Physical Weed Management Tools

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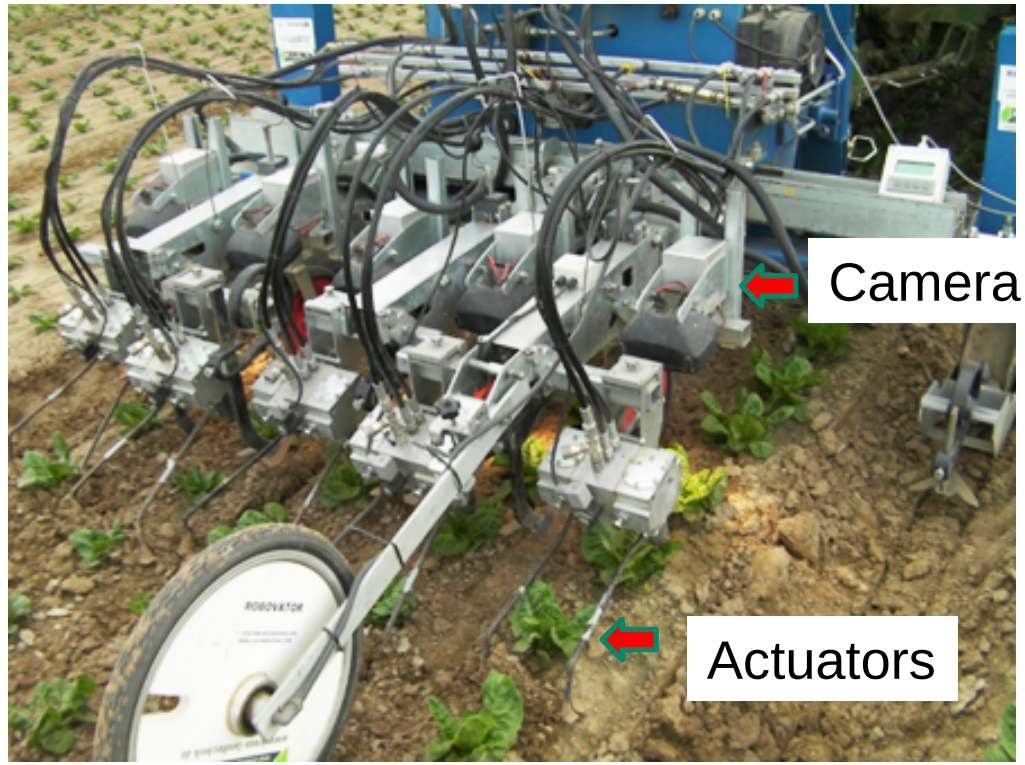
Topics today

- Weed control efficacy of automated weeders
- Soil disinfestation with steam

Auto weeder components



Intelligent weeders

- Designed to be labor efficient weeding machines
- Guided by machine learning (Farmwise, Stout, Carbon)

Stout cultivator,

Farmwise ‘Titan’

Carbon laser weeder

Stout Smart Weeder


Farmwise - Titan

Evaluations

- Evaluations of Stout, and Titan on commercial fields and field station
- Replicated 4 times and arranged in a RCBD
- Weed control and hand weeding times

Weed control & hand weeding times - Farmwise

Treatment	Weed removal	Hand weed
Trial 1	%	Hr./A
Titan	69.0 a	10.9 b
Standard	0.2 b	19.9 a
Trial 2		
Titan	31.7 a	9.8 b
Standard	0.1 b	11.2 a

Richard Smith – On farm assessments

Weed control & hand weeding times - Stout

Treatment	Weed removal	Hand weed
Trial 3	%	Hr./A
Stout	98 a	4.6 b
Standard	2 b	11.4 a
Trial 5		
Stout	99 a	4.6 b
Standard	0 b	11.5 a

Richard Smith – On farm assessments

Percent weed control & hand weeding times - Stout

Treatment	Weed number	Hand weed	Yield
	1,000/A	Hr./A	Tons/A
Stout	90 b	30.4 b	25.2
Standard	786 a	78.3 a	25.2

Fennimore - field station

Cultivation summary

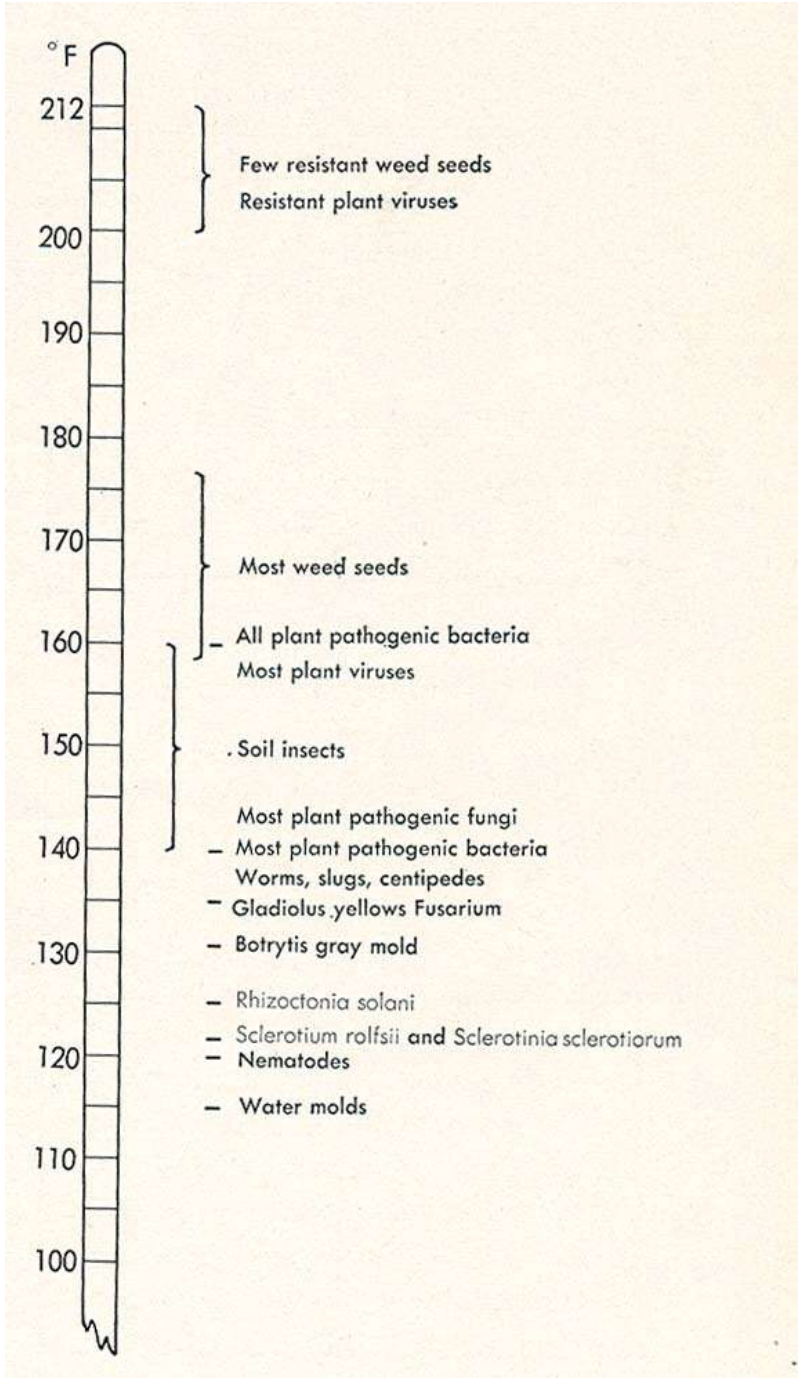
- **Farmwise Titan reduced hand weeding 13 to 45% and resulted in 32 to 69% weed control**
- **Stout reduced hand weeding 60 to 62% and resulted in 89 to 99% weed control**

Laser weeder at Soledad, CA

Preliminary results with Carbon Robotics weeder

- **Two trials in high density arugula (*Eruca vesicaria*) at Soledad, CA and San Lucas, CA**
- **Soledad 80% weed control SD 14.6%**
- **San Lucas 83% weed control SD 15.9%**
- **In high density crops it has a very short window to control the weeds due to crop growth and weed visibility to the weed detection system.**

Soil disinfestation with steam



Soil Disinfestation With Steam

Objective: Reach required temperature dwell time to control target soil pests.

K.F. Baker, 1957

The objective of soil treatment with steam

DWELL TIME

- Soil pathogens like Pythium and Verticillium are more easily killed than beneficial soil microorganisms
- The objective is not to sterilize soil but to selectively pasteurize it
- Not too hot, not too cold

180° 158° 140°

Beneficial soil microbes

- Steam is a method of soil disinfestation – a process that kills soil pests by cooking them
- Dwell time is the necessary time above a the target temperatures – 20 minutes at 158°F
- Too hot and the beneficial nitrifying bacteria can be killed
  - Nitrifying bacteria convert ammonium to nitrate
  - If they are killed then ammonium toxicity can result
  - Easy to avoid this overheating problem with the technology we are working with a a moving applicator
- Too cold and Verticillium and Macrophomina are not killed

Sheet steaming heat penetration

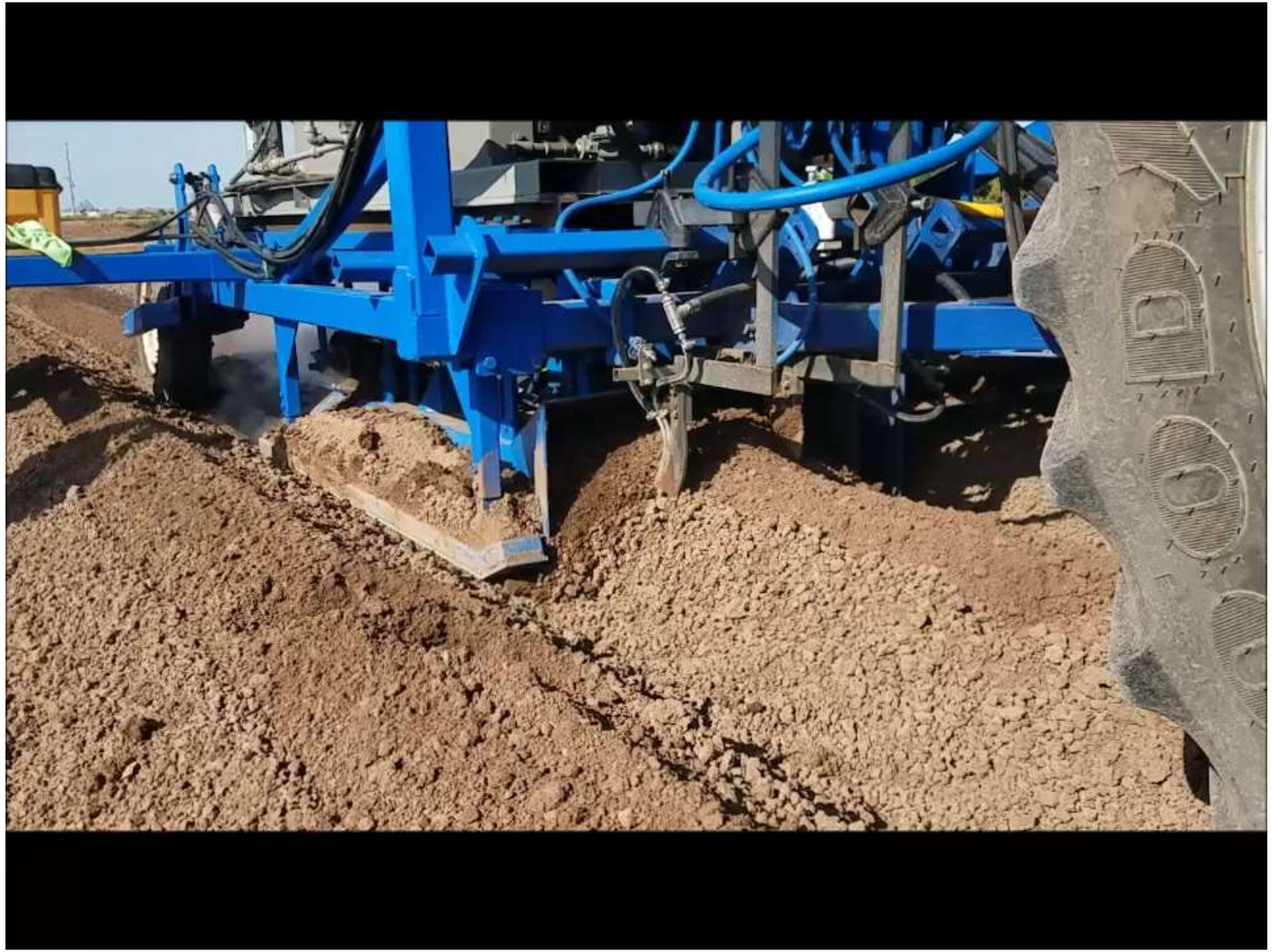
The problem with sheet steaming that all steam must pass through the soil surface

Sioux Mobile steam generator


FRONTIER
GALAXY
300

Steam blanket –SynTex

https://syntexbag.com/c/mining-solutions/steam-blankets/pe –



Weed control by species

- Purslane 99%
- Shepherd’s-purse, nettleaf goosefoot 88%
- Burning nettle, henbit, pigweed 100%
- Little mallow 42%

Summary

- Steam controls weed seeds
- Steam significantly reduces a number of diseases such as Pythium and Verticillium
- Steam boosted vegetable yields