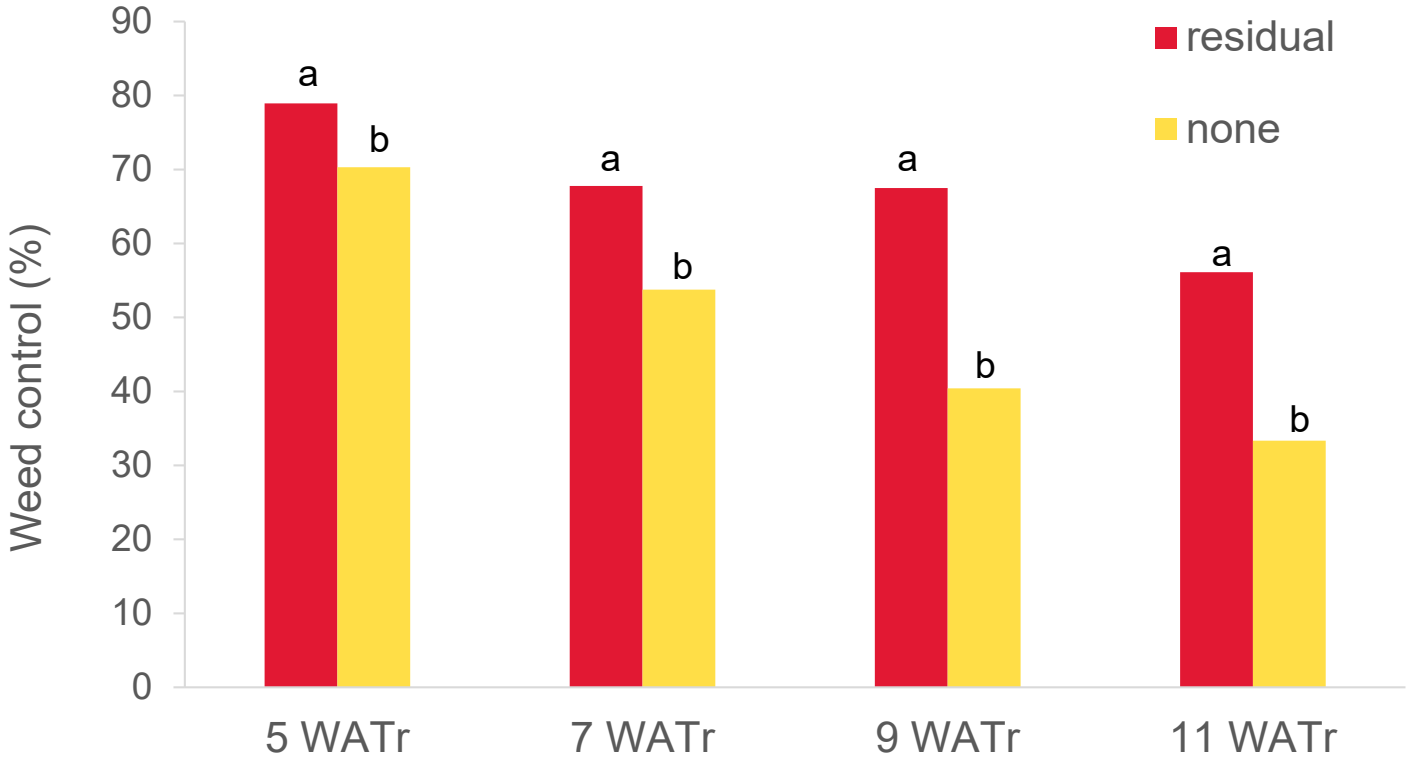


Values with the same letter at the same rating time are not significantly different according to Fisher's LSD (α = 0.05)

Results

Residual Herbicide Treatment

- A residual herbicide application increased weed control at all rating times
  - 67 & 68% increase in weed control when using a residual at 9 & 11 WATr, respectively



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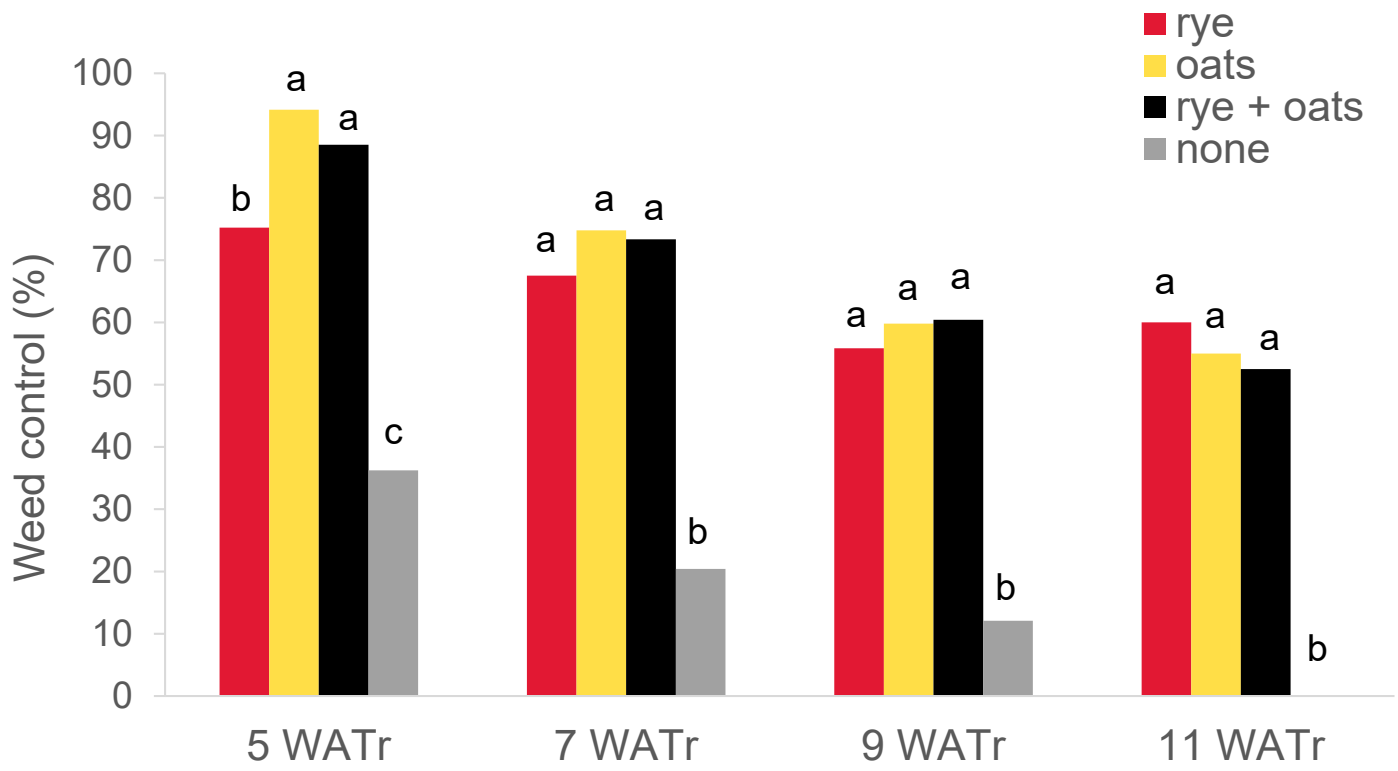
Results

Cover Crop Species

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

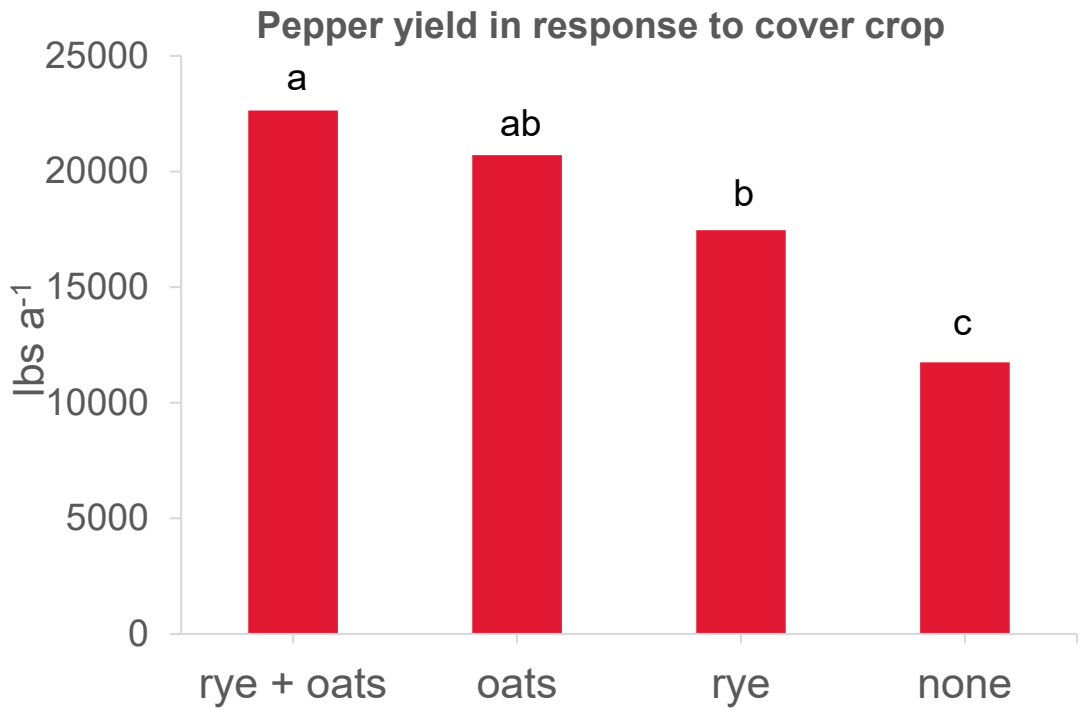


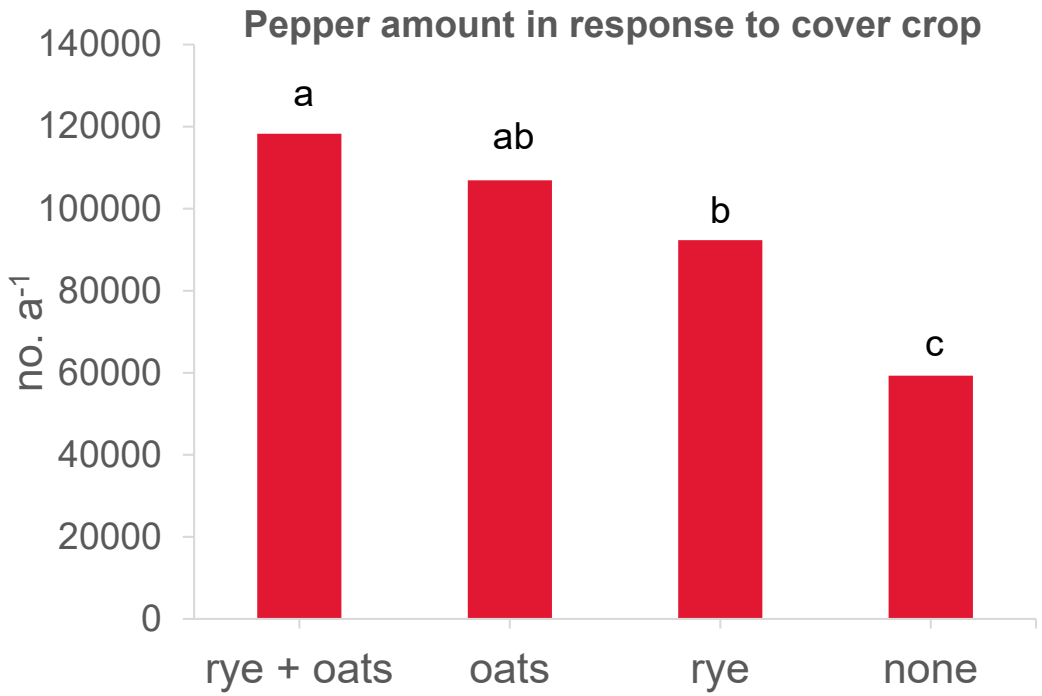
Values with the same letter at the same rating time are not significantly different according to Fisher's LSD (α = 0.05)

Results

Pepper Yield

- Cover crop presence resulted in greater pepper yield (weight & no. of fruit) vs. no cover crop.
  - ❖ Yield in rye + oats were significantly greater than rye only





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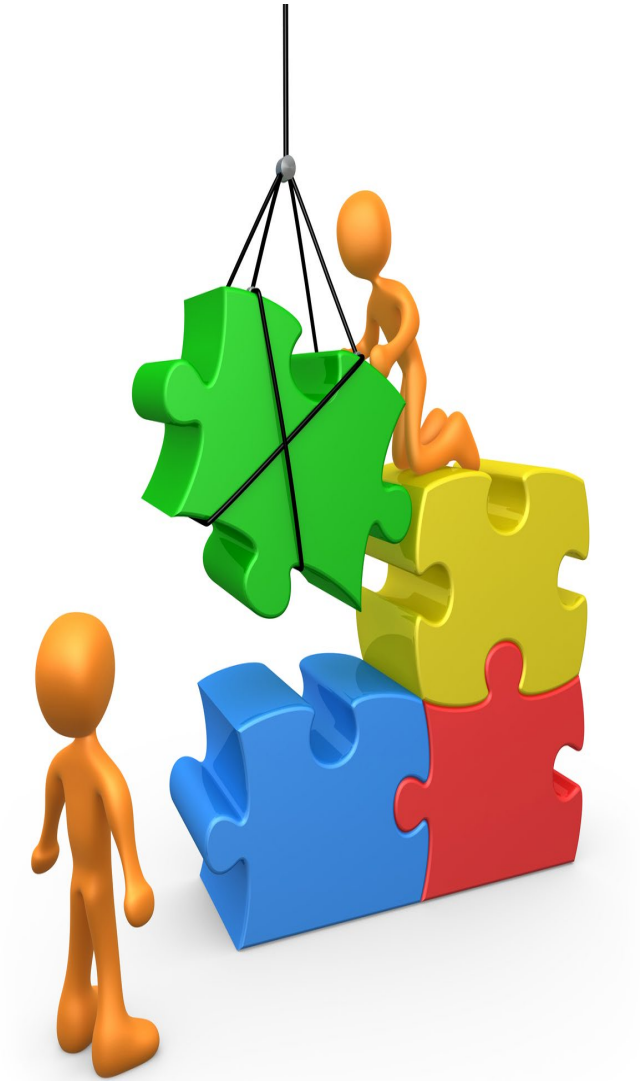
Conclusion

Improvements & Future Work

- Changes in cover crop termination mechanics?
  - Roller crimper, getting tighter to plastic
- Transplant at/after cover crop termination?
  - More confidence getting hooded sprayer closer to plastic

Summary

- Cover crop presence increased pepper yield (weight & no. of fruit) & weed control vs. no cover crop
- Termination with paraquat offered the best weed control
- The application of a residual herbicide positively influenced weed control vs. no residual
- Synergistic effect of mixing cereal rye and spring oats on yield
- This technique can be a viable IWM option in plasticulture vegetable systems



Questions?

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Biosolarization

Biosolarization

- A soil disinfection technique similar to solarization.
- Involves adding organic material into soil prior to passive solar heating.
- As the moist soil heats up, the organic material decomposes and releases allelochemicals and other biotoxic chemicals.
- After ~10 days of biosolarization, the plastic mulch is removed, and the soil is allowed to aerate for ~7 days prior to crop transplant.

Biosolarization

Benefits

- Compatible with organic farming
- More suitable for certain geographical areas compared to solarization
- Eco-friendly
- Can be used with other weed management techniques
- May contribute to soil fertility

Field Study

Objectives

- Develop a novel practice that vegetable farmers can utilize to manage multiple crop pests concurrently.
- To evaluate how a fruit-based biosolarization, living mulch and strip tillage system solo and combined can manipulate insects and weeds.

Field Study

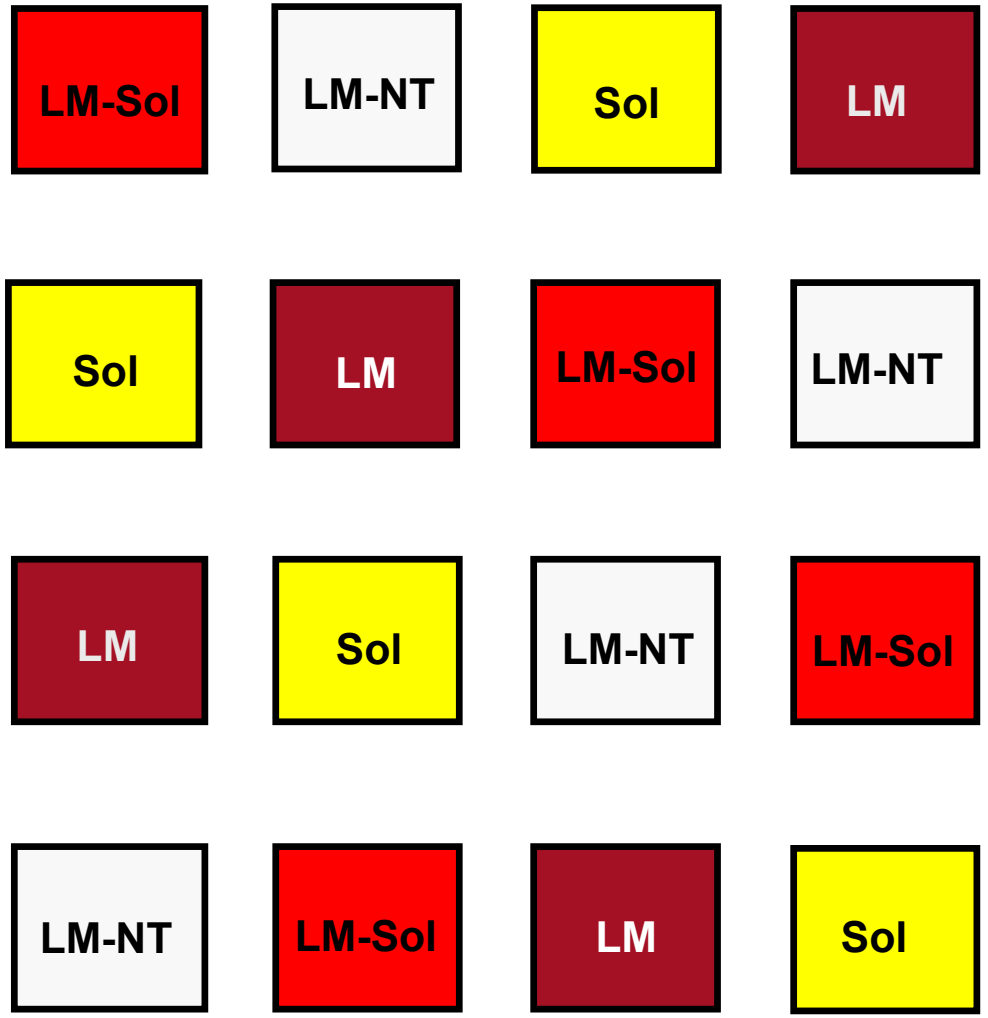
Treatments

Living mulch (LM)

Living mulch no-till (LM-NT)

Solarized (Sol)

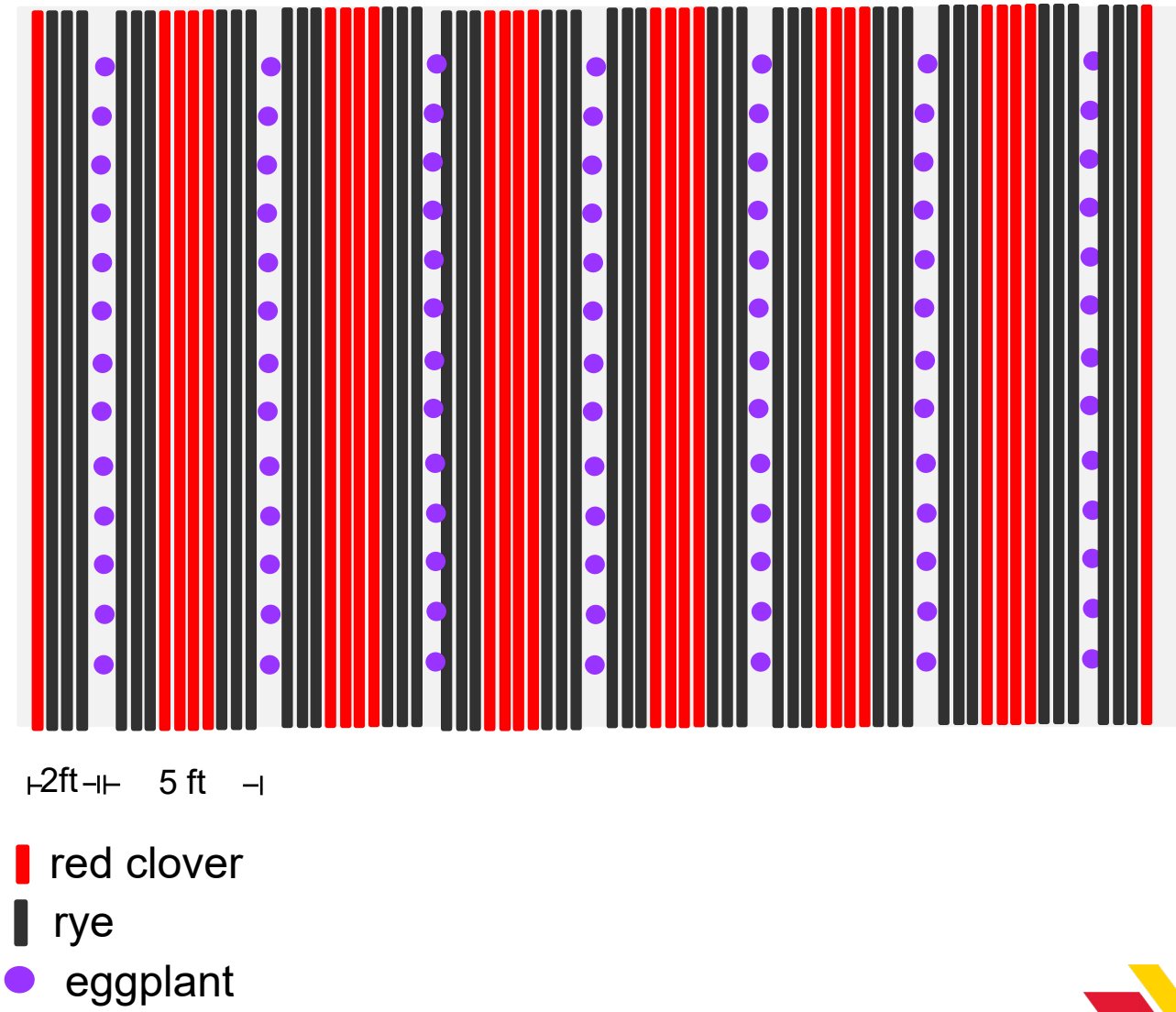
Biosolarization/Living mulch solarized (LM-Sol)



Field Study

Fall Preparation

- Red clover + rye mixture planted in LM-Sol, Sol and LM treatment plots @ 6-inch row spacing.
- In LM-NT plots, red clover and rye seeded in separate rows.
  - 6 rows of rye & 4 rows of red clover



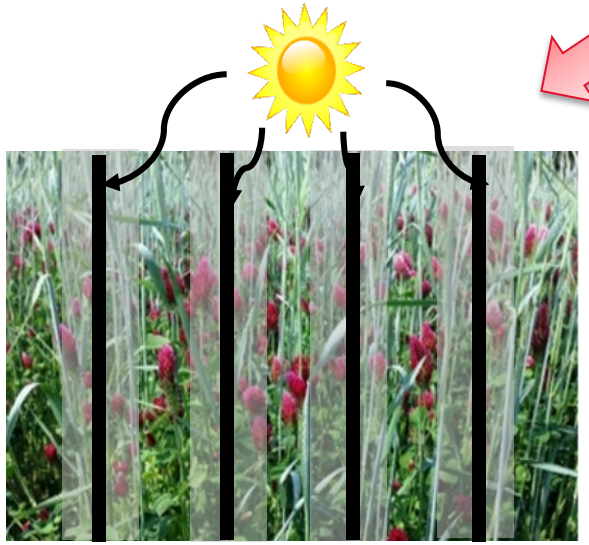
Field Study

Spring Preparation

- LM: entire plot roller-crimped to terminate rye. Intra-row areas strip-rotovated prior to eggplant transplant.
- LM-NT: rye terminated via roller crimper (temporarily stunt red clover growth)
- Sol: entire plot mowed and rotovated. Transparent plastic & drip lines laid in intra-row areas.

Field Study

LM-Sol



Data Collection

- Cover crop biomass
- Soil temperature
- Root-knot nematode
- Weed assessments
- Insect assessments
- Crop growth, development & yield

Results

Photo: Howard F. Schwartz, Colorado State University, Bugwood.org

Photo: Steve Dewey, Utah State University, Bugwood.org

Summary

- Viable option for intra-row weed management?
  - Promising raw data (early-season)
- Compatible with Organic farming
- Can be used with other weed management methods (inter-row)
- Not very effective on nutsedges (vegetative reproduction)

Questions?

Acknowledgements

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Thank You!

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Cornell University is located on the traditional homelands of the Gayogo̱hó꞉nǫ' (the Cayuga Nation). The Gayogo̱hó꞉nǫ' are members of the Haudenosaunee Confederacy, an alliance of six sovereign Nations with a historic and contemporary presence on this land. The Confederacy precedes the establishment of Cornell University, New York state, and the United States of America. We acknowledge the painful history of Gayogo̱hó꞉nǫ' dispossession, and honor the ongoing connection of Gayogo̱hó꞉nǫ' people, past and present, to these lands and waters.

This land acknowledgment has been reviewed and approved by the traditional Gayogo̱hó꞉nǫ' leadership.

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