WEED CONTROL AUTOMATION IN VEGETABLES

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ROBOTIC WEEDERS

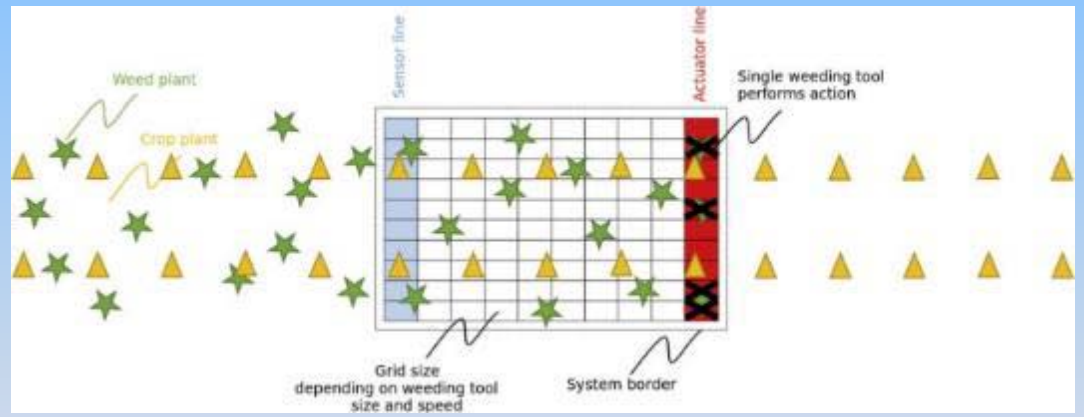
- What are they?
- How do they work?
- Are they any good?
- Are they commercially available?

ROBOTIC WEEDING: TWO STEPS

1. **Detection of the crop row**
2. **Actuation – control of the weed**

PLANT DETECTION AND ACTUATION

- Detection system
  - Camera
  - Electronic controller
- Algorithm to classify plants
  - Color threshold
  - Spatial classification
- Actuator
  - Spray solenoid
  - Cultivator knife
  - Other device

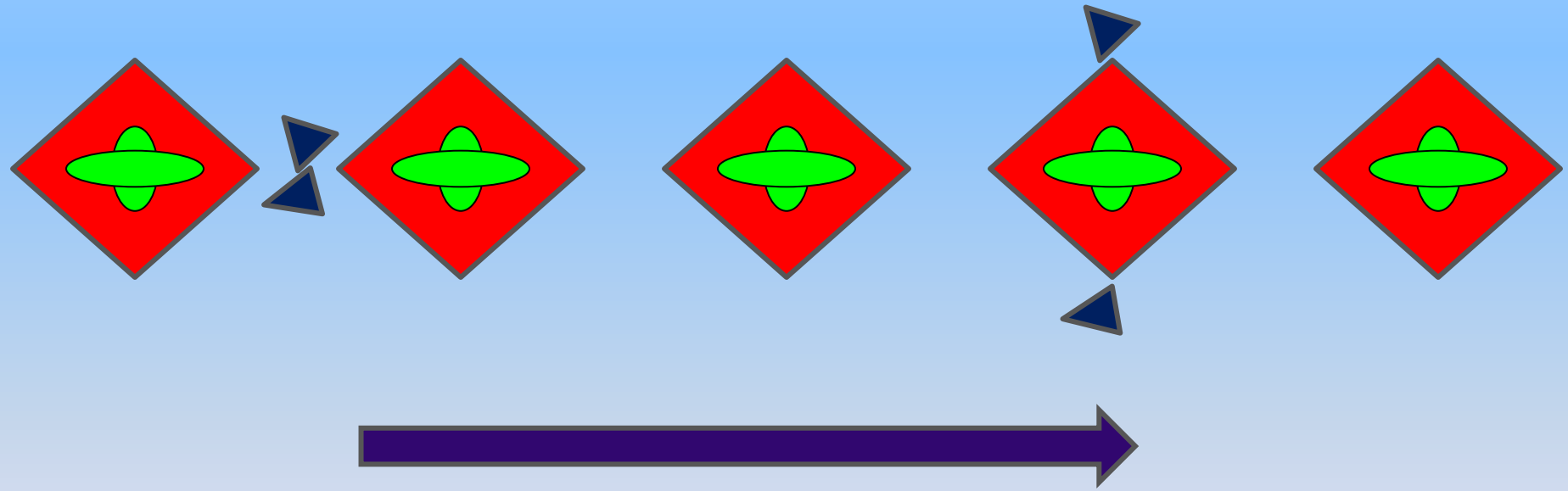


Siemens 2014

Actuator: Intra-row cultivator on the Robovator

Closed

Open

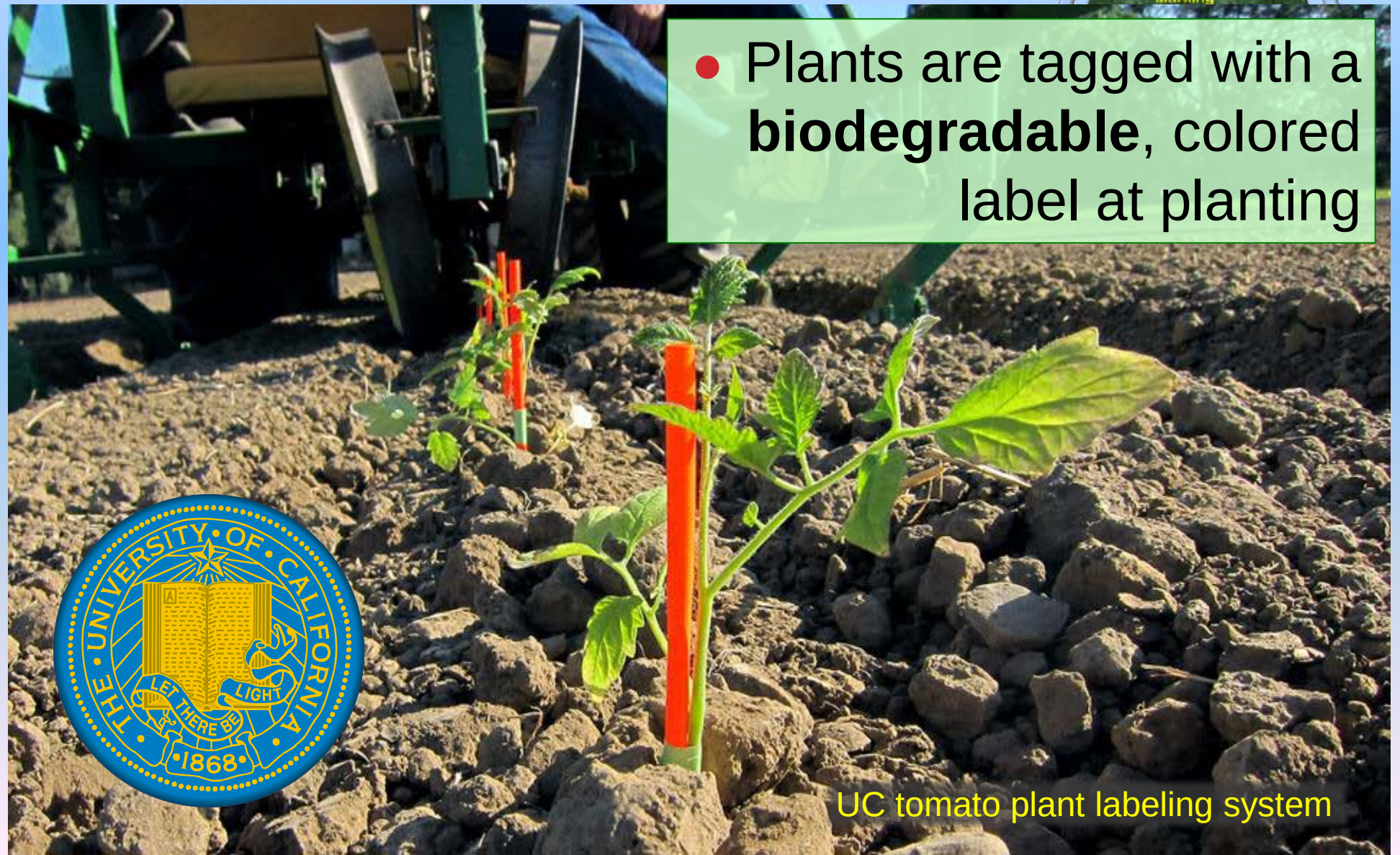


Travel direction

ROBOVATOR IN TOMATO

CROP SIGNALING PROTOTYPE

Plant Labels



- Plants are tagged with a **biodegradable**, colored label at planting

UC tomato plant labeling system

CROP SIGNALING RESULTS

Plant Labels

WEED DENSITIES AND HAND WEEDING TIMES – TOMATO 2017

Cultivator	No. acre	% weed reduction	Time hr./A	% time reduction
Automated	377 B	82	46.3 B	39
Standard	2074 A	0	76.0 A	0
P-value	<0.0001		0.0021	

Davis, CA May 2017

Robovator Costs – based on lettuce

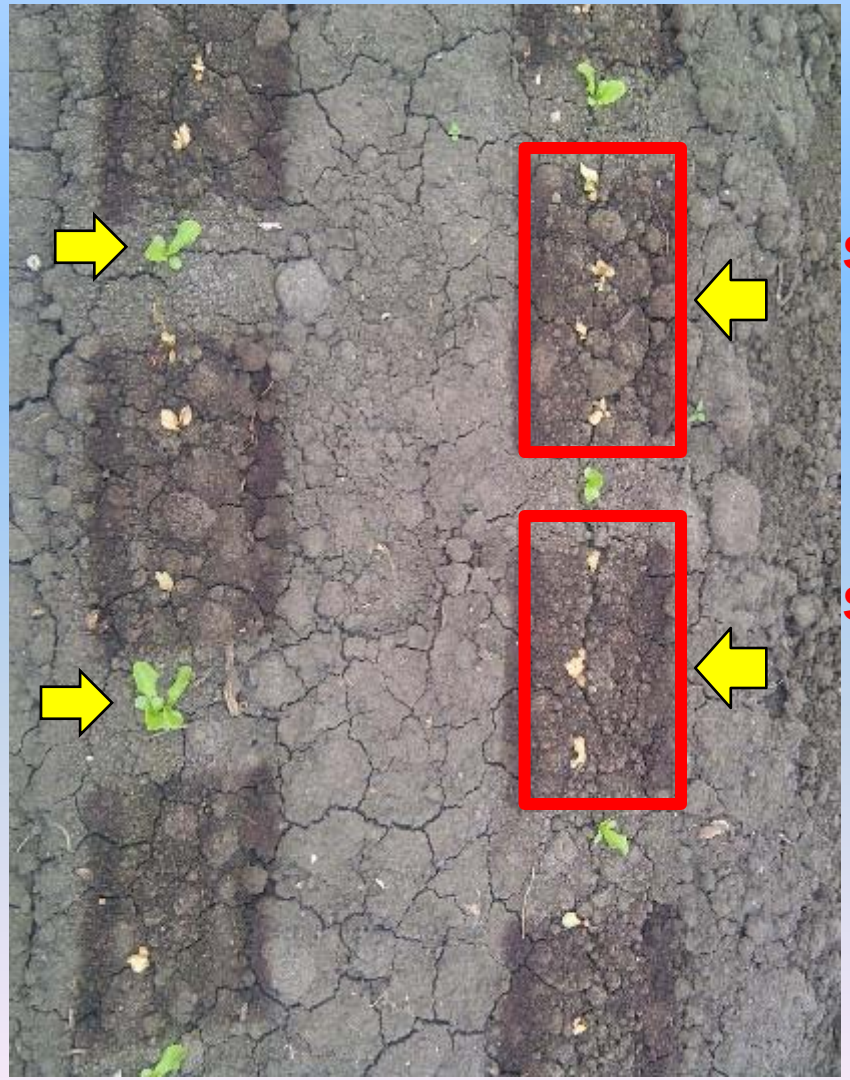
- Contract costs in Salinas 80 inch bed $110/A (6 seedlines)
- Can do 1 acre in 48 min at 1.5 mph
- Can operate at night

AUTOMATION IN VEGETABLE CROPS

Lettuce thinners

Robotic Cultivators

LETTUCE THINNING- INTERMITTENT SPRAYERS



WEEDING TECHNOLOGY

- The robotic weeders we have now are the first generation
- The US & California need to develop our own homegrown technology
- We need faster, better & cheaper machines