Evaluation of mechanical and automated in-row cultivators for weed control in conventional processing tomatoes

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Background

- Matrix-post-transplant applications
- Robovator-automated weeder using vision technology
- Finger weeder-mechanical weeder for in-row weed control
- High costs of hand weeding later in season

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Objectives

- Evaluated weed control, time, and costs associated with using mechanical/automated cultivators as part of a conventional weed management program in 2020 and 2021
- Compared in-row cultivators to grower standard practice and postemergence herbicides

Field sites

- Colusa site (2020 and 2021)
  - Field in Colusa, CA
  - Drip-irrigated
  - 60” beds, double row
  - PPI trifluralin and s-metolachlor
  - Standard cultivation 1x, hand hoe 1x
  - Plots: 5 beds x 250 ft, 3 replications

- Merced site 2020
  - North of Dos Palos
  - Drip-irrigated
  - 72” beds, double row
  - 2nd year in tomatoes
  - PPI trifluralin and s-metolachlor
  - Standard cultivation 2x, hand hoe 1x
  - Plots: 1 bed x 905 ft, 4 replications

Treatments

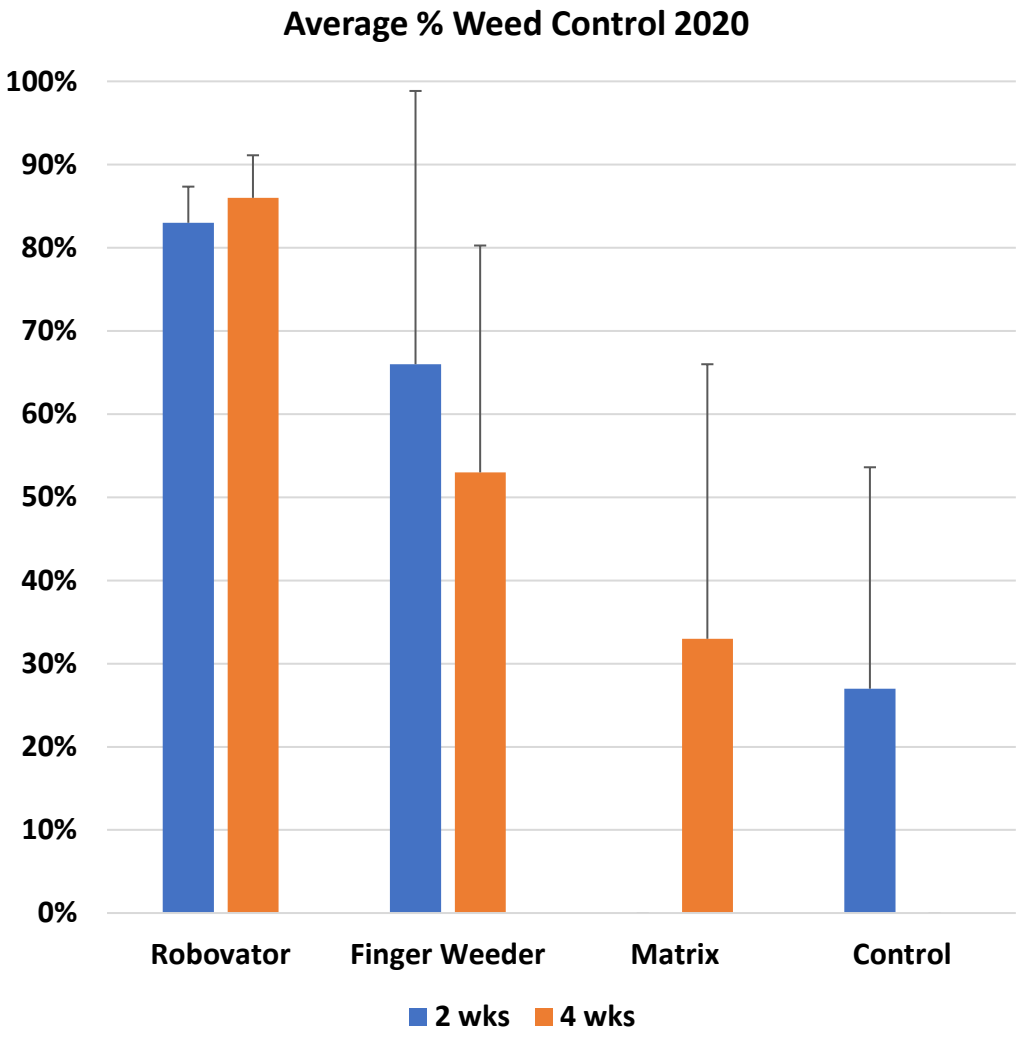
Grower standard=(Treflan (trifluralin) and Dual Magnum (S-metolachlor) pre-plant incorporated, cultivation outside of seed line, hand-hoeing crew 1x)

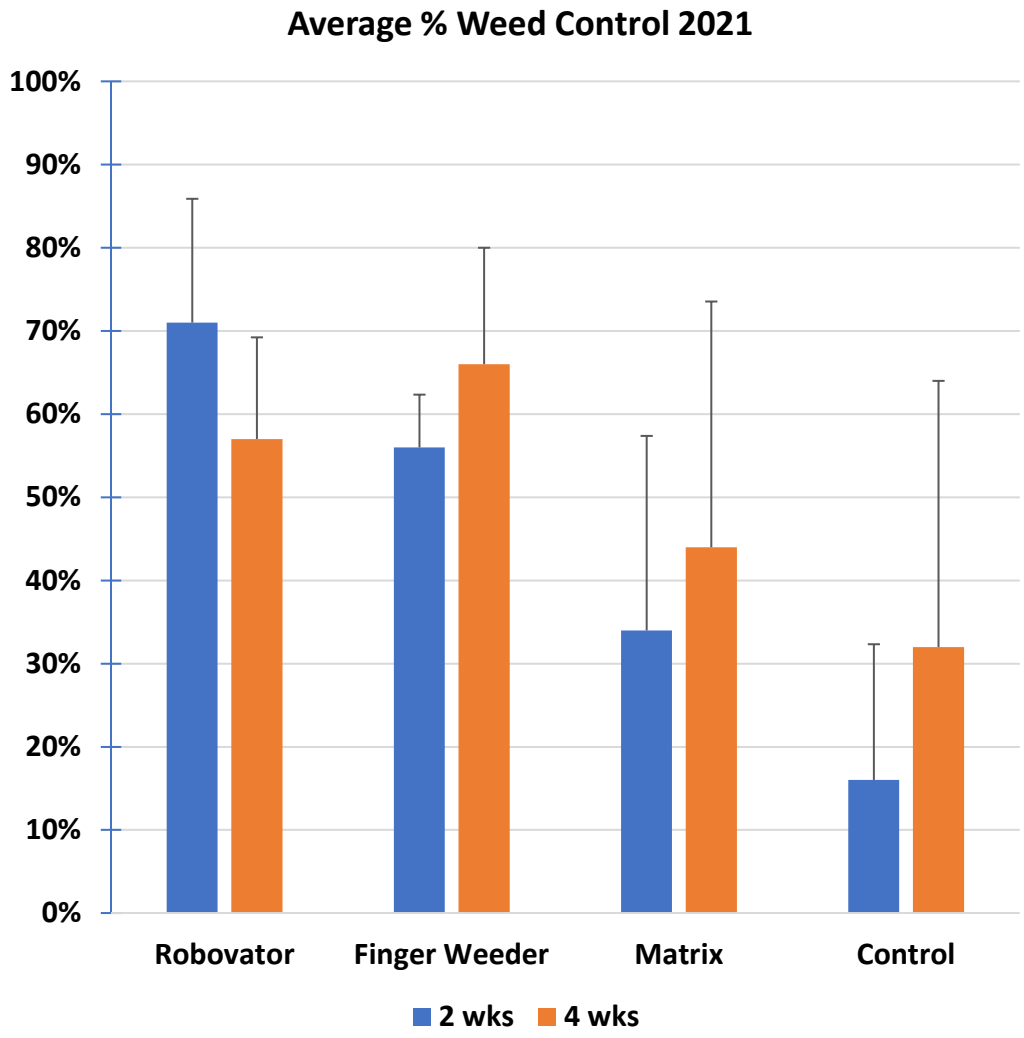
1. **+ Matrix (rimsulfuron) post-transplant (10 – 14 days after transplanting)**
2. **+ Finger weeder post-transplant (14 days after transplanting)**
3. **+ Robovator post-transplant (14 days after transplanting)**
4. **+ no Matrix and no in-row cultivation (Control)**

Measurements

- Plant stand pre/post-treatment to determine crop injury (~2-3 days after treatment)
- Time it takes for mechanical cultivators and hand weeding crews to move through plots
- Weed control evaluation pre/post-treatment
  - Post-treatment assessments at 2 weeks and 4 weeks
  - Additional pre/post-hand-weeding assessment (~2 months post treatment)
- Yield

Weed control results-Colusa





Cost savings-Colusa

- All treatments significantly reduced costs of hand-weeding compared to the control.

Treatment		2020			2021		
		Hand hoe hours/A	Cost $/A	Significance	Hand hoe hours/A	Cost $/A	Significance
1	Matrix (rimsulfuron) 2oz/A (Grower standard)	0:31	$41.88	b	1:29	$120.18	b
2	Robovator	0:37	$49.98	b	1:03	$85.08	b
3	Finger weeder	0:42	$56.70	b	1:29	$120.18	b
4	No Matrix or cultivation	1:49	$147.18	a	2:39	$214.68	a

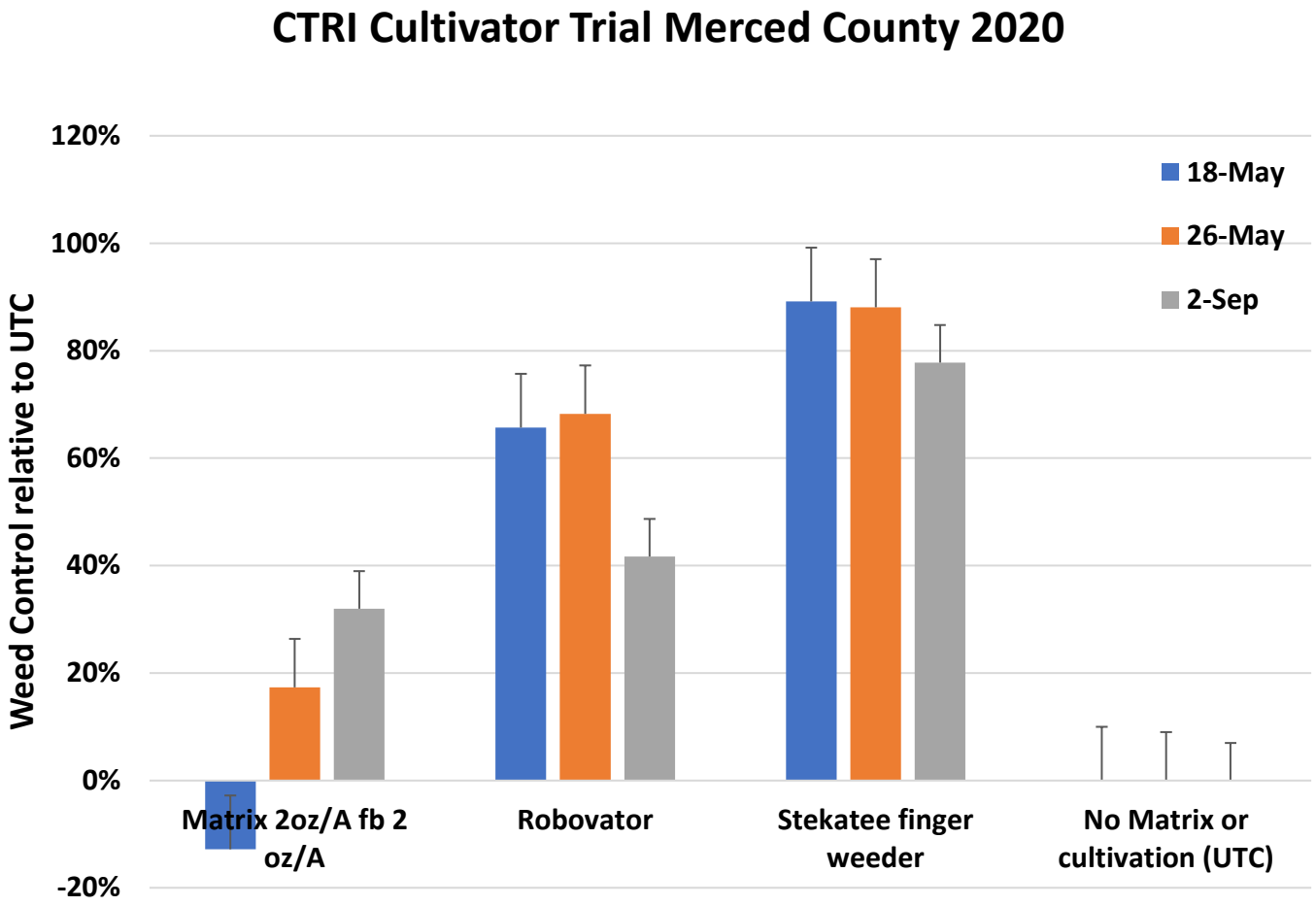
Estimated time for 6 people to hoe 1 acre. Costs calculated based on $13.50 per hour.

Summary-Colusa

- No significant differences for weed control between cultivator treatments, Matrix and control, but cultivators performed well
- High variation between plots (same treatment but different areas of field)
- No significant yield differences between treatments
- Crop injury and technical issues from Robovator in 2021 did not have a negative effect on weed control or yield

Results-Merced, 2020

- Significant reduction in weeds
- Matrix treatments had significantly better yield than other treatments
- Robovator crop injury



Cost savings-Merced, 2020

Hand hoeing costs in Matrix herbicide and finger weeder treatments were significantly less than the others.

Treatment		Hand hoe hours/A	cost $/A	
1.	Matrix 2oz/A fb 2 oz/A	1:46	$ 95.40	c
2.	Robovator	4:42	$ 253.80	b
3.	Stekatee finger weeder	0:49	$ 44.10	c
4.	No Matrix or cultivation (UTC)	7:27	$ 402.30	a

Estimated time for 4 people to hoe 1 acre. Costs calculated based on $13.50 per hour.

Takeaways

- Robovator provided excellent control in Colusa in 2020, but caused crop injury in Merced, and in Colusa in 2021
  - High winds/non-upright plants affect precision of Robovator and lead to higher % crop injury
- Finger weeder provided excellent weed control in both fields in 2020, except for one plot in Colusa field with heavy bindweed
- Matrix and finger weeder treatments reduced costs and time for hand weeding in Merced, and Matrix and both cultivators reduced costs in Colusa compared to the control

Photo credits: S. Stoddard

Photo credit: S. Light

Thank you!

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