Field Bindweed

Biology and Management

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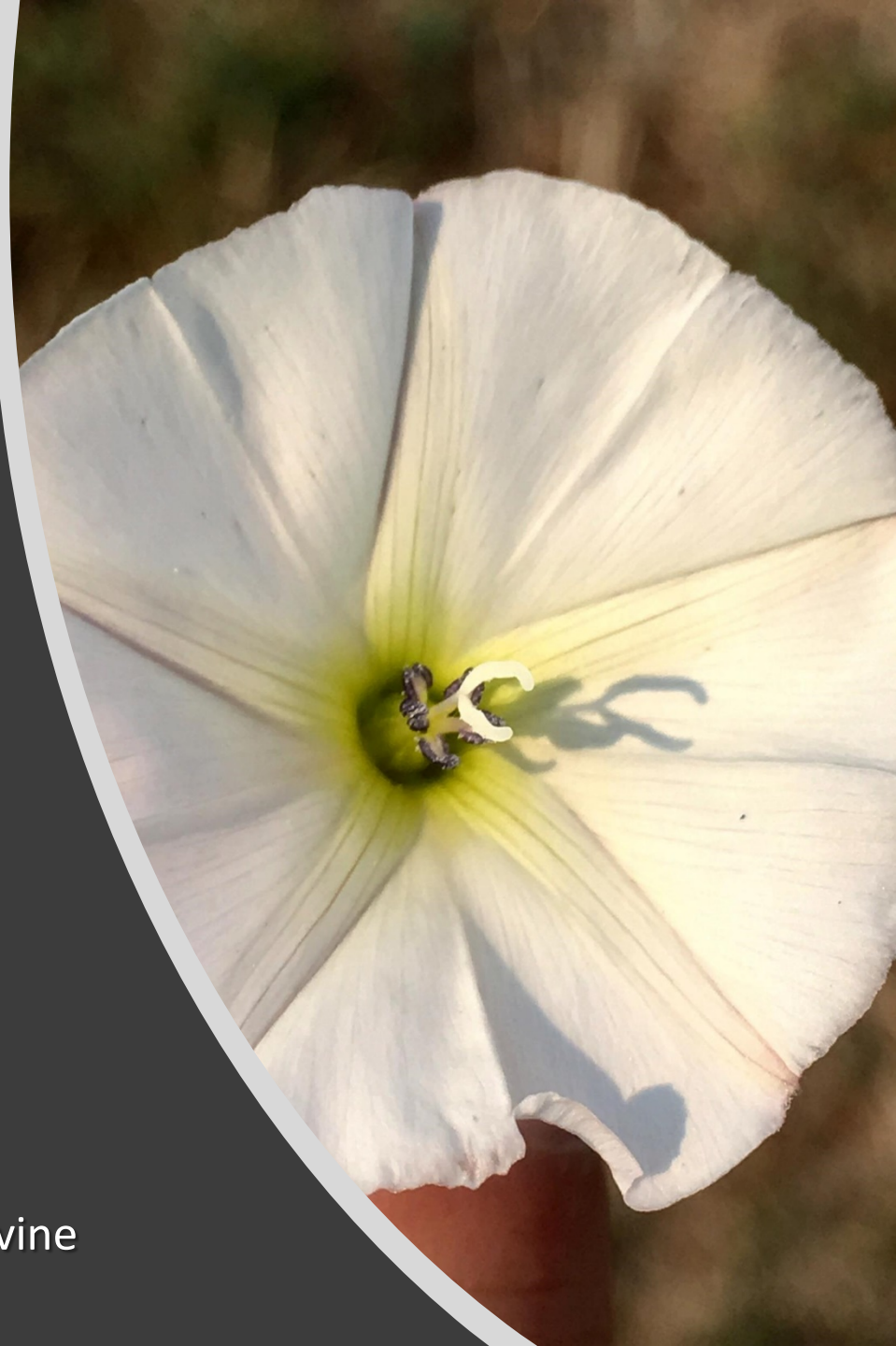
Notes in the Margins: Agronomy and Weed Science Musings

Today's Talk

- Bindweed Taxonomy and Origin
- Root and Rhizome Development
- Seeds, Dormancy, and Longevity
- Responses to Management Strategies
- Going Forward

Bindweed Taxonomy

- Greeks
  - *periklumenon*
  - `circling plant'
- Romans
  - *volucrum majus*
  - 'a worm wrapped in vines'
- Linnaeus - Species plantarum (1753)
  - *Convolvulus arvensis*
  - *'*to entwine the field'
- Common names
  - devil's guts, corn-bind, possession vine

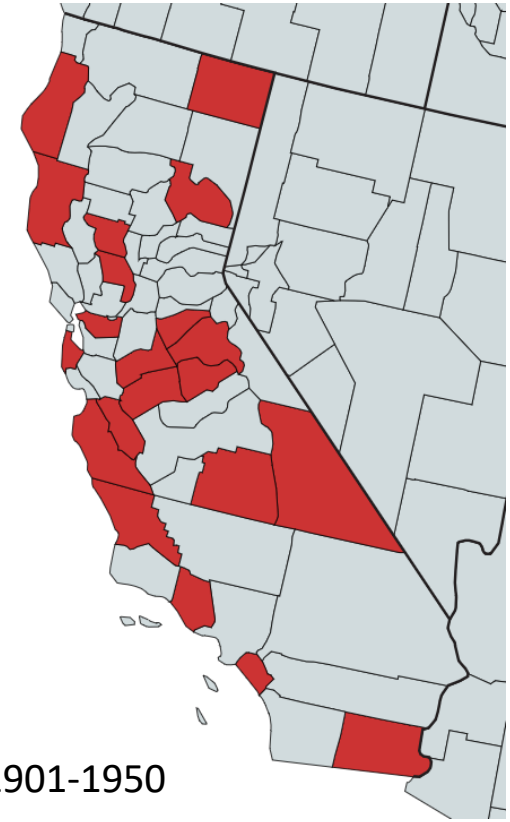


Where is Bindweed From?

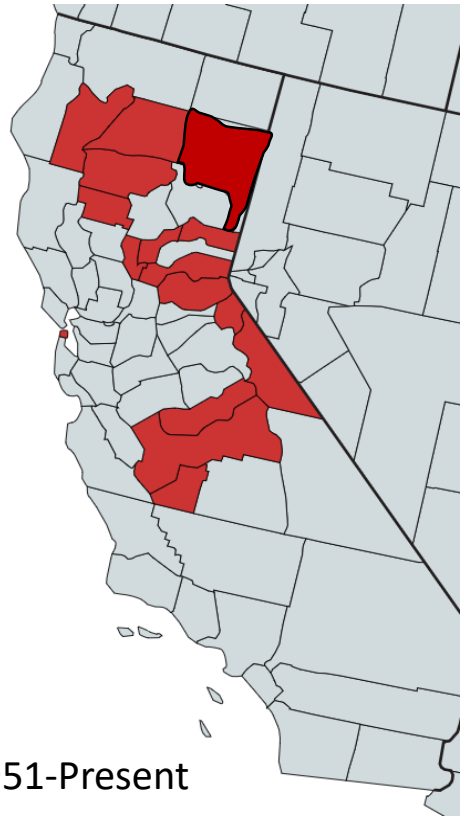
First reported in the United States in Virginia in 1739

Possible agricultural seed contaminant?

1850-1900



1901-1950



1951-Present

Field Bindweed in CA

First Occurrences by County

What Have Californians Said About This Species in the Past?

- **1891**
  - EW Hilgard - The Weeds of California
  - *The most dreaded of perennial weeds.*

- **1911**
  - FT Bioletti - The Extermination of Morning-glory
  - *The wild morning-glory is one of the most troublesome weeds in vineyard, orchard, and other cultivated soils.*

- **1925**
  - WL Jepson - Manual of the Flowering Plants of CA
  - *The most troublesome orchard and garden weed yets naturalized in California.*

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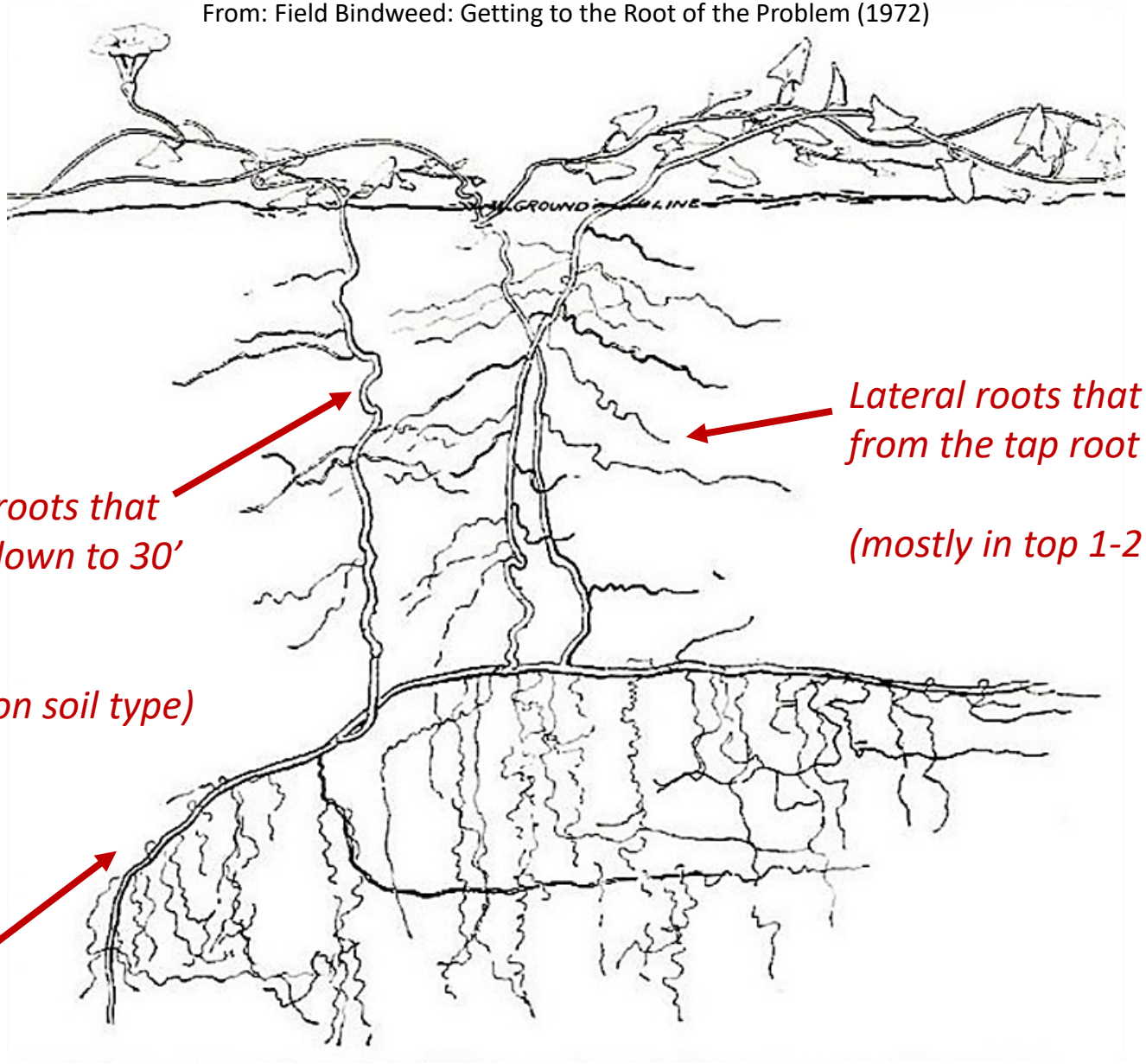
From: Field Bindweed: Getting to the Root of the Problem (1972)



Lateral roots that develop from the tap root

(mostly in top 1-2 feet of soil).

Vertical tap roots that can extend down to 30' deep

(depending on soil type)

Underground buds develop into rhizomes which can establish new crowns and tap roots

Rhizomes and Root Mass Facilitate Bindweed Regeneration Following Control Measures

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The Underground Bud-bank Makes Eradication Difficult

Cultivation to Eradicate Field Bindweed

Timmins and Brun, 1951, Agron. J., pgs 371-375

	Number of cultivations to eradicate	Number of seasons to eradicate
Cultivation every 2 weeks	**21 - 28**	**1.8 - 2.4**
Cultivation every 3 weeks	**18 - 22**	**2.2 - 2.6**
	Number of cultivations to eradicate	**Number of seasons to eradicate**
Cultivation 4” deep	**22**	**372**
Cultivation 8” deep	**17**	**318**
Cultivation 12” deep	**16**	**325**

Deeper cultivations were more expensive and resulted in soil quality degradation

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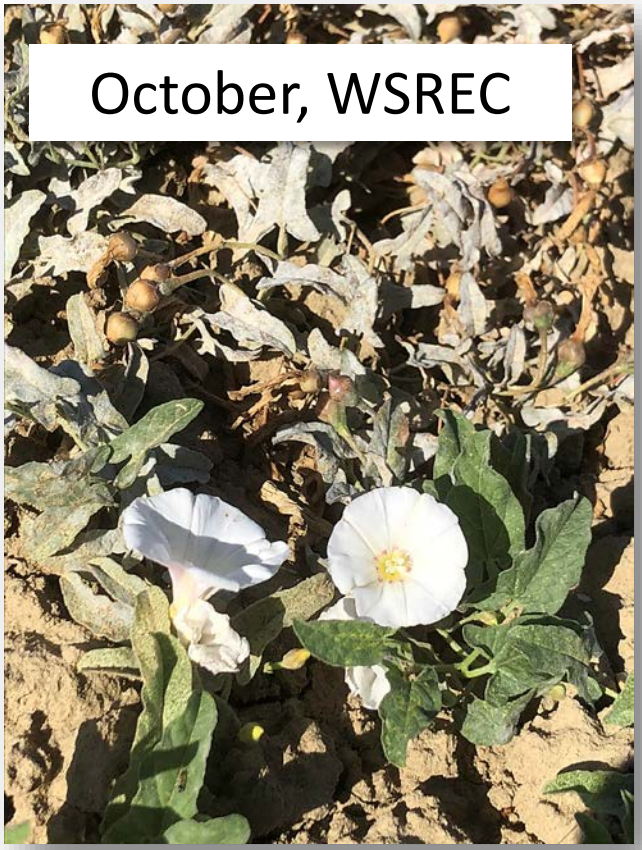
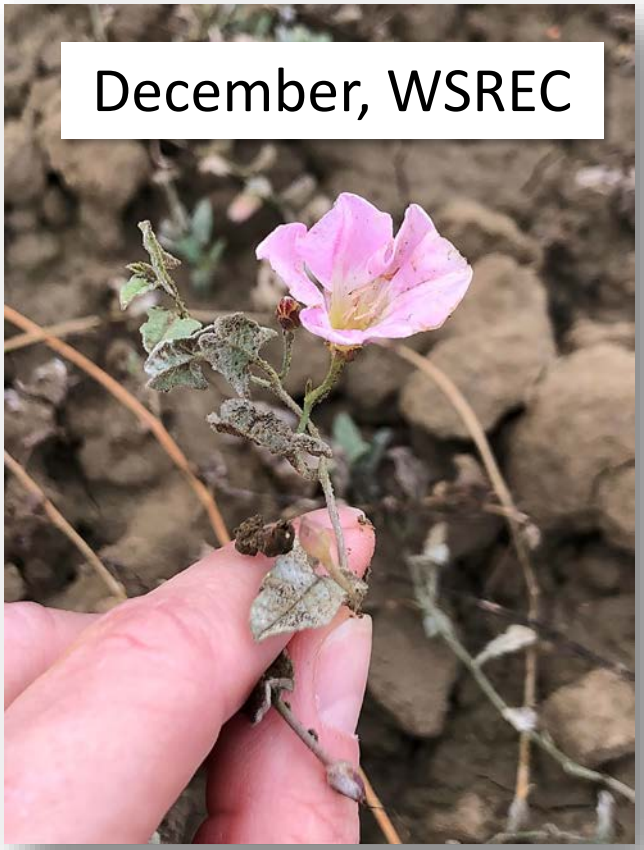
But before we can talk about seeds…

…we should talk about flowers

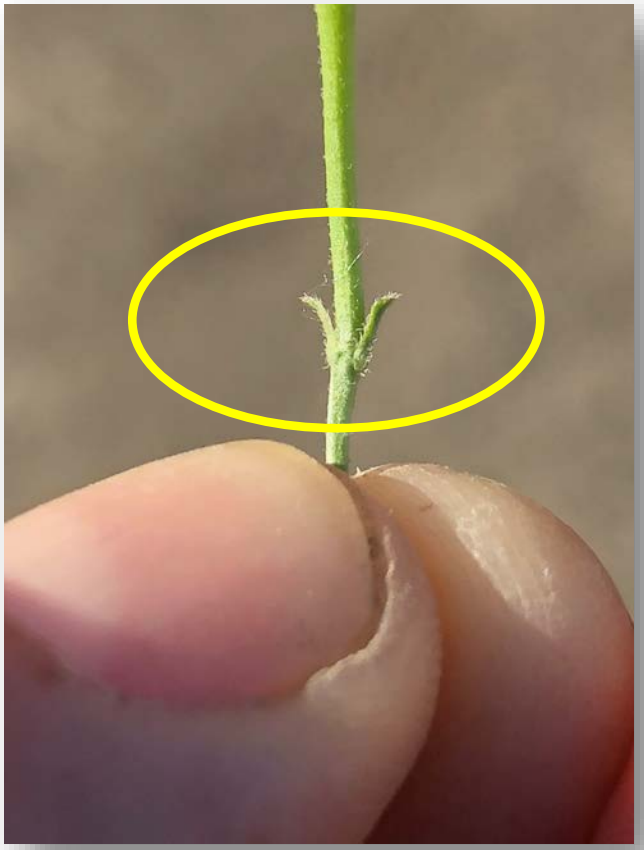
Flowers can be white to dark pink in color

Bindweed Vine and Stages of Flower Development





CalFlora says flowering occurs between April and September…but…



Cool bindweed identification feature…

…look for the bracts!


Field
Bindweed
Seeds

Field Bindweed Seed

- Each seed is 1/8th inch long, brown, wedge-shaped
- One to four seed/capsule
- 20,000 to 8,000,000 seeds/A
- Seeds become dormant one month after forming
- Dormancy is associated with reductions in seed moisture content and seed coat hardening

- *Weaver and Riley (1982) Can. J. Plant Sci. 62:461-472*
- *Brown and Porter (1942) Iowa State College, Res. Bull. 294*
- *Whitesides (1979) Ph.D. Thesis Oregon State University*
- *Stripleng and Smith (1960) Am. J. Bot. 47:386-392*
- *Swan (1980) Wash. State. Univ. Agric. Res. Bull. 0888*

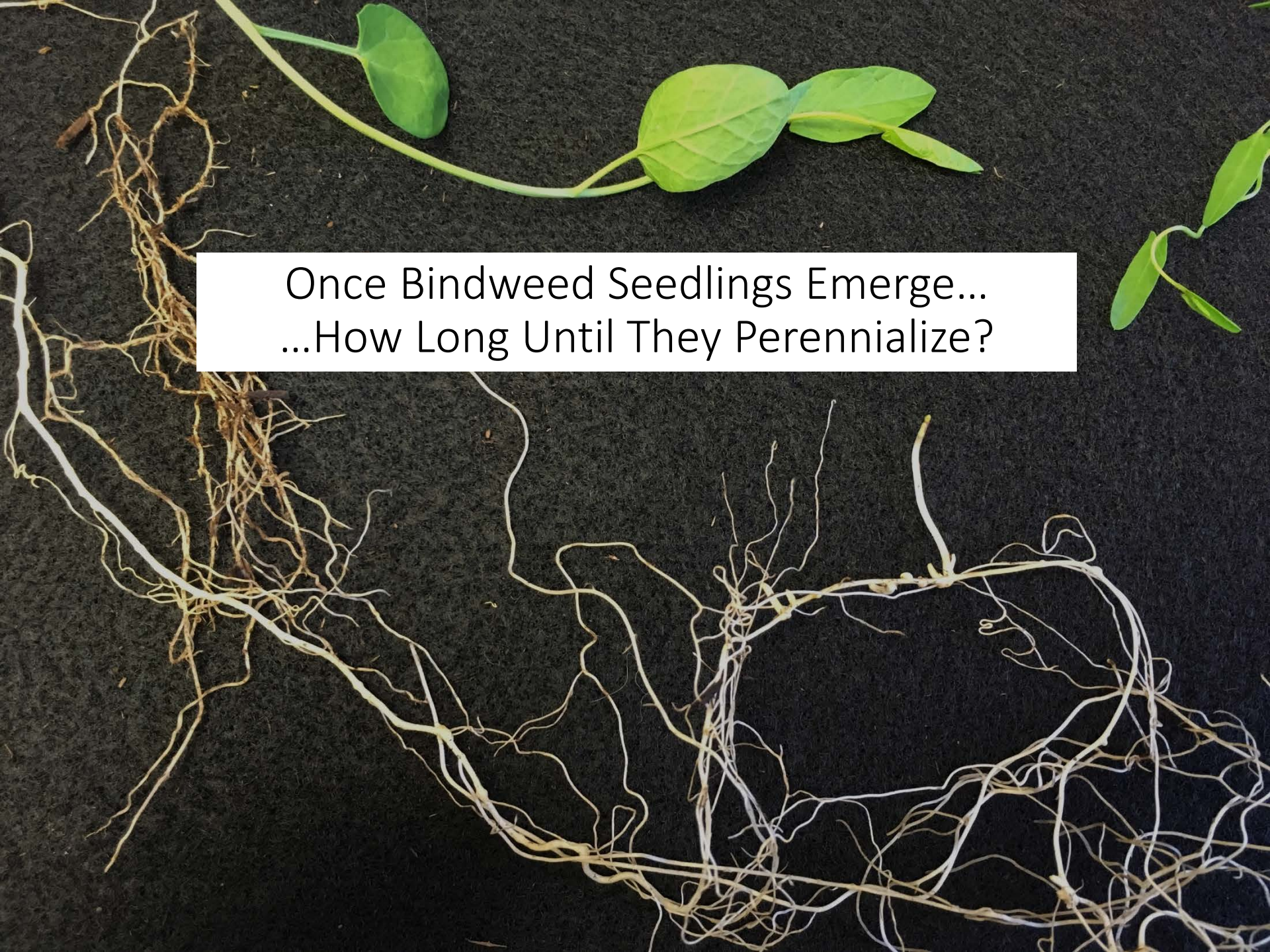
How Dormant is Dormant?

- *Dry Storage Conditions*
  - 1 year = 78 % viability
  - 3 years = 70% viability
  - 5 years = 49% viability
  - 50 years (herbarium specimen) = 8% germinability

  - *Brown and Porter (1942) Agric. Exp. Sta. Iowa State College, Res. Bull. 294*

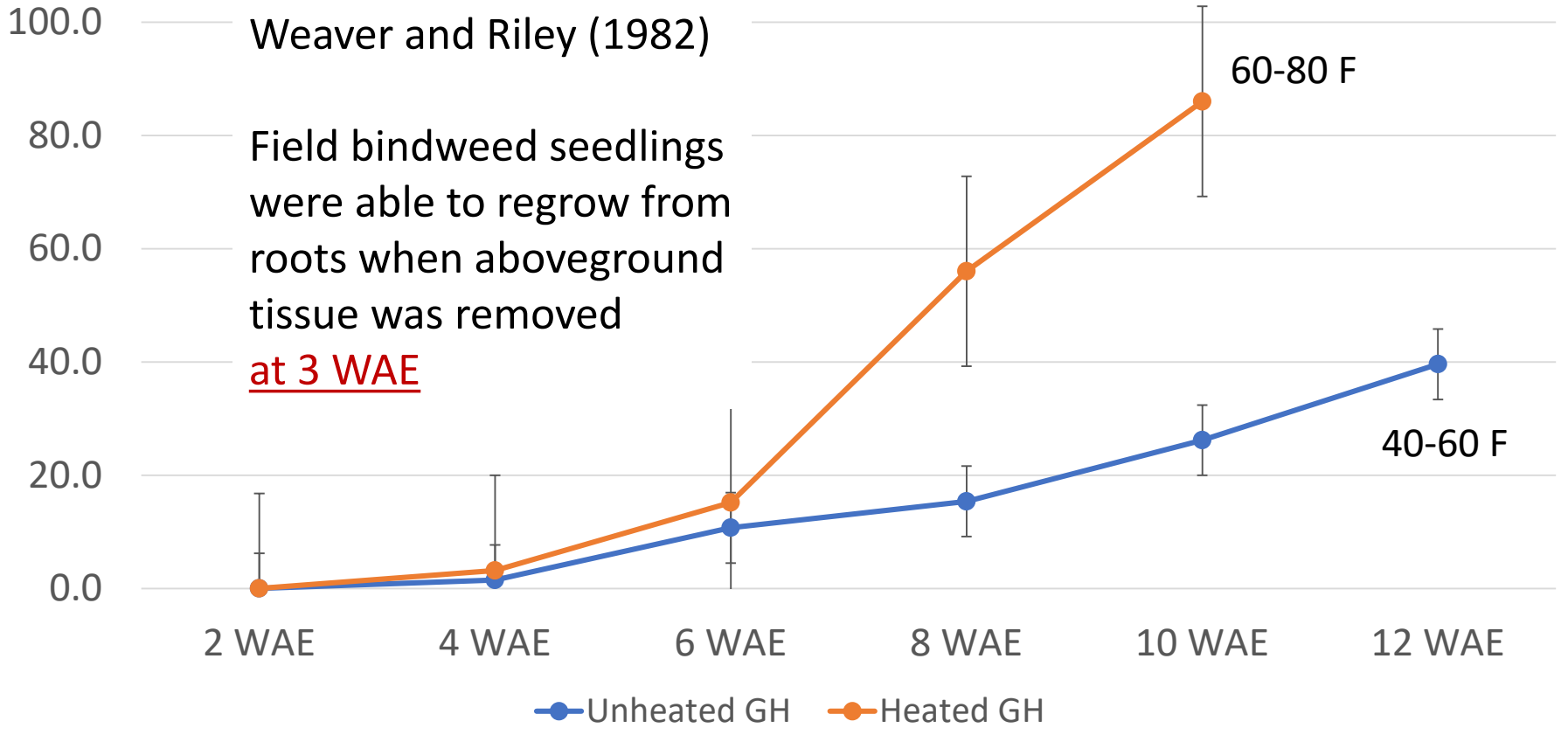
- *Field Conditions*
  - 2 years = 750 seedlings/m^2
  - 6 years = 430 seedlings/m^2
  - Approx 20 years = 800 seedlings/A
  - Approx 30 years = 25 seedlings/A

  - *FL Thomas (1949) Agronomy Journal 41:130-133*


Once Bindweed Seedlings Emerge…
…How Long Until They Perennialize?

Bindweed Root Bud Formation
2 to 12 Weeks After Emergence (WAE)

(Sosnoskie and Thompson (2017) Unpublished)



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Bindweed management is an exercise in persistence and patience

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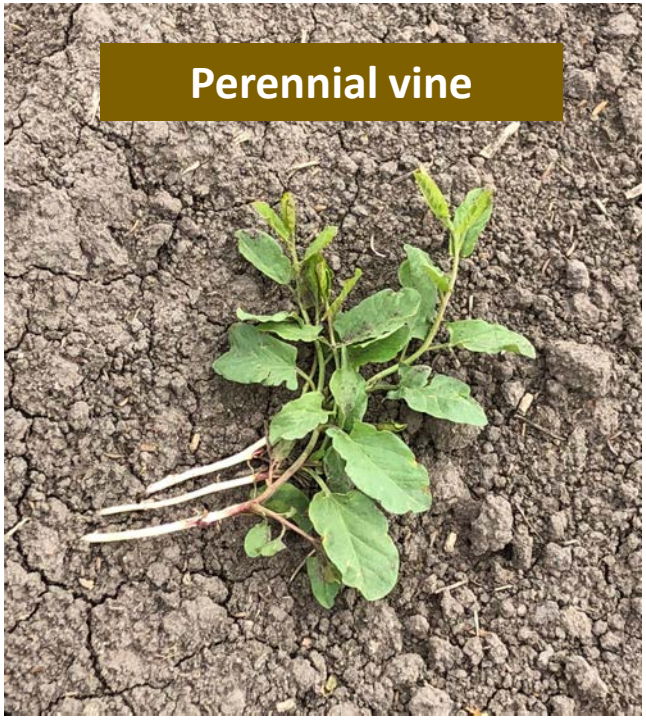
A lot of patience…

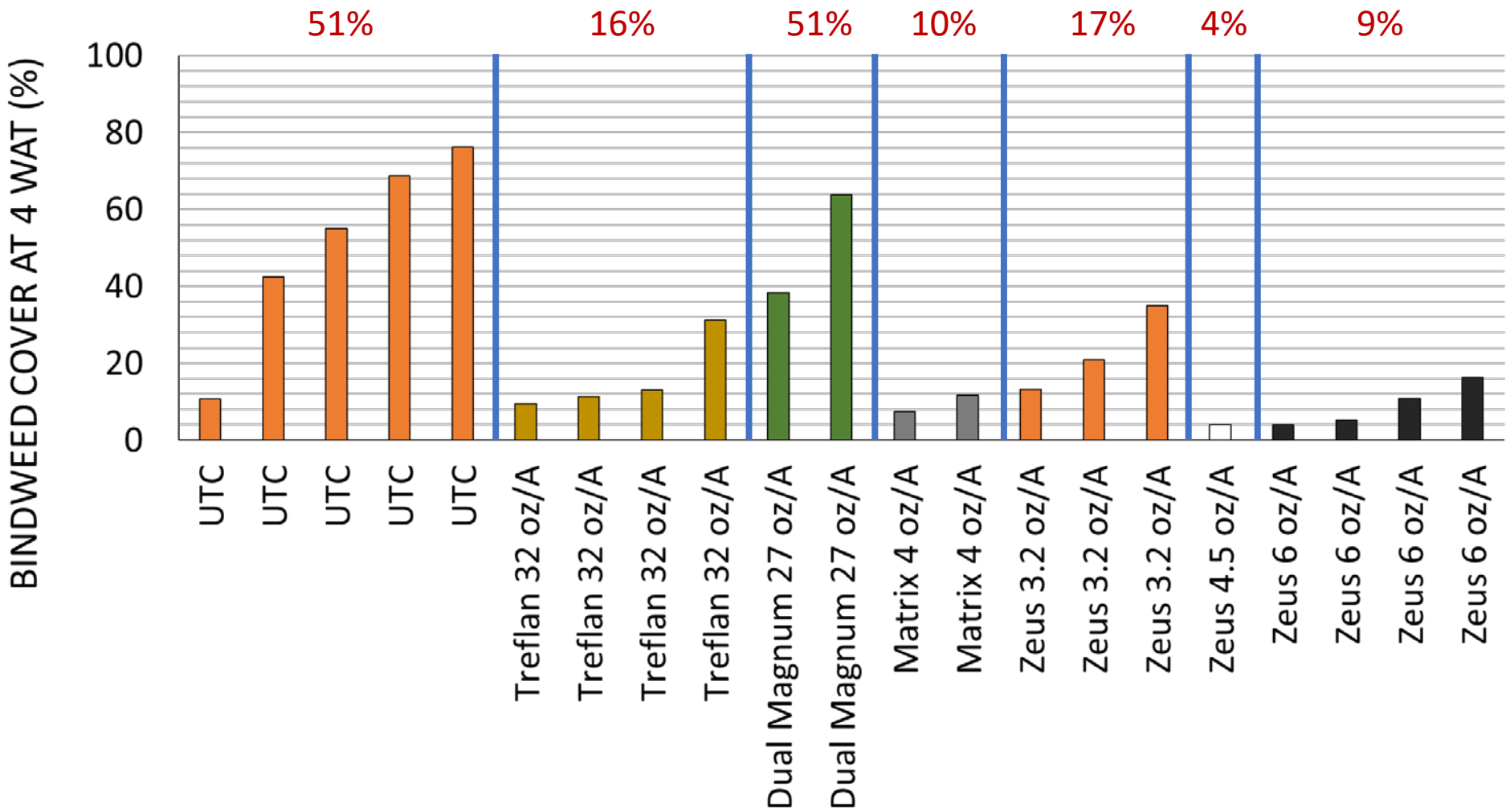
Pre-Emergence Herbicides

Residual Herbicides and Bindweed Suppression

- To be honest, there are not a lot of options
- Emerging seedlings are more likely to be managed by soil applied herbicides, but perennial vines are not
- That being said, there are some products that are capable of suppressing vine growth



A Summary of Bindweed Cover (%) at 4 WAT to Residual Herbicides Across a Series of Trials (2013-2015)



UC ANR IPM Guidelines for Processing Tomatoes (9/16)

http://ipm.ucanr.edu/PMG/r783700311.html

Herbicide:	**Notes:**
Treflan (trifluralin)	PPI (2-3 inch incorporation), Keep roots below treated zone, layby application
Dual Magnum (*S-metolachlor)*	PRE- and POST-plant and layby applications, rate dependent on soil texture, mainly for nutsedge suppression (no effect on perennial bindweed vines)
Matrix (rimsulfuron)	PRE-and POST-emergence activity, less effective against bindweed POST *(my experience),* UC IPM says 2 oz/A PRE, 4 oz/year total
Zeus (sulfentrazone)	Supplemental label for the suppression of nutsedge in transplanted tomatoes, rate dependent on soil texture, significant crop injury *(my experience)*

Soil Cracks Allow Bindweed Vines to Emerge, Potentially Missing Treated Zones

Post-Emergence Herbicides

(In-Crop)

Control of Field Bindweed In Tomatoes with POST Herbicides is Limited

http://ipm.ucanr.edu/PMG/r783700311.html

	Rimsulfuron	**Carfentrazone**
Seedlings	Partial Control	Control
Perennial Vines	Partial Control	Partial Control

Greenhouse studies to look at injury of regenerated bindweed vines from rimsulfuron and carfentrazone

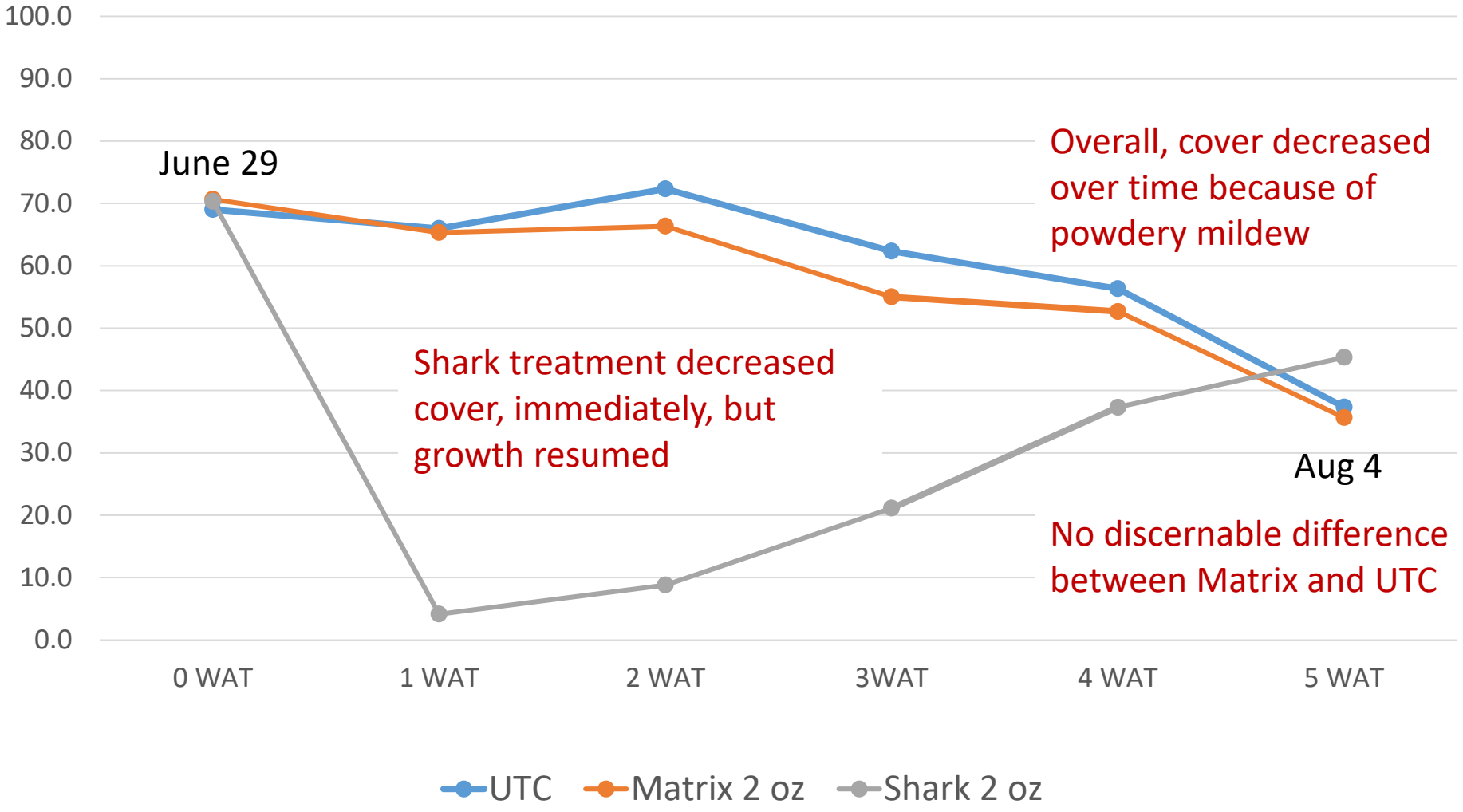
		Percent (%) Injury				
Herbicide	Rate	3 DAT	7 DAT	14 DAT	21 DAT	28 DAT
UTC		0.0	0.0	0.0	0.0	0.0
Matrix	2 oz/A	1.3	4.0	12.5	17.5	12.5
Shark	2 oz/A	91.3	95.0	91.3	85.0	80.0

Field bindweed plants were grown from 10 cm long, fall-exhumed rhizomes grown in a heated GH

Number of vines> 4” per plant = 6-8 at time of application

Percent (%) Field Bindweed Cover

(Bare ground Field Studies)

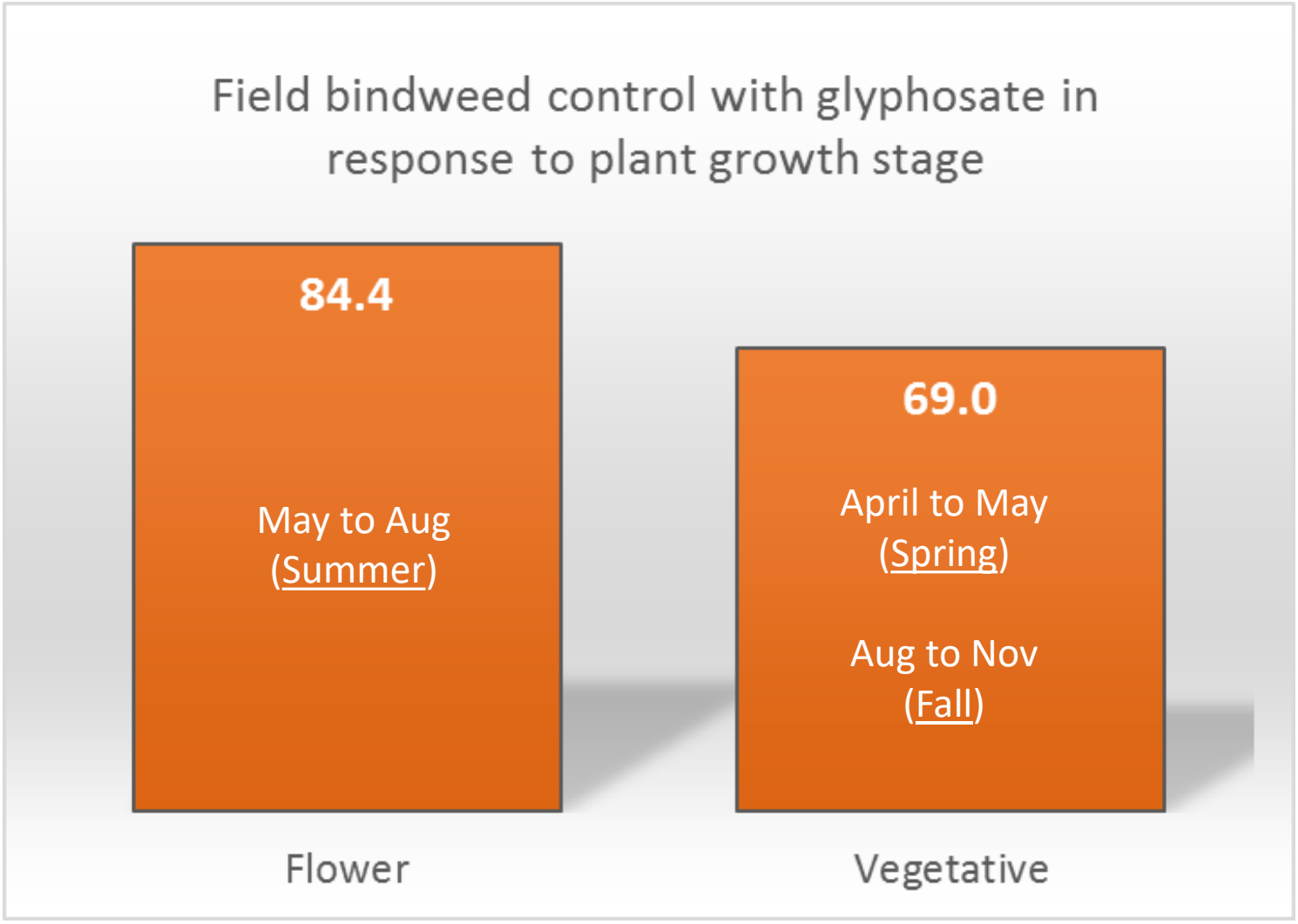


Post-Emergence Herbicides

(Post-Harvest, Fallow)

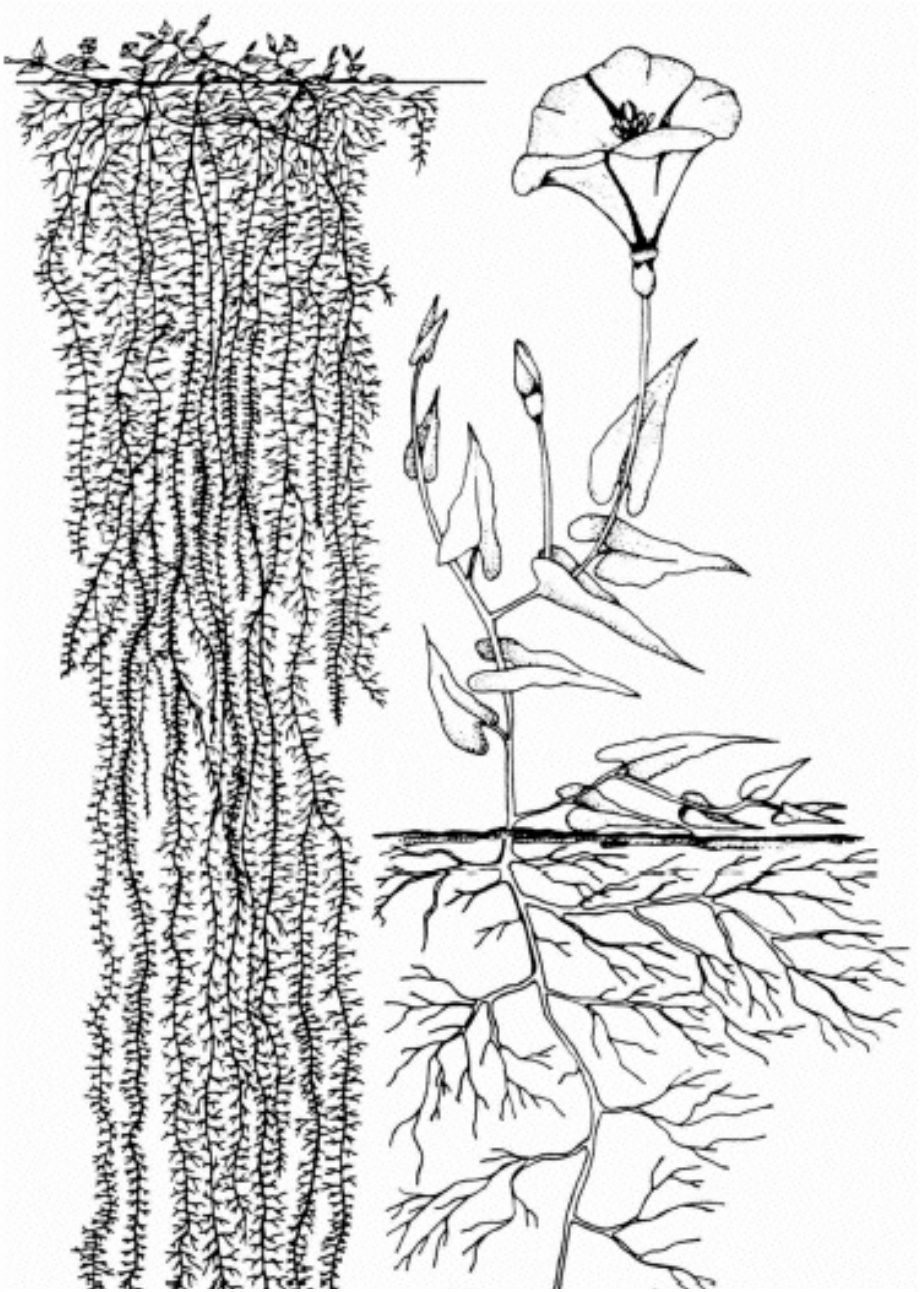
Field bindweed control with POST herbicides is affected by the timing of applications

(Wiese, A. F. and D. E. Lavake. 1986. Weed Sci. 34:77-80)

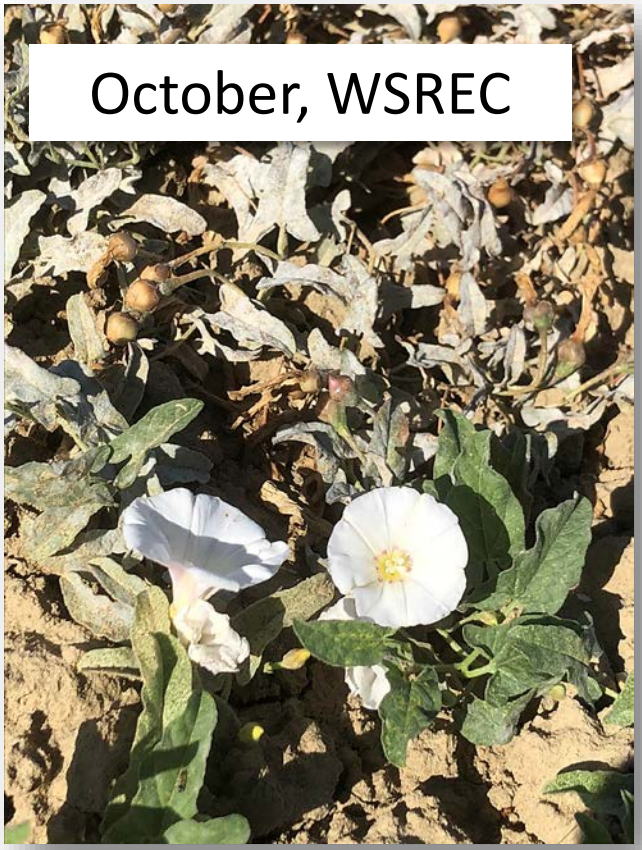


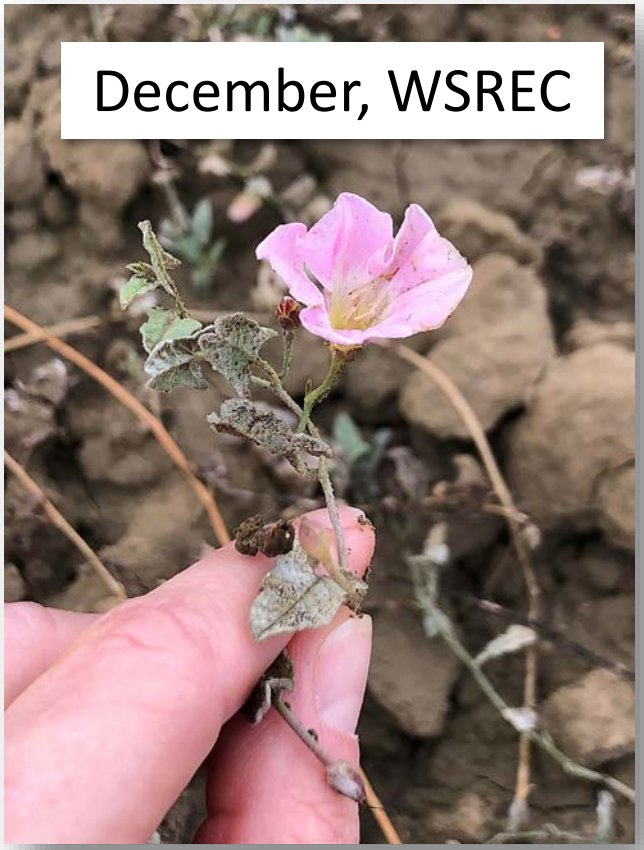
Why Flowering?

- Several reasons:
- *Surface area for herbicide capture*
- *Vigorous plant growth*
- *Movement of photosynthetic materials to meristems, including root growing points*
- *Glyphosate is phloem transported*

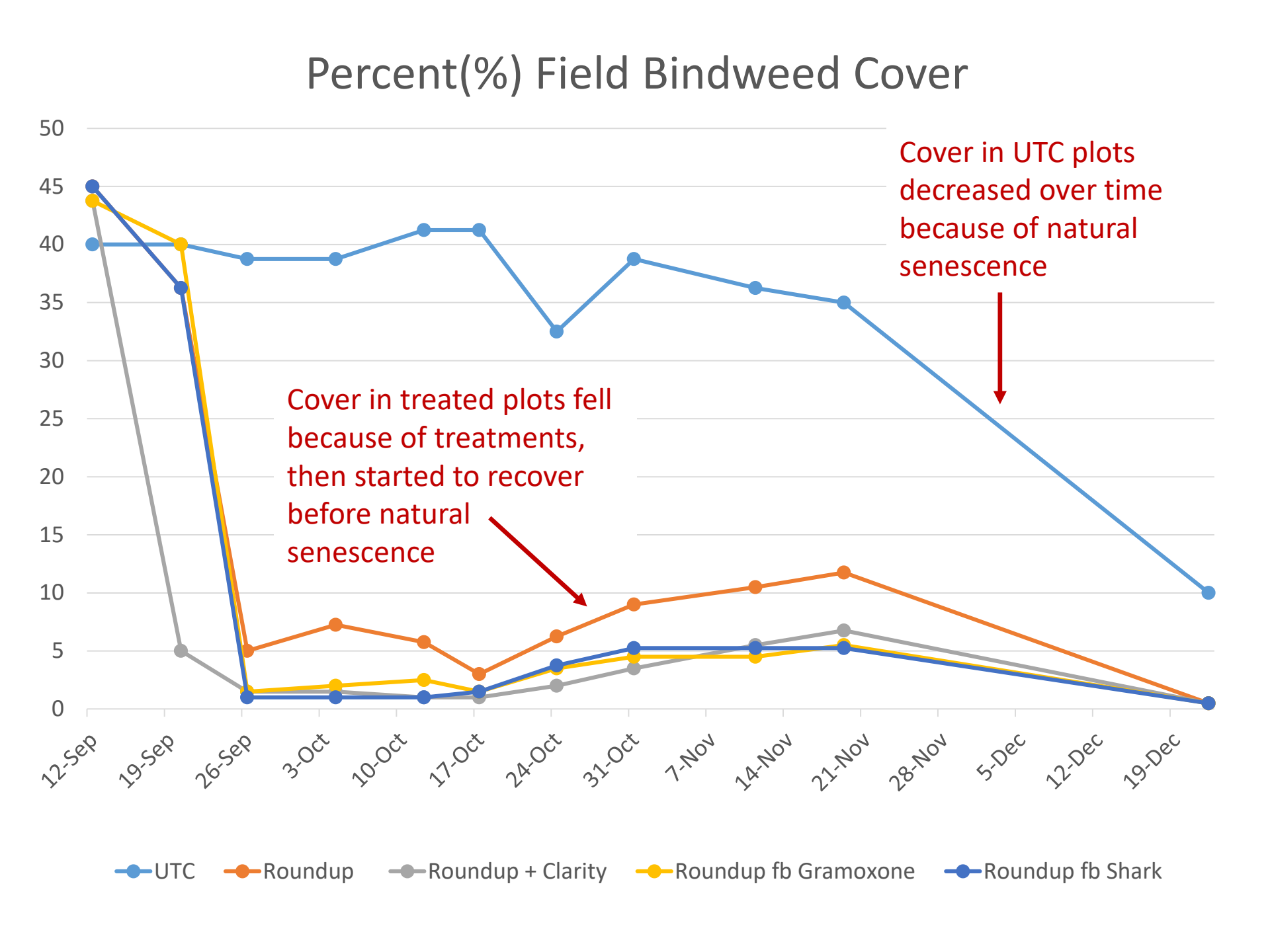


Root system of field bindweed, *Convolvulus arvensis.*
Redrawn from B. F. Kiltz. 1930. *J. Amer. Soc. Agron.* 22:216-234.

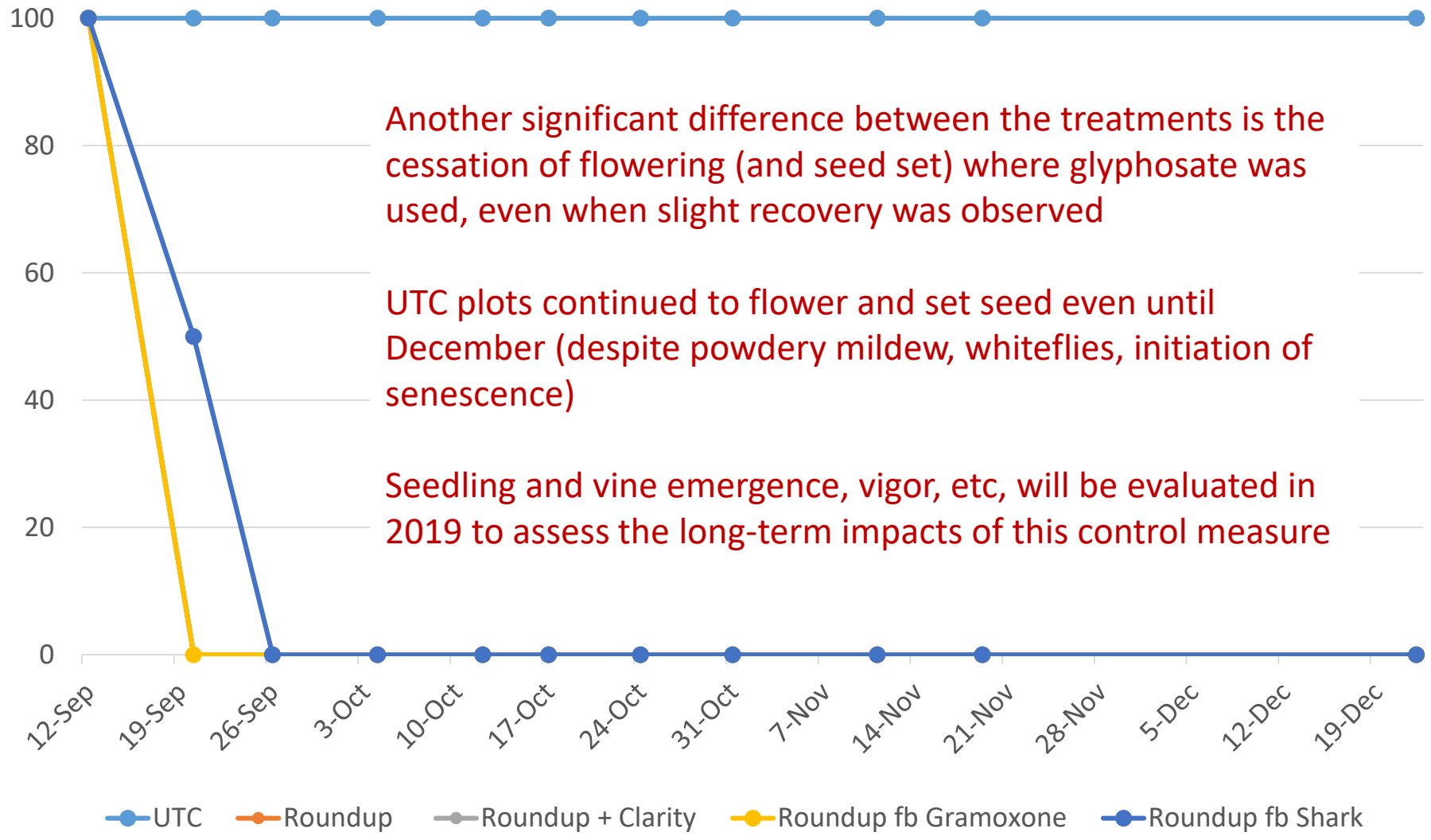




But are late season applications ineffective?


Percent(%) Field Bindweed Cover
50
45
40
35
30
25
20
15
10
5
0
12-Sep
19-Sep
26-Sep
3-Oct
10-Oct
17-Oct
24-Oct
31-Oct
7-Nov
14-Nov
21-Nov
28-Nov
5-Dec
12-Dec
19-Dec
Cover in UTC plots decreased over time because of natural senescence
Cover in treated plots fell because of treatments, then started to recover before natural senescence
UTC
Roundup
Roundup + Clarity
Roundup fb Gramoxone
Roundup fb Shark

Percent (%) Plots with Flowering Field Bindweed



Another significant difference between the treatments is the cessation of flowering (and seed set) where glyphosate was used, even when slight recovery was observed

UTC plots continued to flower and set seed even until December (despite powdery mildew, whiteflies, initiation of senescence)

Seedling and vine emergence, vigor, etc, will be evaluated in 2019 to assess the long-term impacts of this control measure

Still, try to maximize efficacy…

Apply glyphosate to vigorous vines, when possible

Be mindful about spray solution quality

Pay attention to external factors, like dust, that can reduce herbicide performance

Rotations with agronomic crops

Definitely an opportunity to use the crops competitive ability, available herbicides, to control bindweed…

But must be an active process that utilizes tools timing effectively

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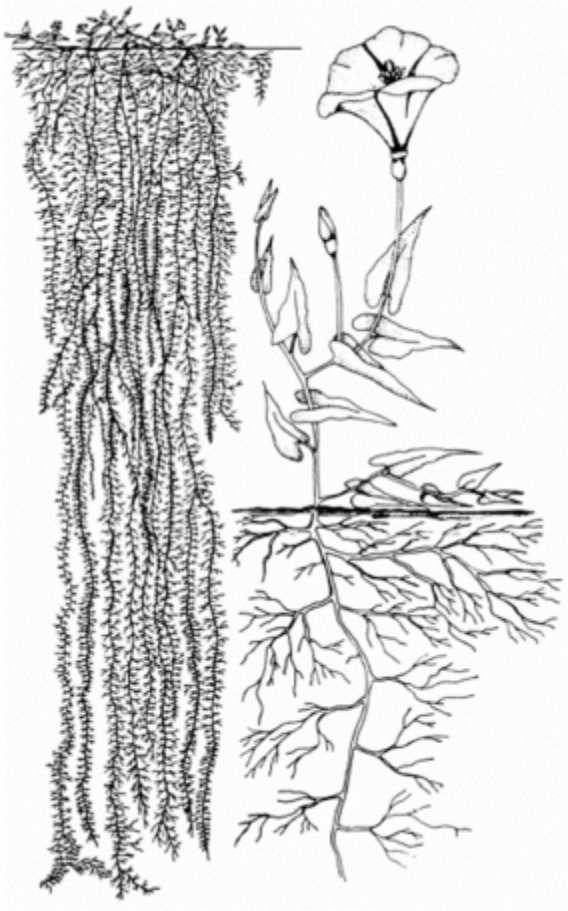
Future Research Plans



Redrawn from B. F. Kiltz. 1930
J. Amer. Soc. Agron. 22:216-234

2019 and Beyond…

- Phenology of bindweed perennialization and the specie's response to different weed management strategies
- Long-term effects of different herbicides and times of application on vine vigor, seed set, seed viability, and vine emergence
- Evaluate the use of herbicide combinations in agronomic crops to suppress field bindweed in following commodities
- Increase root bud and rhizome sensitivity to management tools
- Given that most of the information that is known about bindweed biology, ecology, and management was developed in the Eastern/Mid-Western US, determine how California's growing environment affects bindweed growth and development relative to "literature standards"

Thank you so much for your time!

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