ELECTRIC WEED CONTROL FOR COVER CROP TERMINATION

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Oregon State University

Today's presentation

- What is electric weed control (EWC)?
  - New equipment technology
- Cover cropping in organic vegetable production
- Research results on EWC for cover crop termination
- Future research in specialty seed crops with new technologies

What is EWC?

- Electric weed control (EWC)
- The use of electric current to kill weeds
  - Physical weed control method
  - Electrodes need to contact the weed

What is EWC?

- You may be familiar with the electrode above the crop that kills weeds taller than the crops
  - Companies like WeedZapper (US)

- Newer equipment can apply lower to the ground or inter crop rows
- Small handheld implements to large tractor implements

https://landscapeandamenity.com/sections/professional-groundscare/articles/2018-11-05/introducing-rootwave-pro-electricide

- Companies with new equipment include
  - Zasso (Brazil)
  - Rootwave and Garford (England)
  - Crop.zone (Germany)
  - Naturavolt (subgroup of Zasso)

Zasso

Rootwave and Garford

Rootwave

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Naturavolt

Crop.zone
Weed control and potato desiccant

Cover cropping in organic vegetables

- Cover crops are useful for improving soil health but also a cultural method for weed control
- How do cover crops suppress weeds?
  - Direct competition
  - Allelopathy
  - Cover or mulch effect

Cover crops for weed suppression

- Cover or mulch effect
  - Cover crop residue on soil serve as a mulch suppressing weed emergence
  - Affected by termination timing and method
  - Useful in no-till production

Cover crop termination methods

- Current available tools
  - Mowing
  - Tillage
  - Roller crimper
  - Herbicides (glyphosate) in conventional production

- EWC could be a new non-chemical tool for cover crop termination that does not disturb the soil
  - No-till production

Research trial

Objectives:

1. Evaluate efficacy of EWC and mowing alone and in combinations for cover crop termination
2. Evaluate weed control and snap bean response in till and no-till seedbed preparation after different cover crop termination methods

Materials and Methods

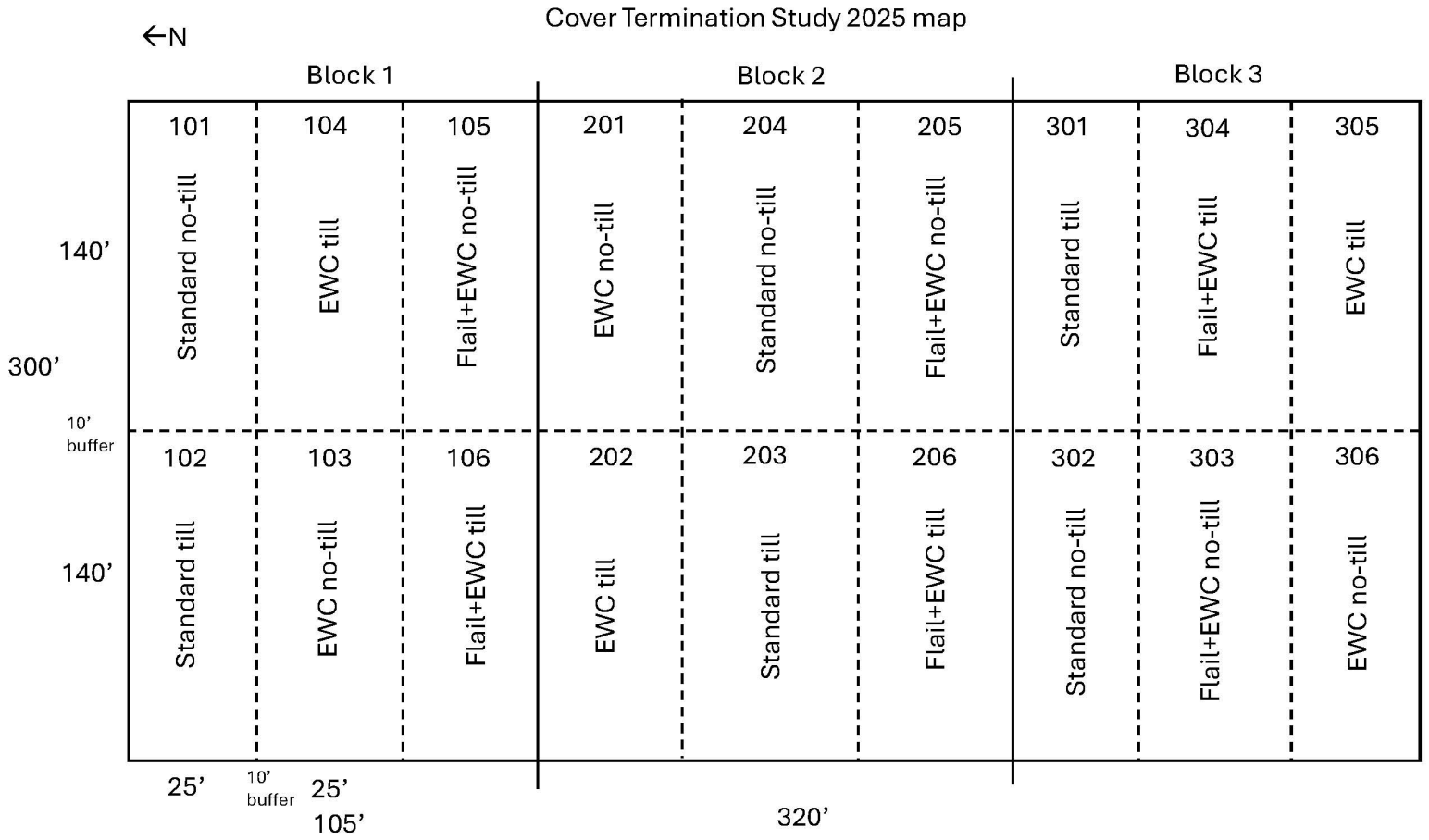
- OSU Vegetable Research Farm in Corvallis, OR
- A mix of oat and crimson clover were planted in fall 2024
  - 80 lbs/A oats
  - 40 lbs/A crimson clover
- Before termination, the cover crop dry biomass averaged 3,294 lbs/A

Materials and methods

Table 1. Treatment table to evaluate electric weed control as a cover termination tool in western Oregon.		
TRT #	**Cover crop termination method**	**Soil preparation**
1	Mowing	No-tillage
2	Mowing	Tillage
3	EWC 15 MJ ha^{-1} (0.6 mph)	No-tillage
4	EWC 15 MJ ha^{-1} (0.6 mph)	Tillage
5	Mowing + EWC 15 MJ ha^{-1} (0.6 mph)	No-tillage
6	Mowing + EWC 15 MJ ha^{-1} (0.6 mph)	Tillage
EWC, electric weed control; MJ, megajoule of energy; mph, miles per hour.		

- Terminated on May 6th, 2025
- A tractor-driven, commercially available electric applicator unit, EH30 Thor (Zasso, Brazil) with a 4 ft wide applicator was used
- The mowing was performed with a Pak flail mower, IFA Flail (Rears Mfg. Co., Coburg, OR)

Research trial



Zasso EH30 Thor, offset electricity applicator 4ft wide

- Pak Flail mower

- Immediately after application

- After mowing only

- After mowing 5 d, right before the following EWC application

Electric weed control applied after the mowing treatment

EWC alone treatments

EWC controlled all cover species and weeds under the canopy.

In dense biomass areas, EWC had reduced control of vegetation under the cover crop canopy.

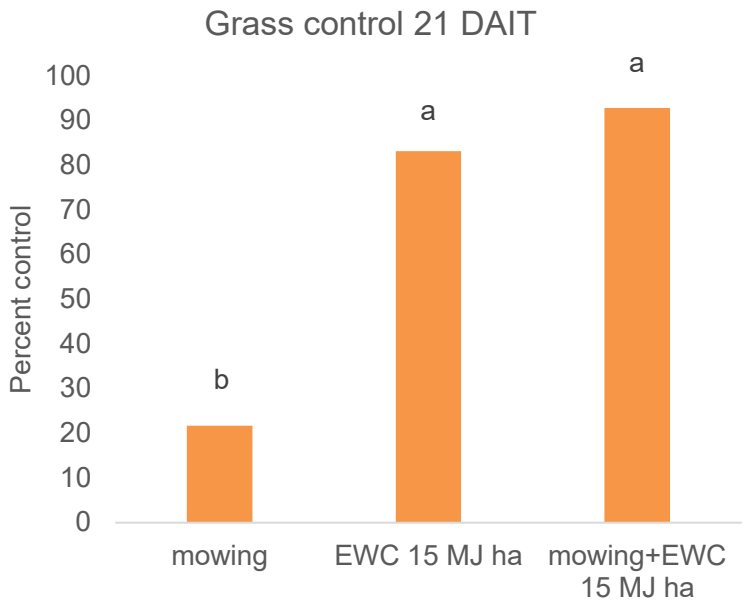
Mowing alone treatments

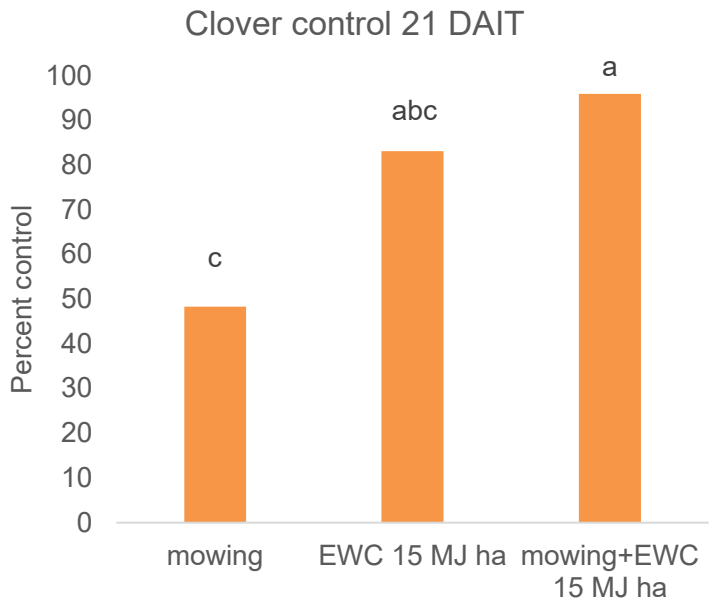
mowing alone did not eliminate all the oats

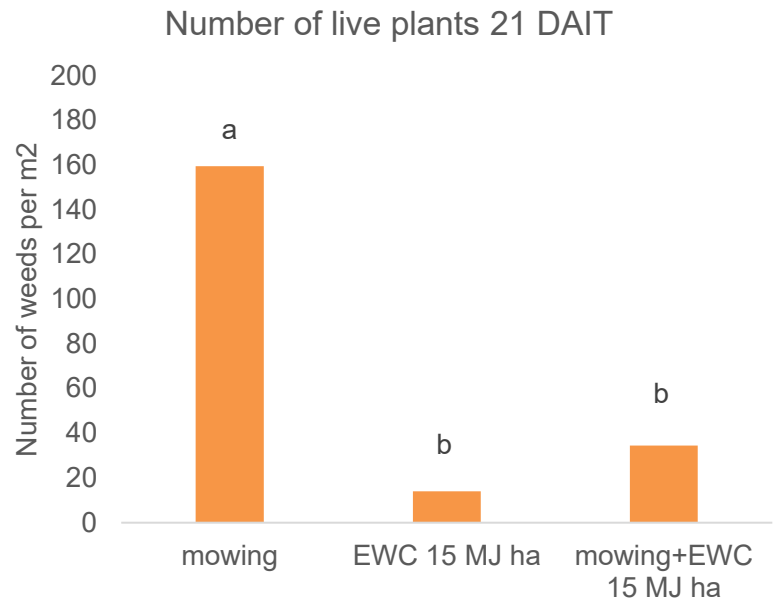
Mowing + EWC treatments

The treatment after mowing still left many oats to continue growing and dry biomass was prone to catch on fire.

Results of cover crop termination 21 days after initial treatment (DAIT). Standard error is presented on error bars and means were subjected to Tukey's HSD α=0.05.







The count of live plants includes all cover crop species and weeds present in the field. Other weeds present at the time of collection included ryegrass and filaree. EWC at 15 MJ ha^{-1} translates to 0.6 mph of tractor speed.

Till and no-till seedbed preparation

Snap beans were planted after cover crop termination, either as conventional tillage and no-till

- Tillage treatments
  - 3-passes with disc followed by rototiller with harrow to smooth out the plots

Planting snap beans

- OSU 5630 variety
- John Deere 7000 conservation planter at 30 in row spacing and a plant population of 182,000 A^{-1}

Till and no-till seedbed preparation

Tillage after cover crop termination with mowing

No-tillage after cover crop termination with mowing alone

Till and no-till seedbed preparation

Tillage after cover crop termination with EWC alone

No-tillage after cover crop termination with EWC alone

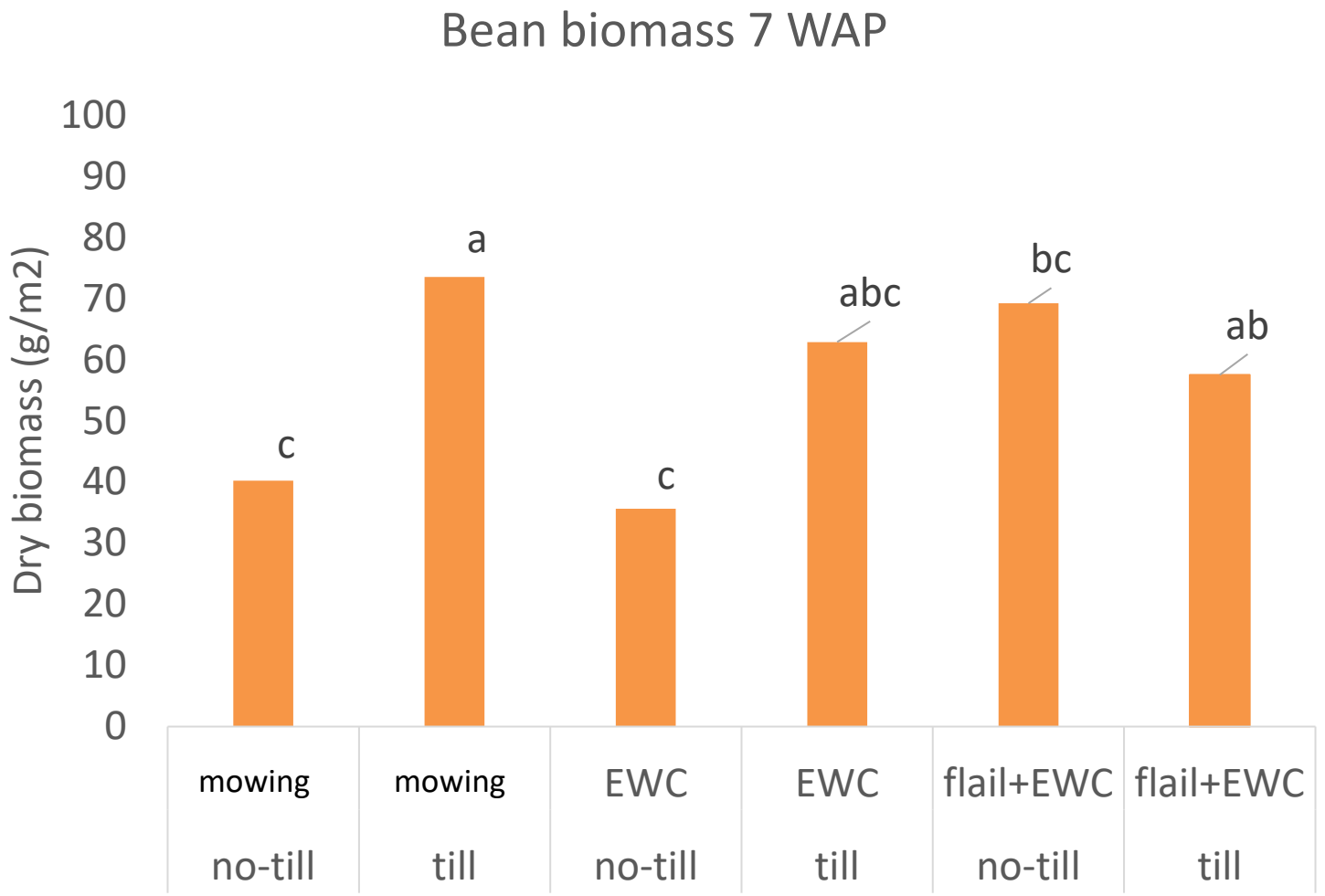
Till and no-till seedbed preparation

Tillage after cover crop termination with mowing + EWC

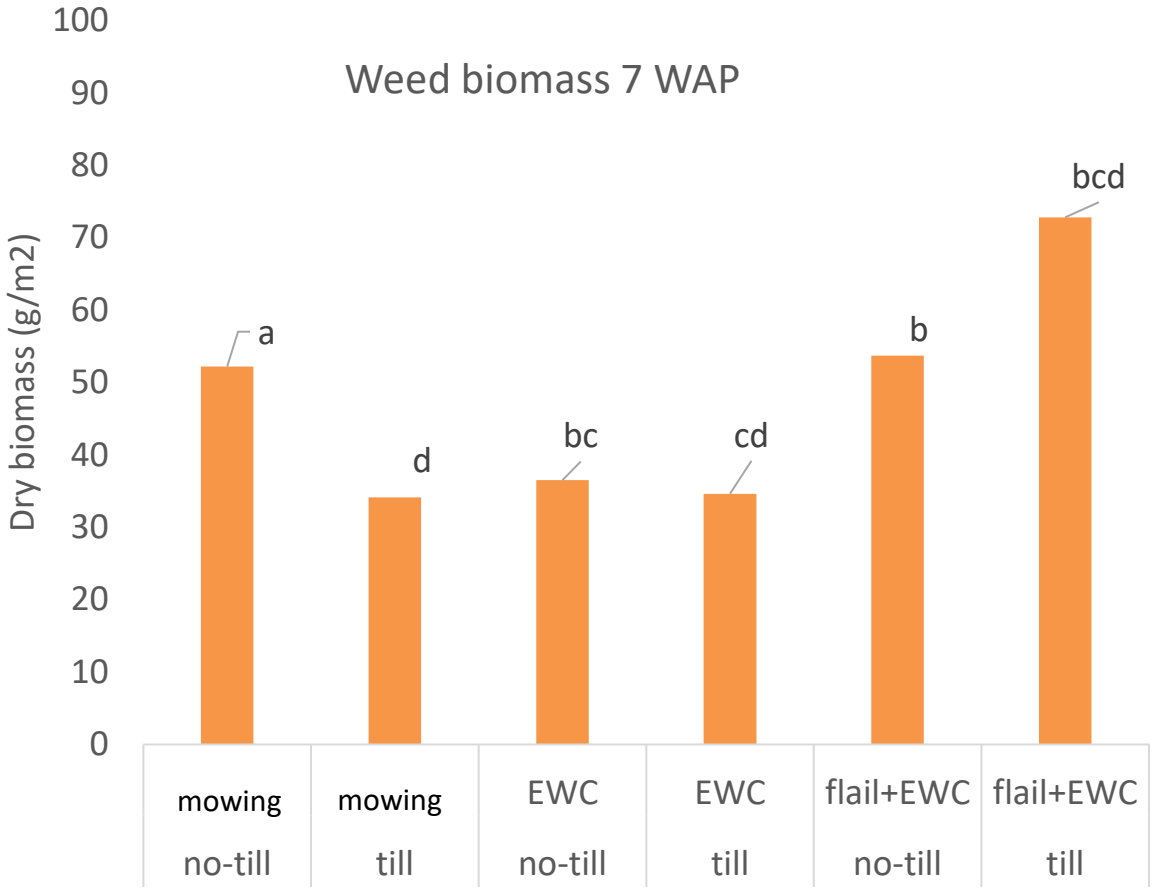
No-tillage after cover crop termination with mowing + EWC

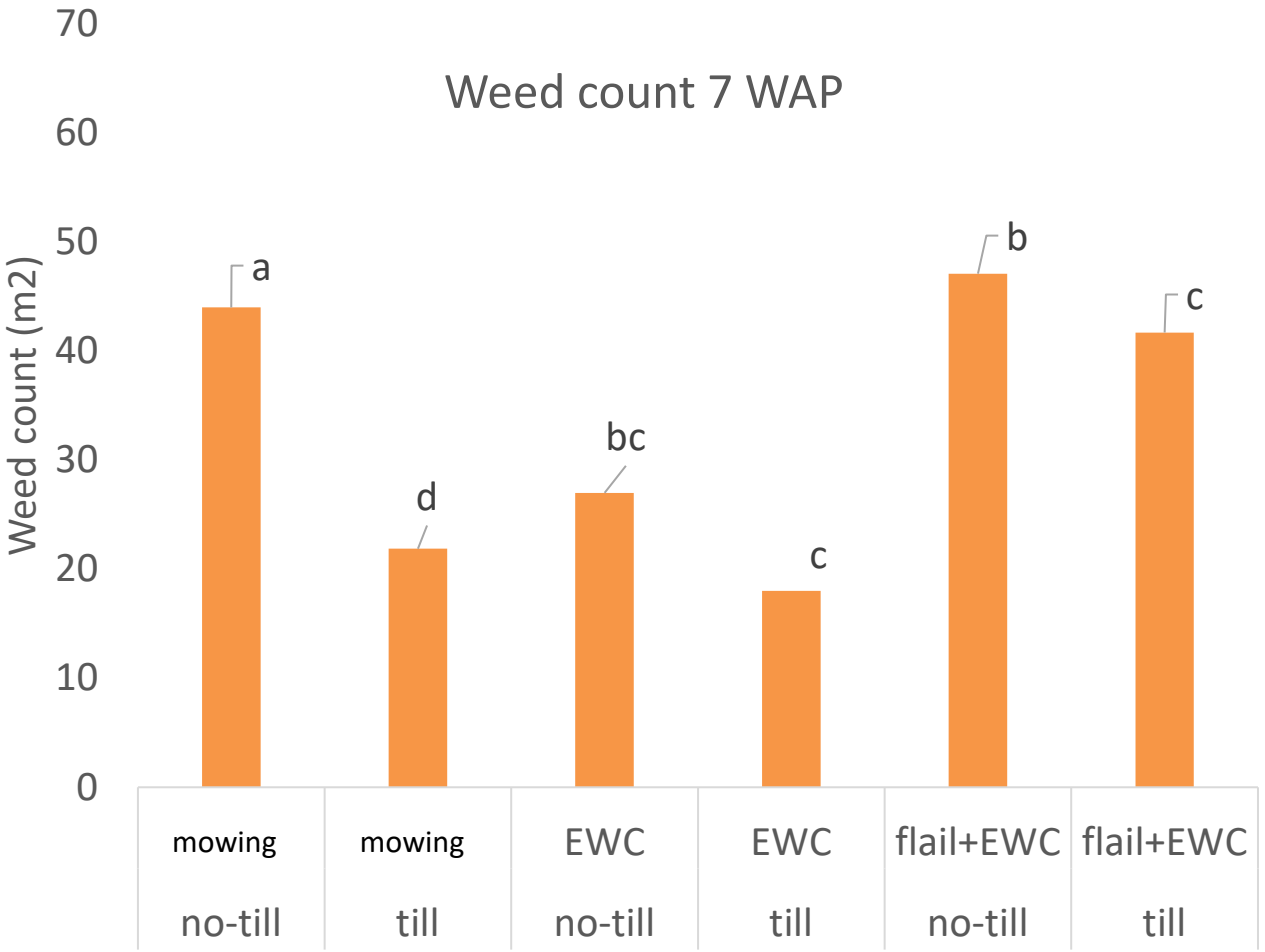
Snap bean results

- Bean biomass and weeds harvested 7 weeks after planting (WAP)
- Seedbed preparation had greatest impact on beans
  - 72% biomass reduction in no-till



Snap bean weed results





Snap bean weed results

- Number of weed species

Cover crop termination	Soil preparation	Number of weed species 7 WAP
Mowing	No-till	3 bc
Mowing	Till	2 d
EWC	No-till	4 ab
EWC	Till	5 a
Mowing + EWC	No-till	4 ab
Mowing + EWC	Till	3 cd

Weed species results

Greater amount of weeds present

- Oats (from the cover crop)
- Common catsear (Asteraceae)
- Annual ryegrass
- Hairy nightshade
- Redstem filaree

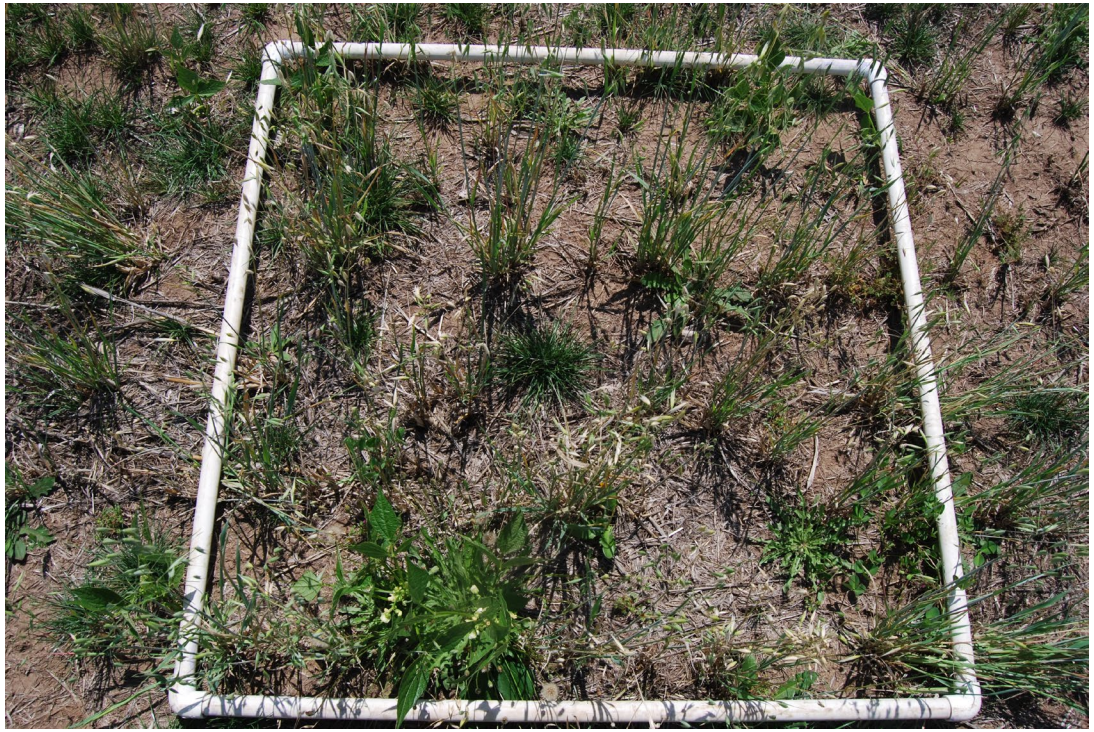
Less amount of weeds present

- Lambsquarters
- Bindweed
- Clover
- Purslane
- Pigweed
- Witchgrass
- Prickly lettuce
- Nutsedge
- Wild carrot

Weed species results

Cover crop termination	Soil preparation	Oats	Common catsear	Annual ryegrass	Hairy nightshade	Filaree
				Number m^2		
Mowing	No-tillage	30 a	19 a	37 a	0 b	16 a
Mowing	Tillage	0 b	0 b	0 b	2 a	0 b
EWC	No-tillage	0 b	11 a	10 ab	0 b	5 a
EWC	Tillage	0 b	0 b	0 b	2 a	0 b
Mowing + EWC	No-tillage	0 b	8 a	13 ab	0 b	11 a
Mowing + EWC	Tillage	0 b	0 b	0 b	4 a	0 b

Mowing alone no-till seedbed



EWC alone no-till seedbed

Till seedbed treatments had more nightshades and filaree

Summary

- EWC is a new tool for vegetable production
- EWC for cover crop termination performs similar or better than alternative options
  - EWC after mowing improves control of all live plants but has potential to catch fires if a lot dry biomass is left behind but still improves termination of oats compared to mowing
- No-till snap bean production did not perform as good as tilled plots; however, this field had no previous no-till practices
- The weed species differed in the till and no-till seedbeds

Acknowledgements

- This project is funded by the Oregon State University Agricultural Research Foundation project number 25205A and the USDA-NIFA Organic Transitions program [2025-51106-45067]
- We will continue this research and evaluate an EWC applications in organic and conventional vegetables

AGRICULTURAL RESEARCH FOUNDATION

USDA NIFA

United States Department of Agriculture
National Institute of Food and Agriculture

Future research

- Reduced tillage in the row with EWC may be applicable for seed crops
- Will have new equipment available
- I have a proposal in review to focus on specialty seed crops
  - Interactions with herbicide use

Future research

- We will begin research evaluating new sprayer technologies for specialty seed crops
  - Carbon Bee Smart Striker equipment
  - Pulse with modulation (PWM) solenoid nozzles and AI camera vision to spray
    - Brown on Green and Green on Green
  - Incorporates on available spray booms, relatively cheaper

https://carbonbee.fr/#about

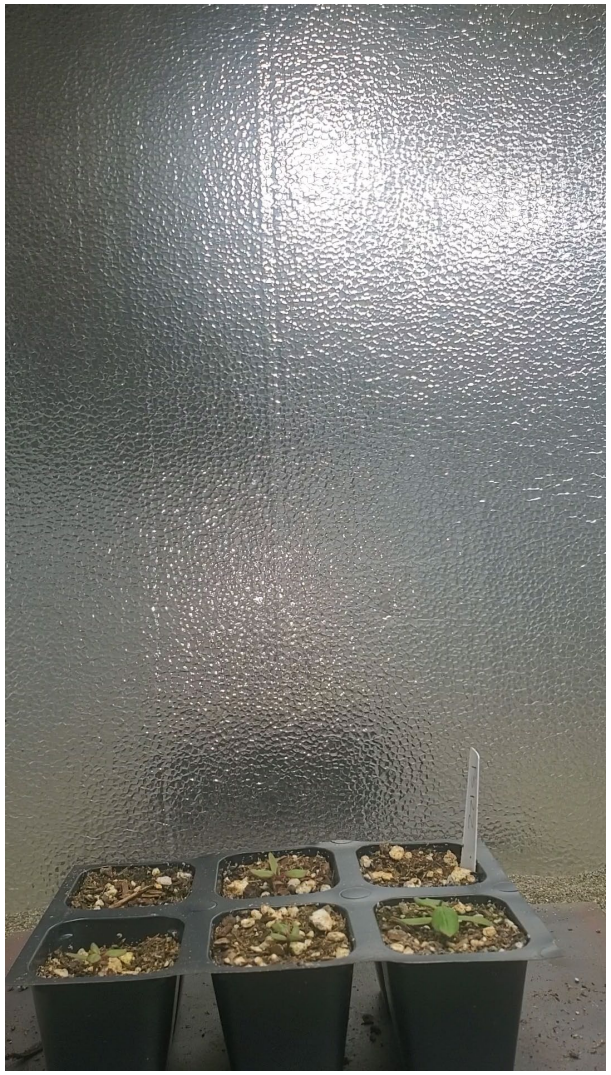
Future research

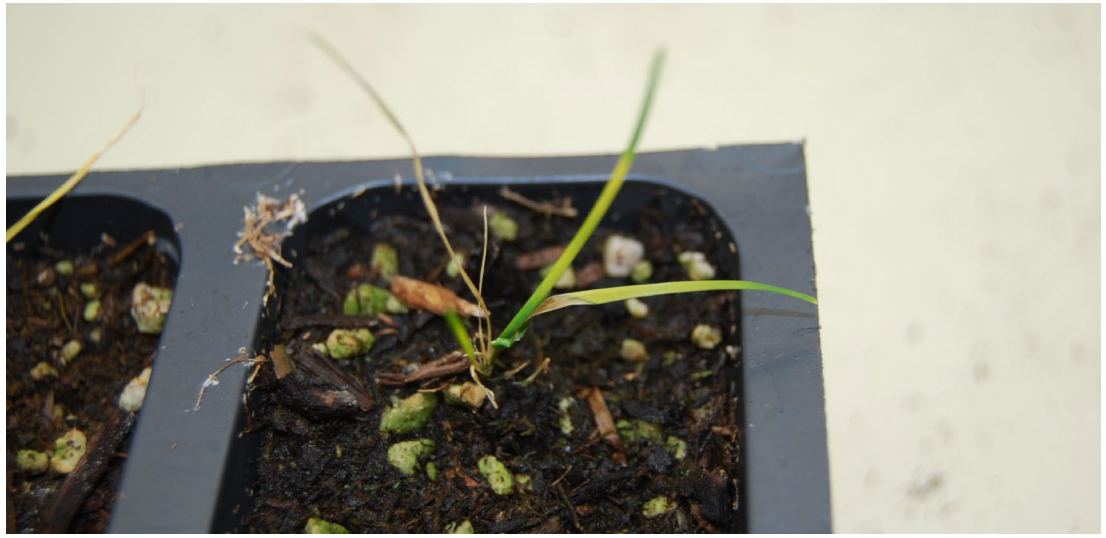
- Open sourced, we can update model with local images
- Test POST applications of registered and unregistered products with this system
  - Radish
  - Spinach

https://www.fieldworkssa.com.au/carbon-bee

Future Research

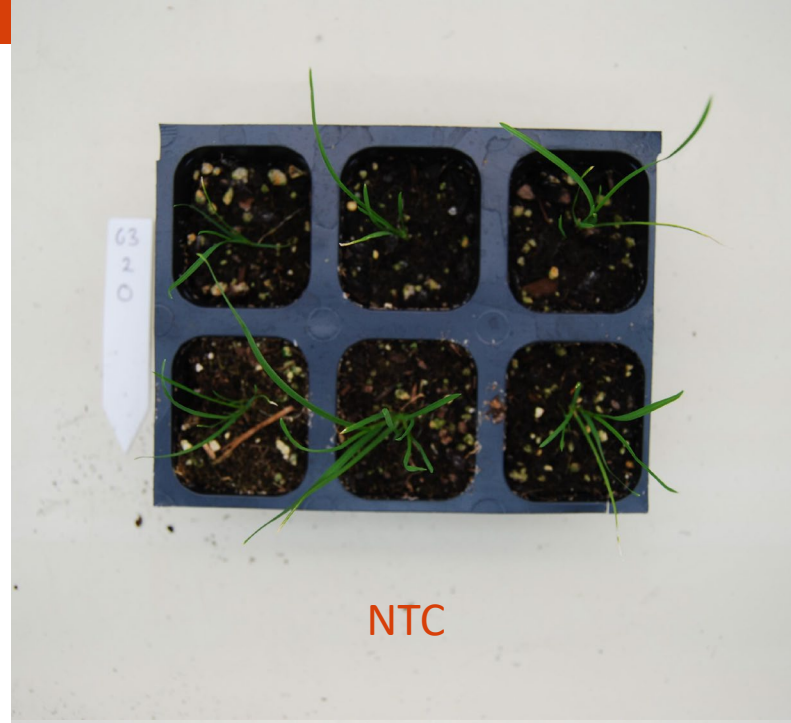
- Laser use for weed management
- We got a small enclosure to study effects of laser use across different weeds
- We know the current available equipment is expensive, but it may eventually get lower or new equipment will come





- Annual bluegrass right after treatment with laser energy
- Energy level and size of plant affect control

- Annual bluegrass control with laser
- 1 week after treatment
- We do see re-growth but we will evaluate impact of interaction of different management tactics



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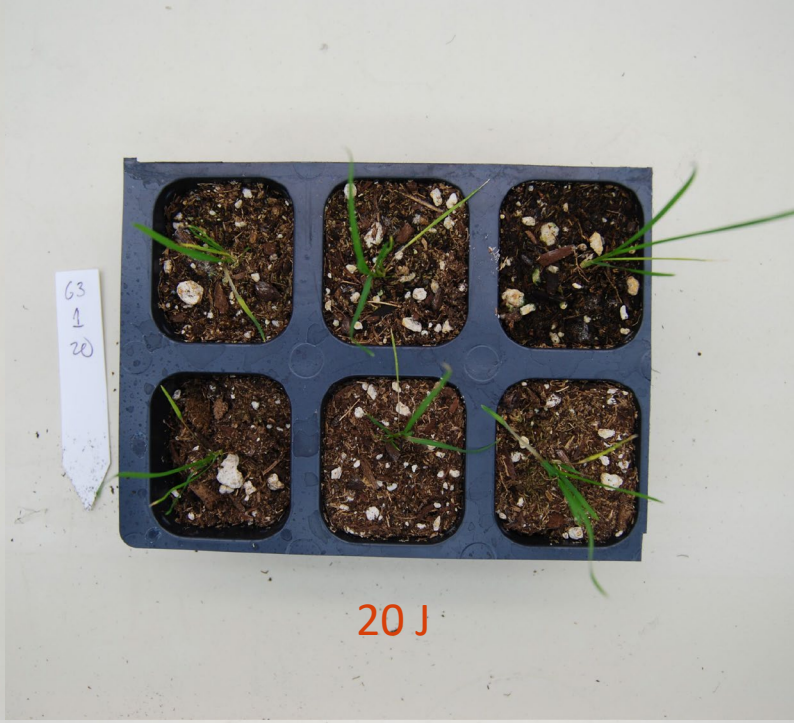

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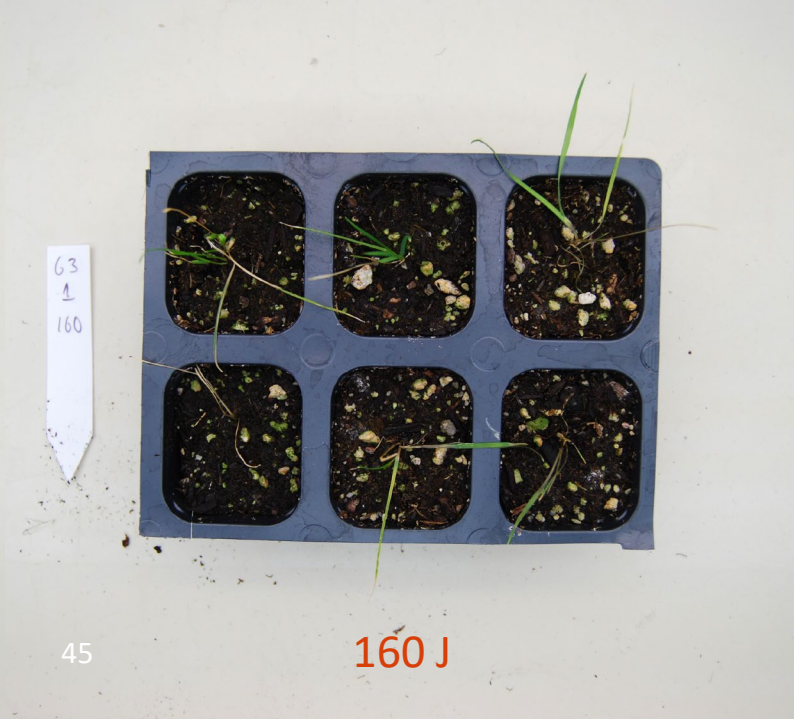

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