Why Salinas Valley lettuce fields do not have herbicide resistant weeds

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Overview

- History of resistance
- Definition
- Herbicide mechanisms
- How resistance develops
- How to prevent (or at least delay) herbicide resistance
- Why the Salinas Valley does not have resistant weeds

Herbicide Resistant Weeds

Strategies for Control/Prevention

- utilize physical weed control tactics cultivation, mulches, hand weeding, etc.
- rotate herbicides with different MOA
- rotate crops
- scout fields
- prevent seed production
- practice sanitation – clean equipment
- keep ditches and non-crop areas clean

Weed resistance history

- Relatively recent
- Common groundsel in the late 1960s was the first confirmed case
- After that time over 250 species of weeds in 52 countries are resistant to one or more classes of herbicides.
- Most resistant weeds in California are found in rice and roadside environments.

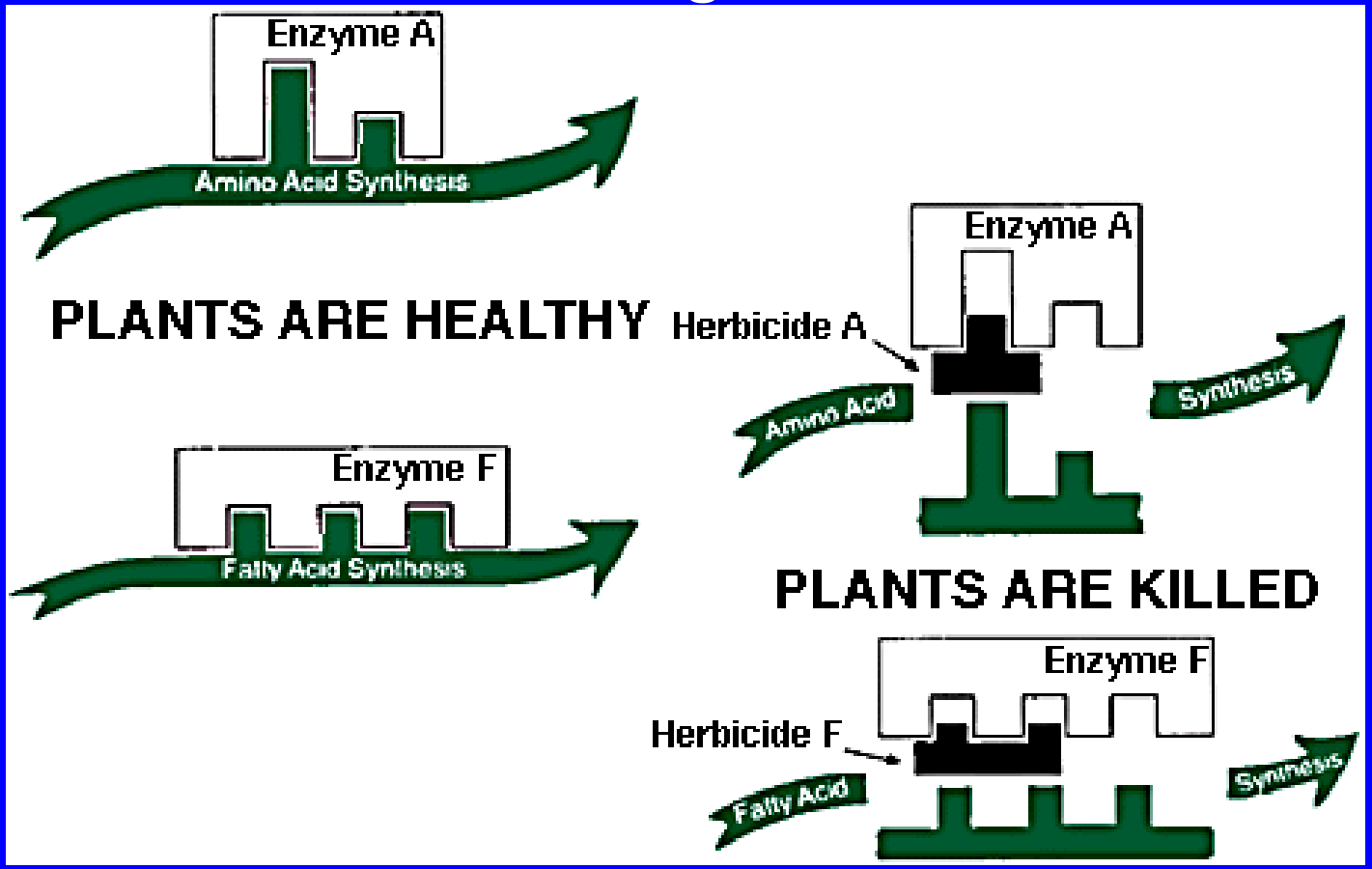
Definition of Herbicide Resistance

Inherited ability of a weed biotype to survive a herbicide application to which the original population was susceptible.

Biotype = a group of plants within a species that have biological traits that are not common to the population as a whole.

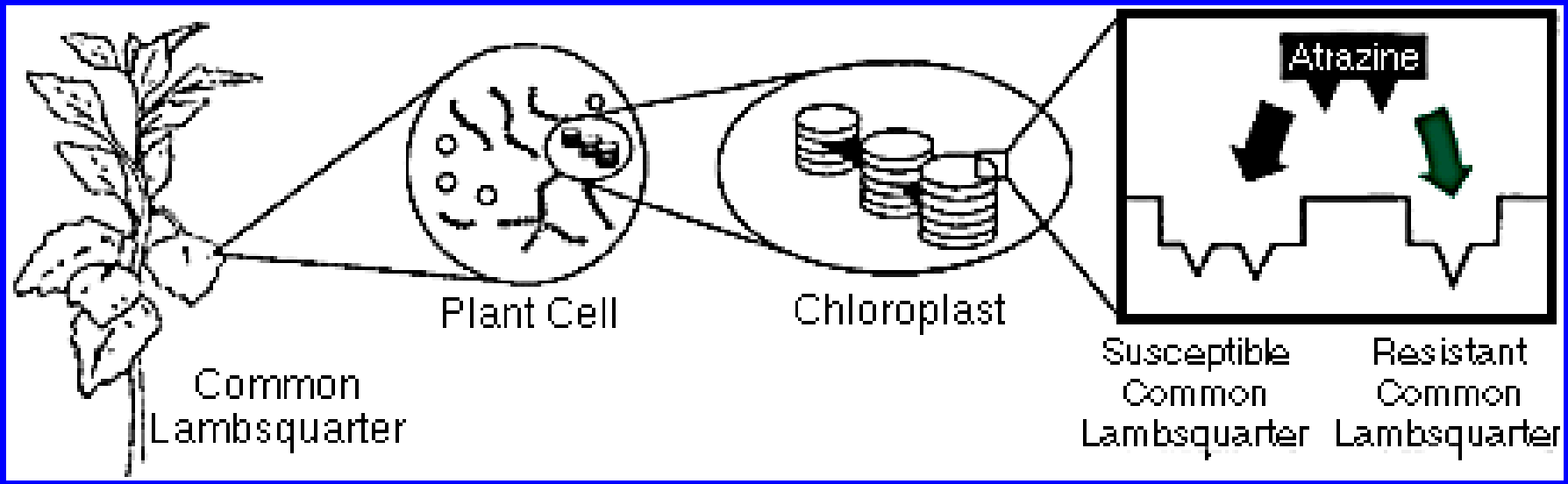
How herbicides kill plants

- Herbicide binding sites



Causes of Weed Resistance: target site change

- Resistant target protein



Selection Pressure

Scientific ☺ Guesstimates

ALS – 1 in 100,000?

ACCase – 1 in 1,000,000?

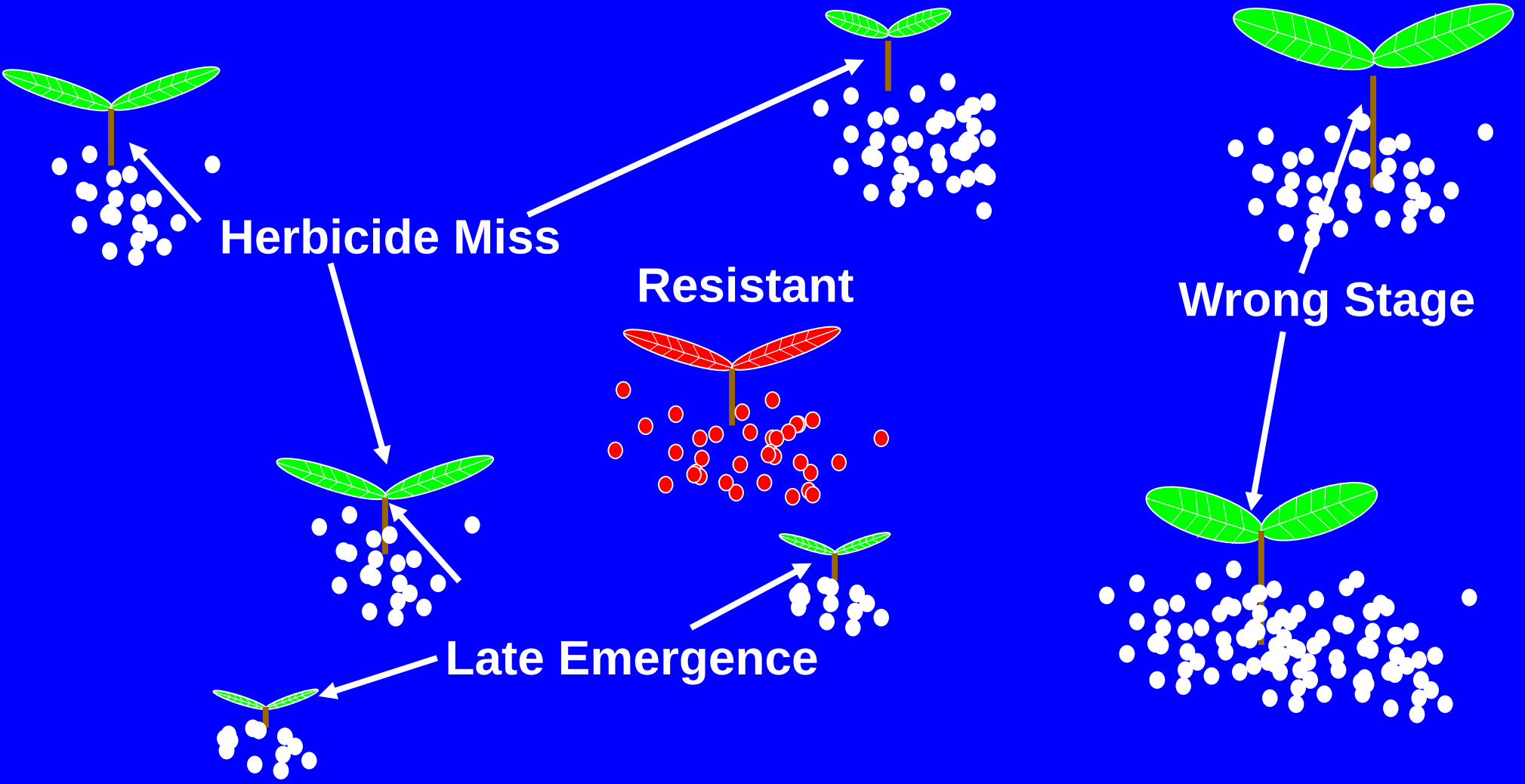
Many herbicides – 1 in 10,000,000?

2,4-D, glyphosate – 1 in 100,000,000?

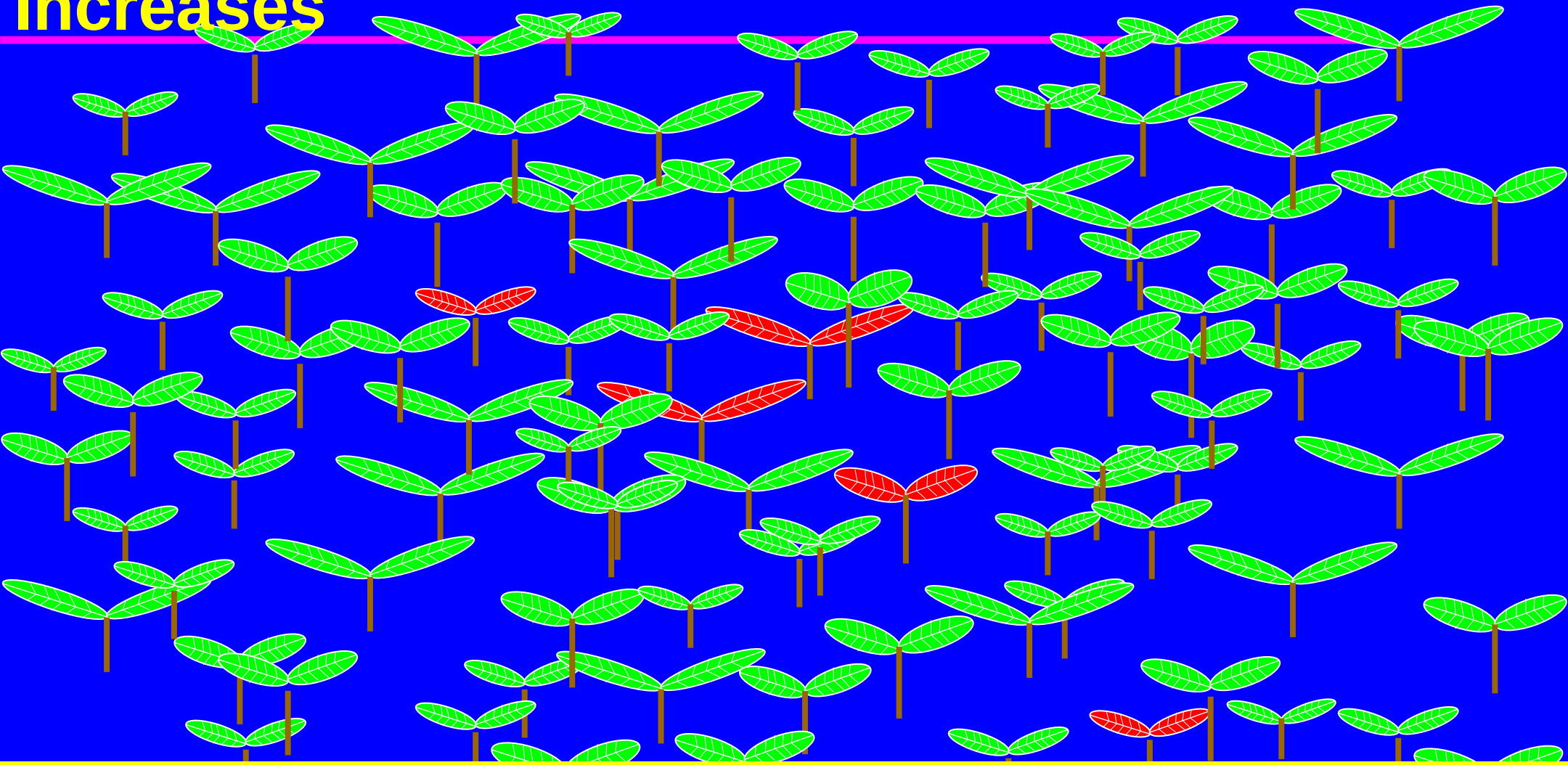
Weed Seeds in Soil often > 100 million seeds/acre

Weed Seedling Populations often > 1 million seedlings/acre

Survivors Set Seed

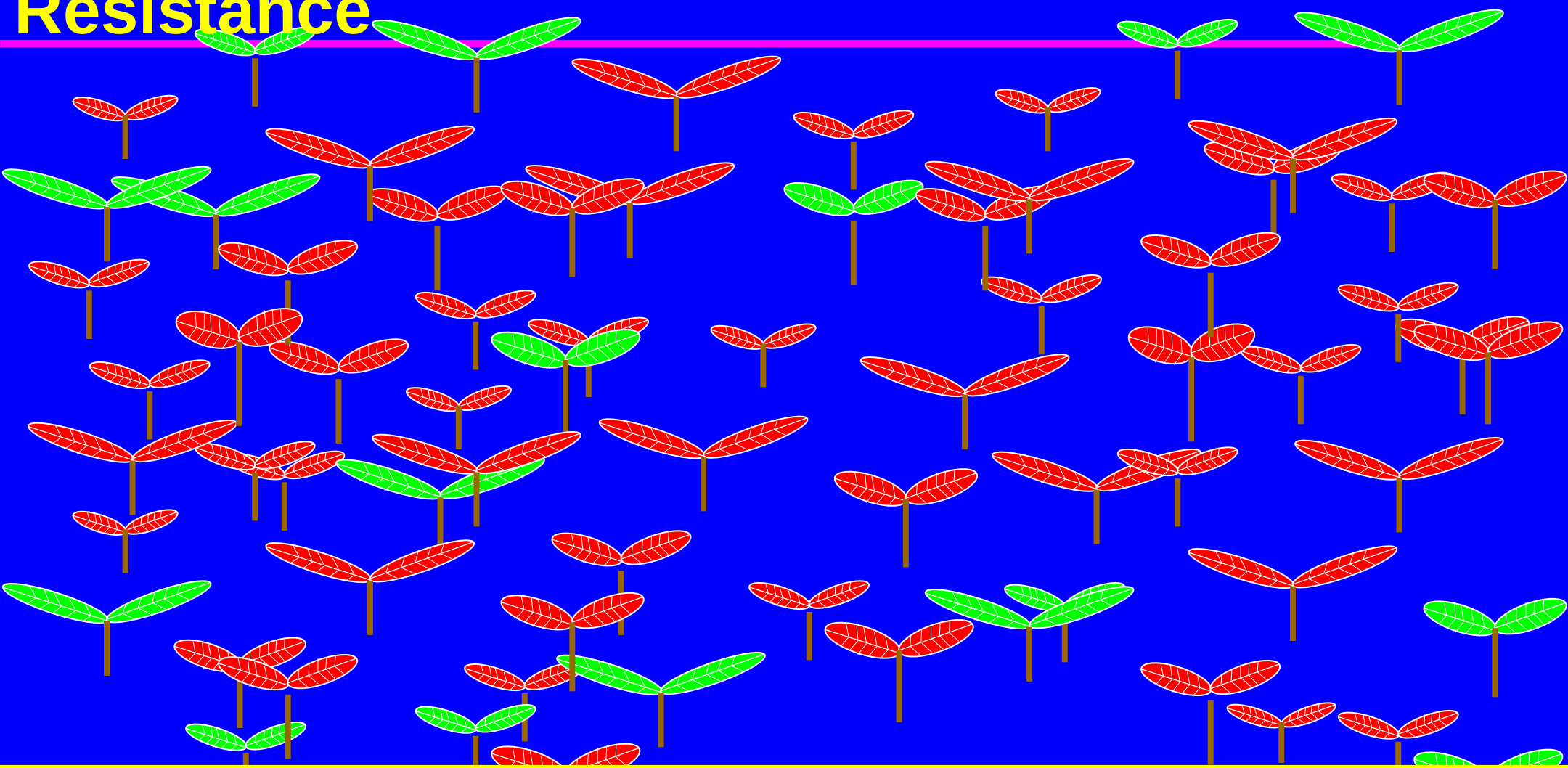


Resistant Proportion Increases



Proportion of resistant to susceptible still quite low for many years (between 5 and 50 years depending on many factors) – resistance not suspected but may be evolving.

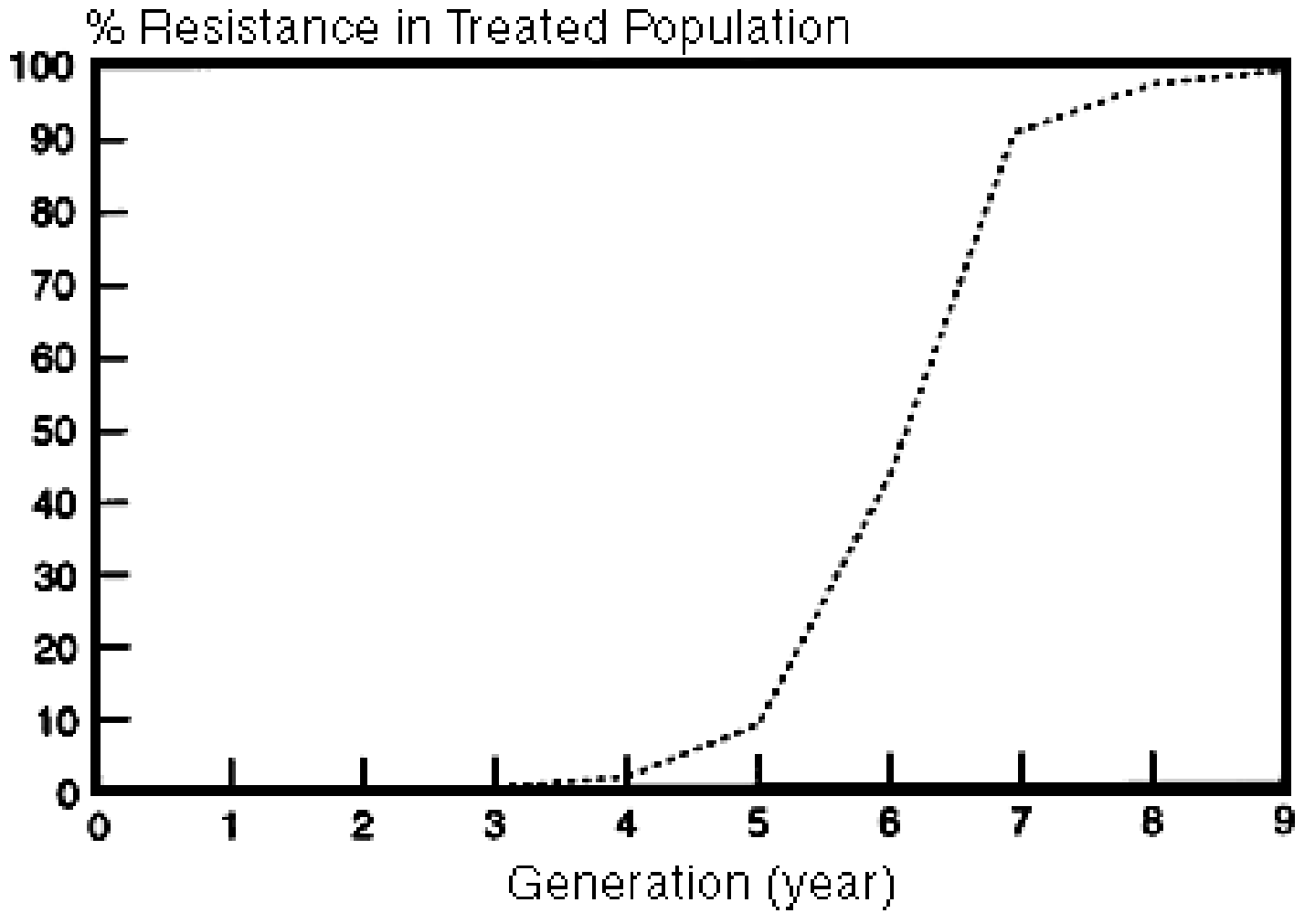
Herbicide Failure due to Resistance



Resistance detected when a high proportion (usually > 30%) of the population are resistant to the herbicide.

Herbicide Resistant Weeds

Selection Pressure



Glyphosate resistant Ryegrass first observed in orchards near Chico

Herbicide Characteristics That Influence Weed Resistance

- herbicides with a single site of action
- herbicides used multiple times during the growing season
- herbicides used for consecutive growing seasons
- herbicides uses without other control strategies
- repeated use of a product for more than 2 years could develop a herbicide resistance problem!!


interferes with harvest operations…….

Glyphosate Resistant Horseweed

Resistant biotype 3

14 DAT

Susceptible biotype

Source: Bob Hayes
University of Tennessee

Salinas Valley Overview

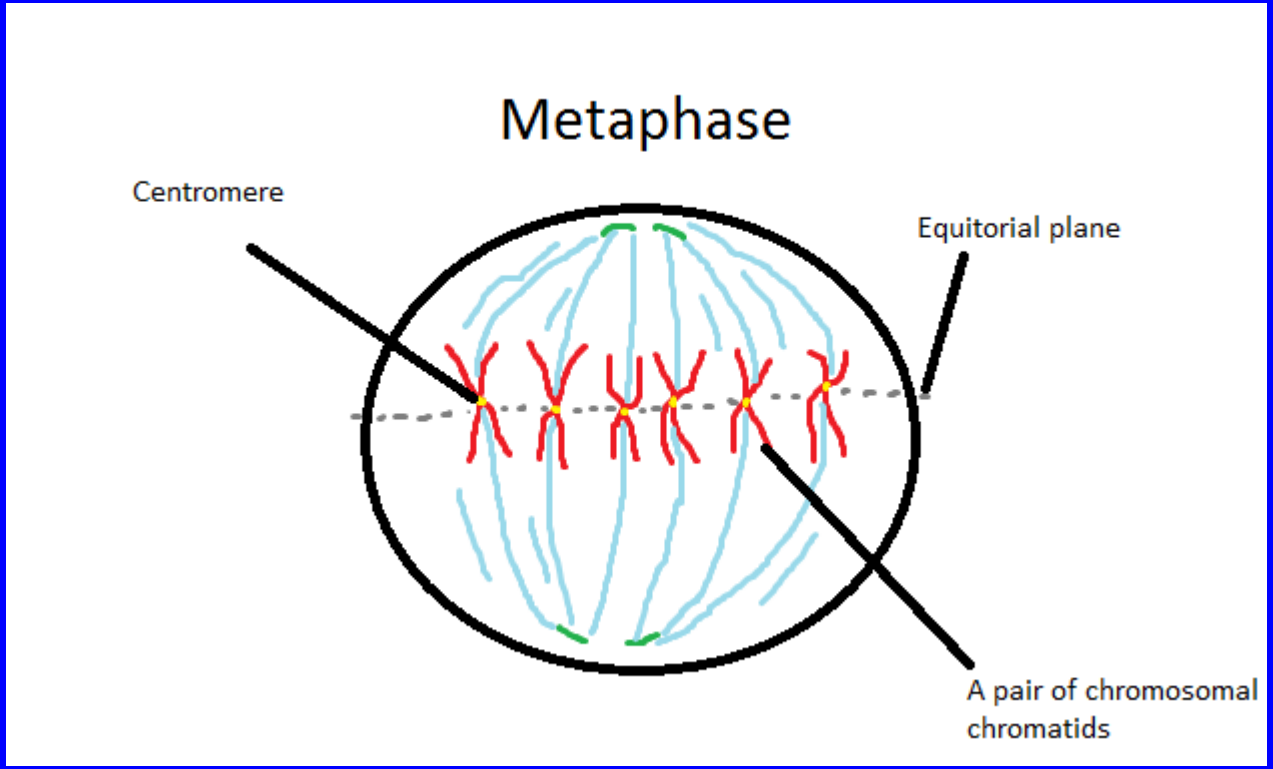
- Major herbicides and mechanisms
- Cultural weed control
  - Crop & herbicide rotation
  - Variation in planting date
  - Physical weed control
- Summary

Microtubule inhibitors

- Prevent cell division – WSSA group 3
- Common herbicides
  - Balan, Kerb, Prowl/Satellite, Dacthal, Treflan
- 46,379 acres of these herbicides applied in 2014 in Monterey County (MC)
- Crops – broccoli, cauliflower, onion,

CA DPR 2016,
WSSA 2014

Microtubules (mitosis)



Protox (PPO) inhibitor

- Prevent synthesis of PPO enzyme – WSSA group 14
- Common herbicides
  - Chateau, GoalTender, Shark
- 24,920 acres of these herbicides applied in 2014 in MC
- Crops – broccoli, cauliflower, onion, strawberry

CA DPR 2016, WSSA 2014

Photosystem II inhibitor

- Inhibit electron transport in photosynthesis – WSSA groups 5 & 7
- Common herbicides
  - Buctril, Caparol, Lorox
- 16,863 acres of these herbicides applied in 2014 in MC
- Crops – carrot, celery, onion

CA DPR 2016,
WSSA 2014

Field selection

C104-01

Clean soil off equipment

Wind-blown annual weed seeds

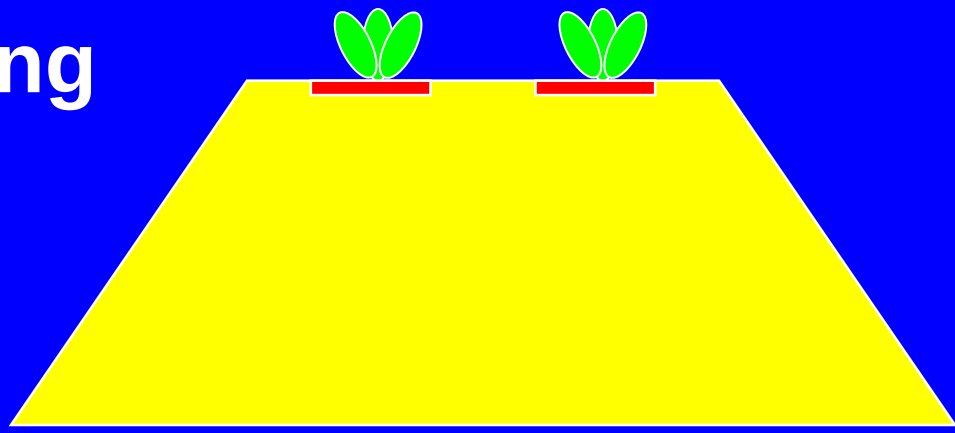
Common groundsel

Annual sowthistle

Rotational crops

Weed management events - lettuce

- Weed control in rotational crops
- Preplant tillage
- Preirrigation and weed removal
- Herbicide/fumigant application
- Cultivation
- Hoeing & hand weeding



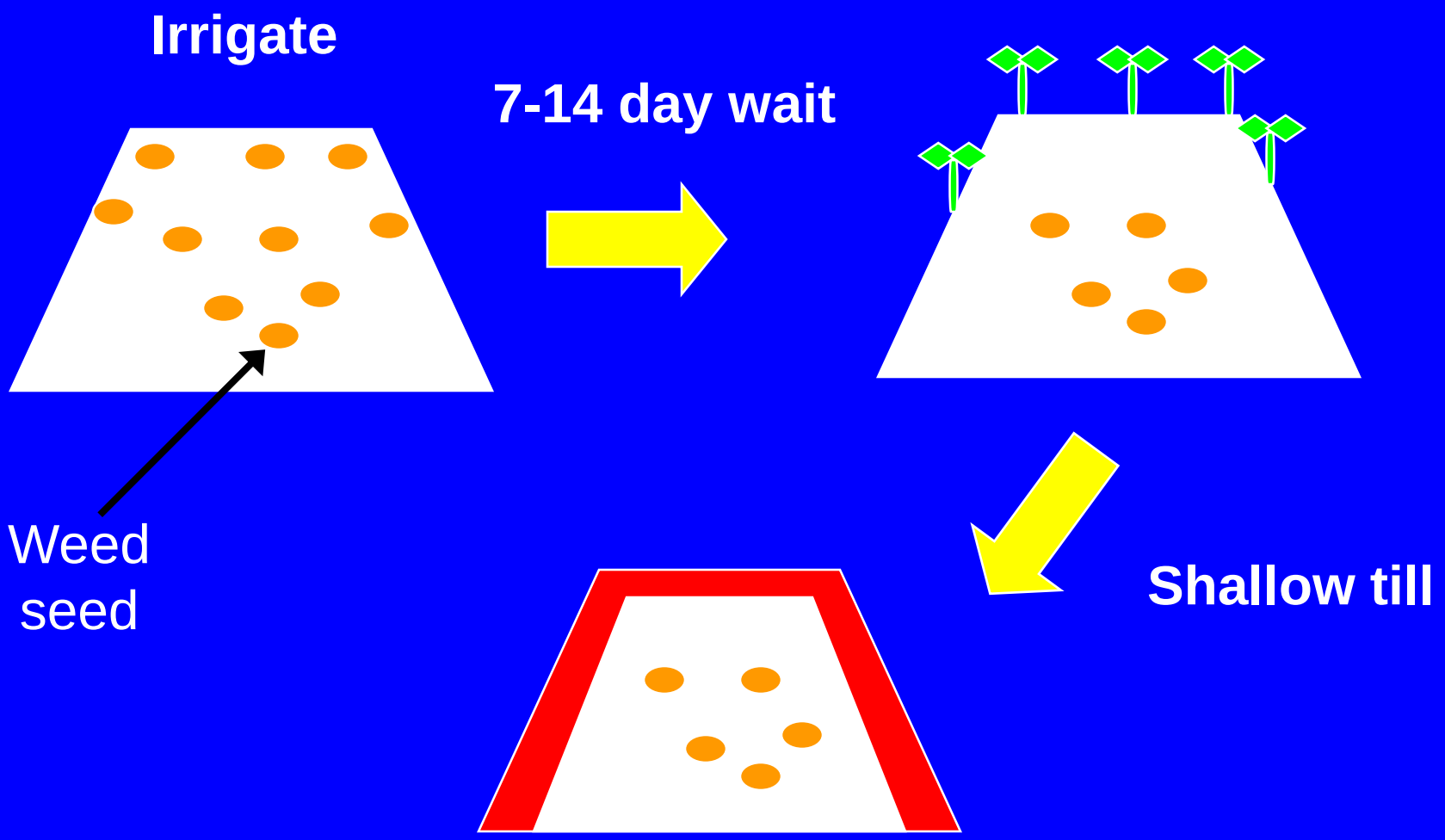
Preirrigation – stale seedbed

- Preirrigation and tillage before planting can be used help reduce weed populations
- The goal is to stimulate weed emergence before seeding or transplanting

Role of preirrigation in weed management

- In the dry months of the year, fields are preirrigated to allow proper tillage.
- The primary objective is to prepare a fine seedbed for planting.
- Performed properly, preirrigation followed by shallow tillage can remove many weeds and improve weed control.

Preirrigation to control weeds



Preirrigation treatments

- Furrow, sprinkler or no preirrigation
- Till and plant 7 to 14 days after preirrigation

Effects of preirrigation

No preirrigation

Preirrigation

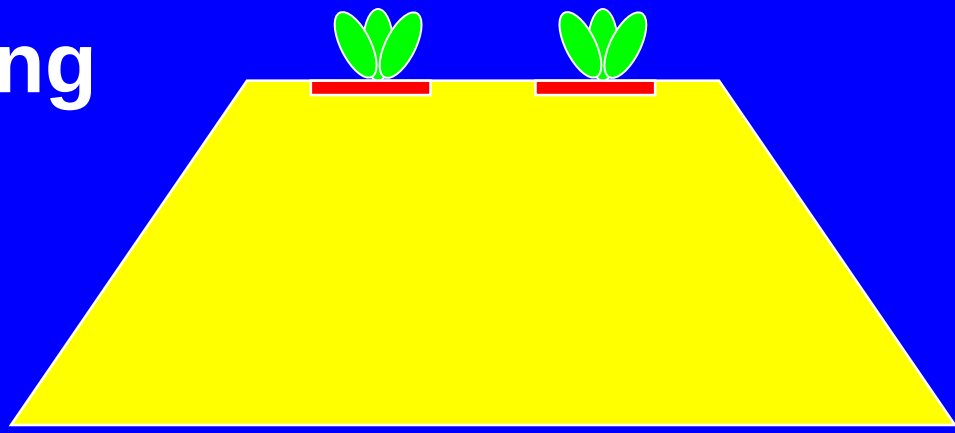

1 Week
Furrow
pre-irrigation
1 Week
Sprinkler
pre-irrigation
2 Weeks
Furrow
pre-irrigation
2 Weeks
Sprinkler
pre-irrigation

Preirrigation

- A single sprinkler preirrigation controls 16 to 50% of the potential weeds.

Weed management events - lettuce

- Weed control in rotational/cover crops
- Preplant tillage
- Preirrigation and weed removal
- Herbicide/fumigant application
- Cultivation
- Hoeing & hand weeding



Plant tape vegetable transplanter

Precision planting

- Precise bed shaping and consistent plant spacing allows for close cultivation

How close can we get?

Hand weeding

Mulches

Rapid crop destruction

Weed Control in Lettuce

No herbicide, no cultivation = 0% control

Kerb only, no cultivation
= 45% control

Kerb + cultivation
= 79% control

No herbicide, cultivation only
= 51% control

Partial weed control

- Lettuce herbicides only provide partial weed control. Other inputs are needed like stale seedbed, cultivation, hand weeding – to manage weeds
- Because weeds are controlled by redundant tools, development of herbicide resistant weeds is unlikely
- You only have to kill a weed once!

Summary

- The Salinas Valley has very high standards for weed control and low weed populations
- The cropping system is complex and weeds are less likely to adapt
- Multiple weed control tools besides herbicides
- Short cropping cycles limit weed chances to set seed