Field Bindweed

Biology and Management

Biología y Manejo de la Maleza Perenne

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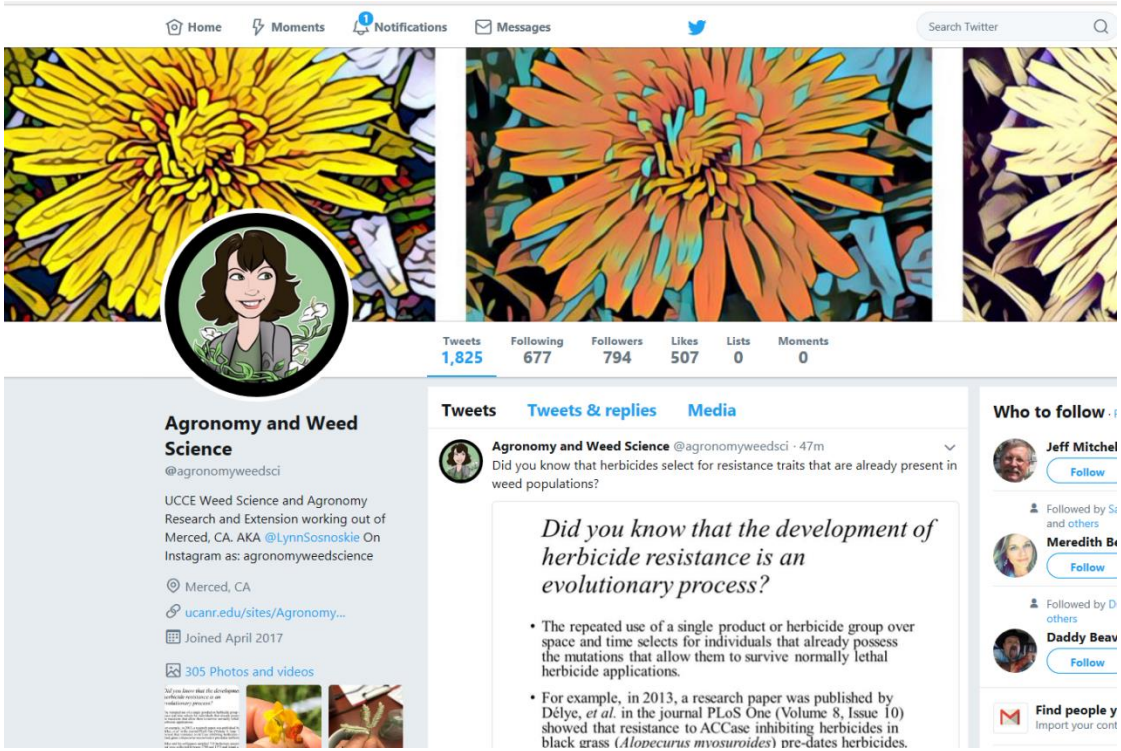

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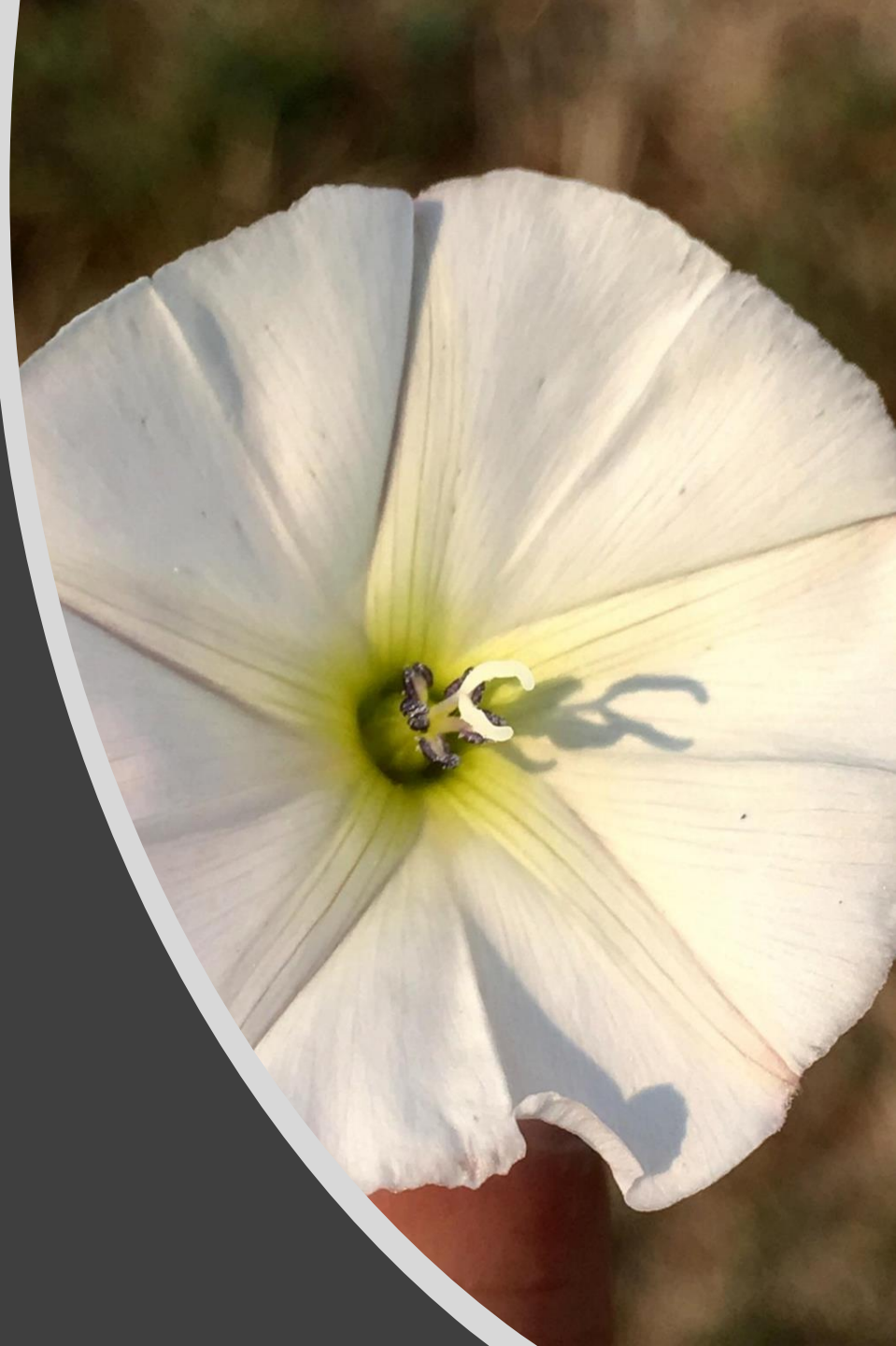
Notes in the Margins: Agronomy and Weed Science Musings

Today's Talk

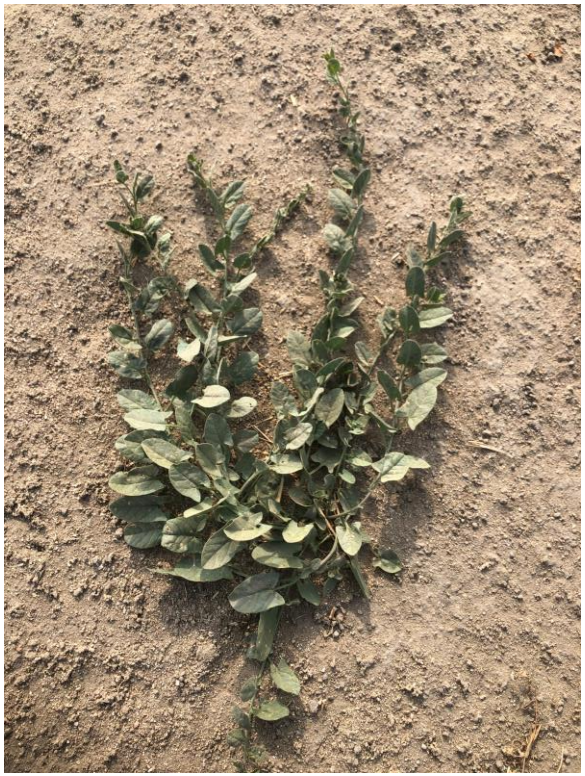
- Bindweed Origin (Origen)
- Root and Rhizome Development (el Desarollo de Raices y Rizomas)
- Seeds (Semillas)
- Management Strategies (Manejo de Malezas Perennes)
- Upcoming Research (Próximas Investigaciones)

Bindweed Backstory

- Native to the Mediterranean region of Europe and Northern Africa
- First reported in the US in 1739 in Virginia (possible seed contaminant)
- Arrived in California in the 1800's (1850 in San Diego)



Are you sure you are looking at bindweed?

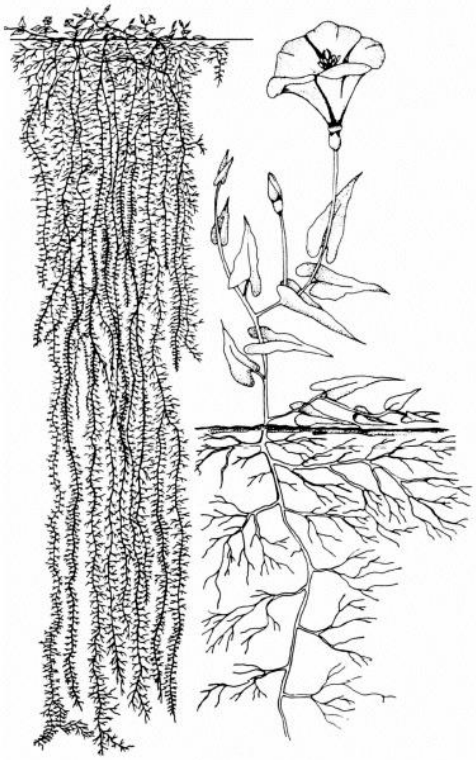


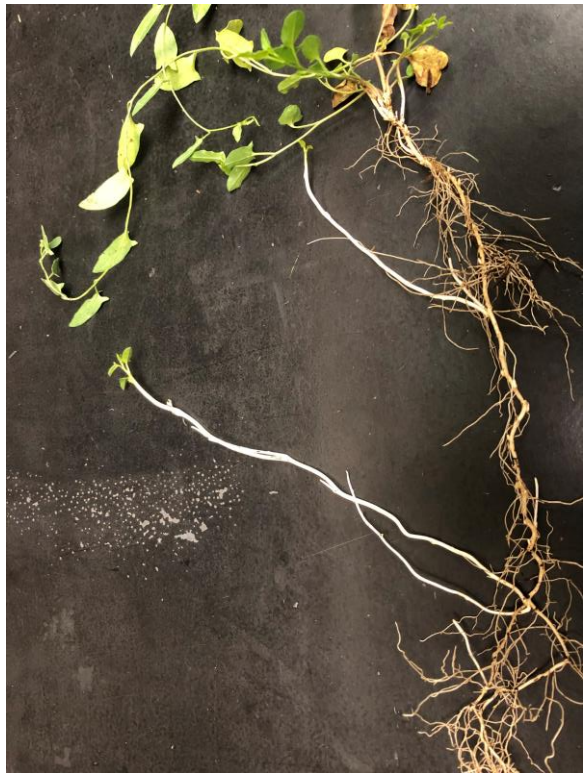
Triangular leaves (hojas triangulares)

Perennial vines (maleza perenne)

White to pink flowers (flores blancas o rosadas)

Subtended by bracts





Extensive root system (muchas raices y rizomas)

Creeping rhizomes aid in spread (la propagación)

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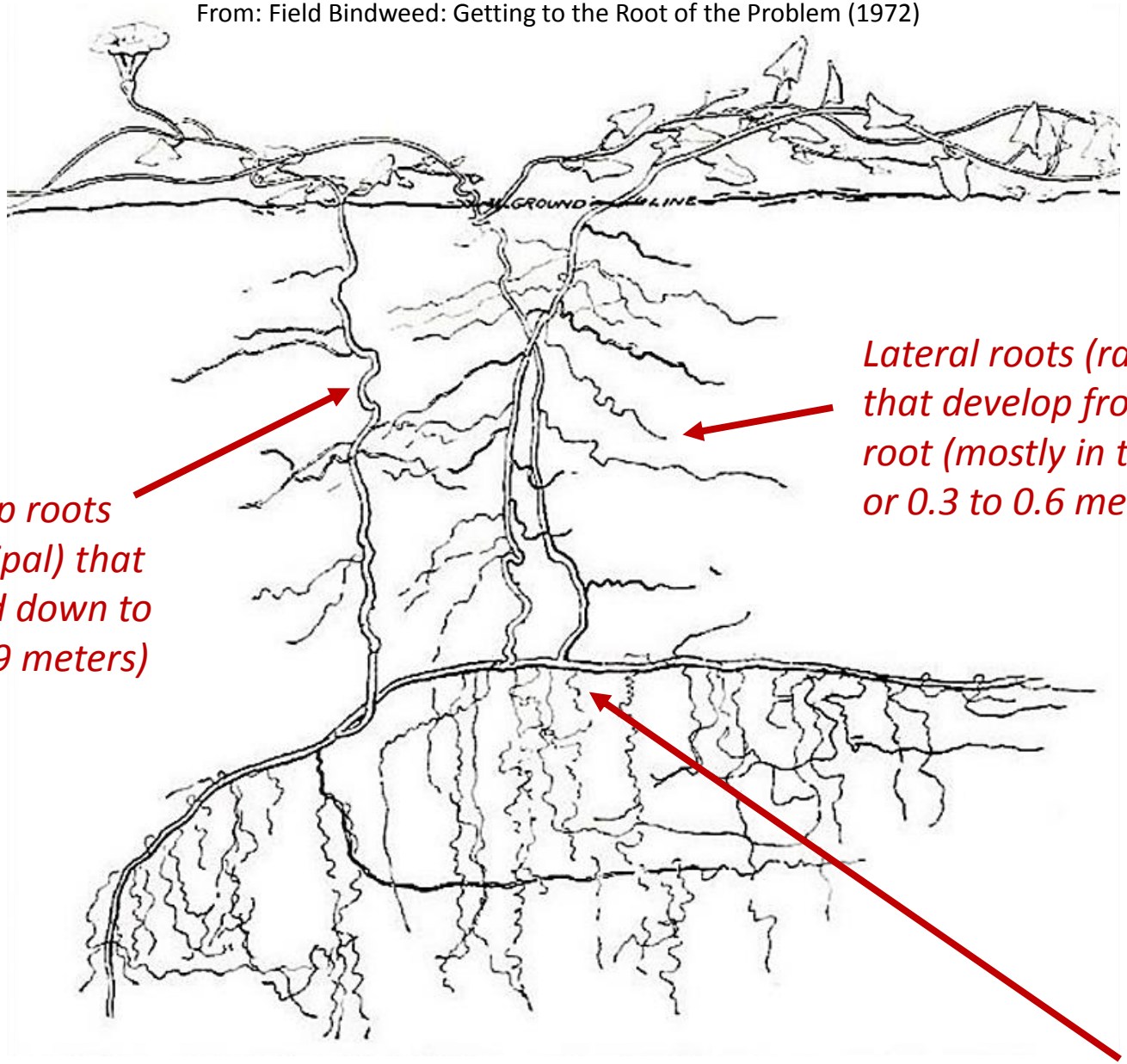
From: Field Bindweed: Getting to the Root of the Problem (1972)



Vertical tap roots (raíz principal) that can extend down to 30’ deep (9 meters)

Lateral roots (raíz lateral) that develop from the tap root (mostly in top 1-2 feet or 0.3 to 0.6 meters of soil).

Underground (subterráneo) buds (brotes) on rhizomes (rizomas) can establish new crowns, tap roots

Cultivation to Manage 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

Field Bindweed Regeneration Following Cultivation is a Function of Multiple Factors

(Resurgimiento despues de Cultivación)

Omezine and Harzallah-skhiri (2010)

African J. of Plant Sci. and Biotech. 4:33-38

<u>ORIGIN:</u>

Rhizomes derived from closer to the soil surface regenerate more readily

<u>BURIAL:</u>

Rhizomes that are buried more deeply are less likely to re-sprout and re-grow

<u>SIZE:</u>

Rhizomes that are larger (>1”) are more likely to regenerate than smaller fragments

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Field Bindweed Seed (Semillas y latencia de la semilla)

- 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*

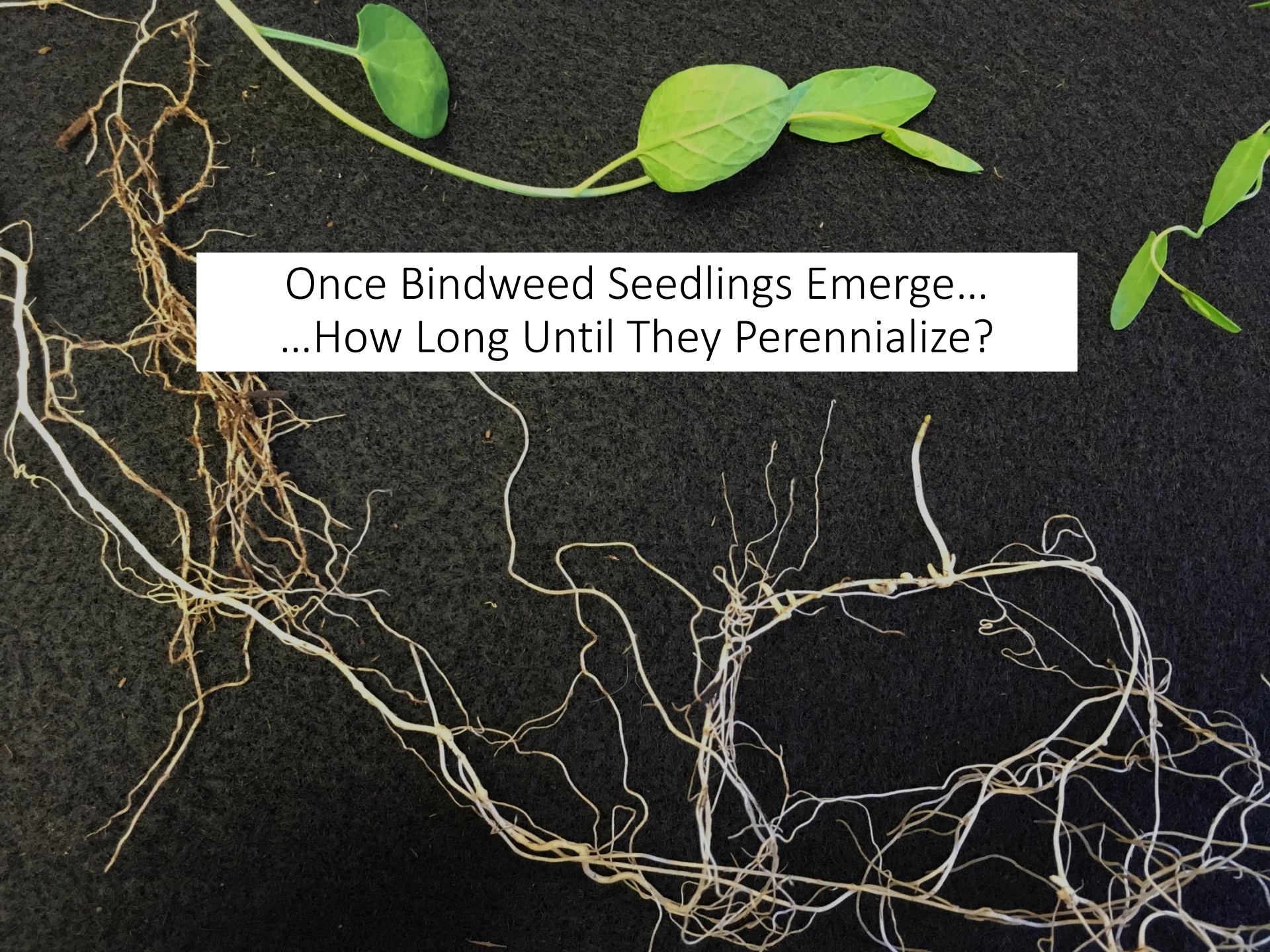
How Dormant is Dormant?

- *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*

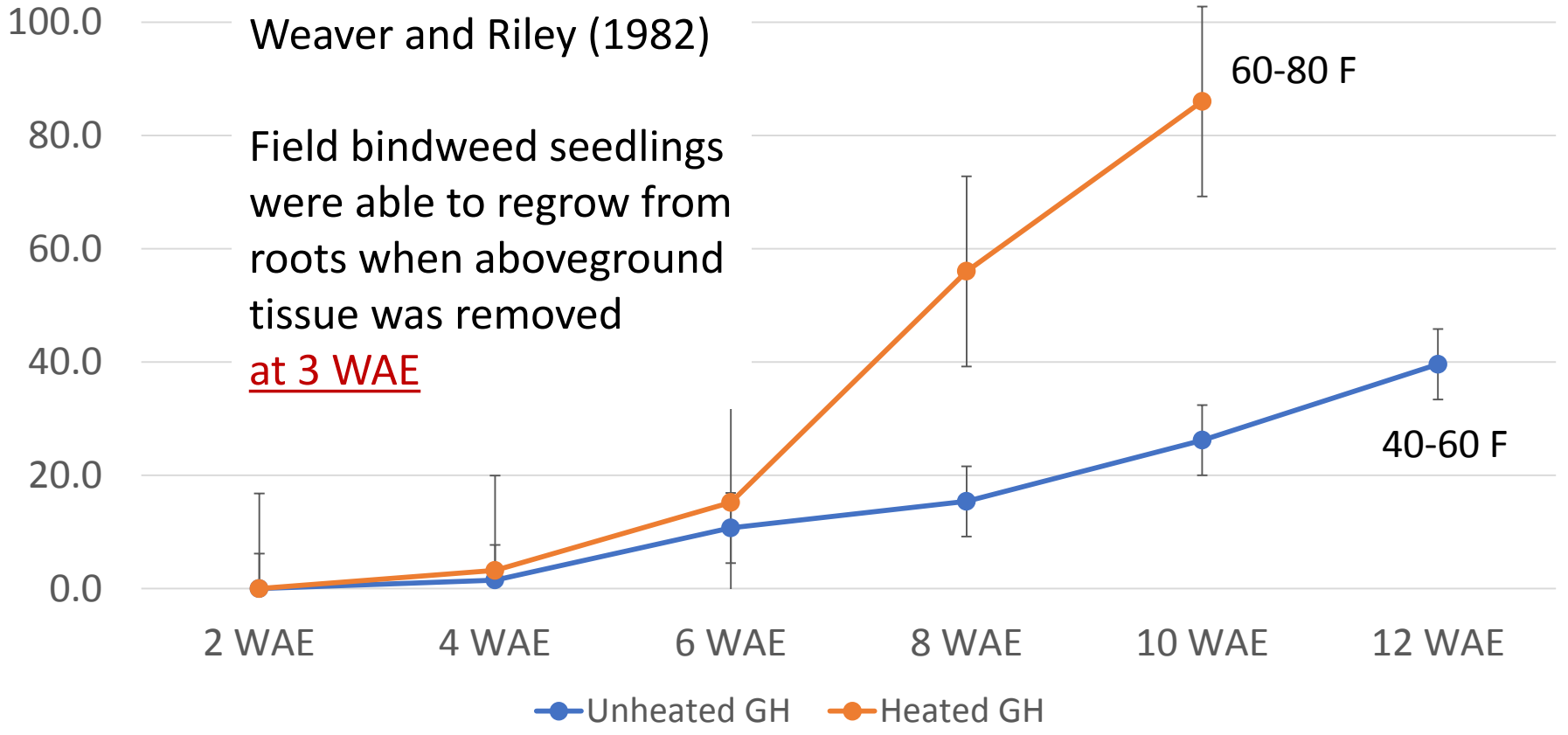
- *Field Conditions*
  - 2 years = 750 seedlings/m^2
  - 6 years = 430 seedlings/m^2
  - Approx 20 years = 800 seedlings/A
  - Approx 30 years = 25 seedlings/A

  - *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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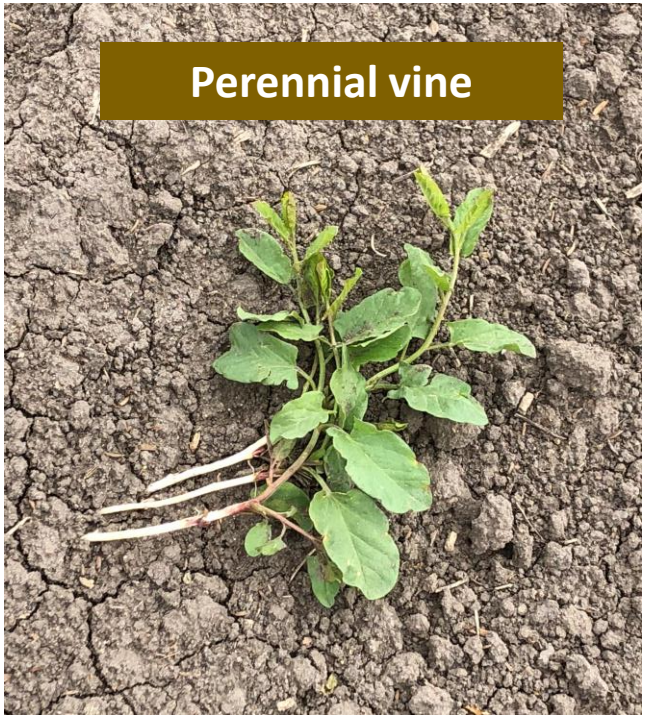
Pre-emergence Herbicides (Herbicida aplicado en el suelo)

Options can be limited…

(las opciones son limitadas…)

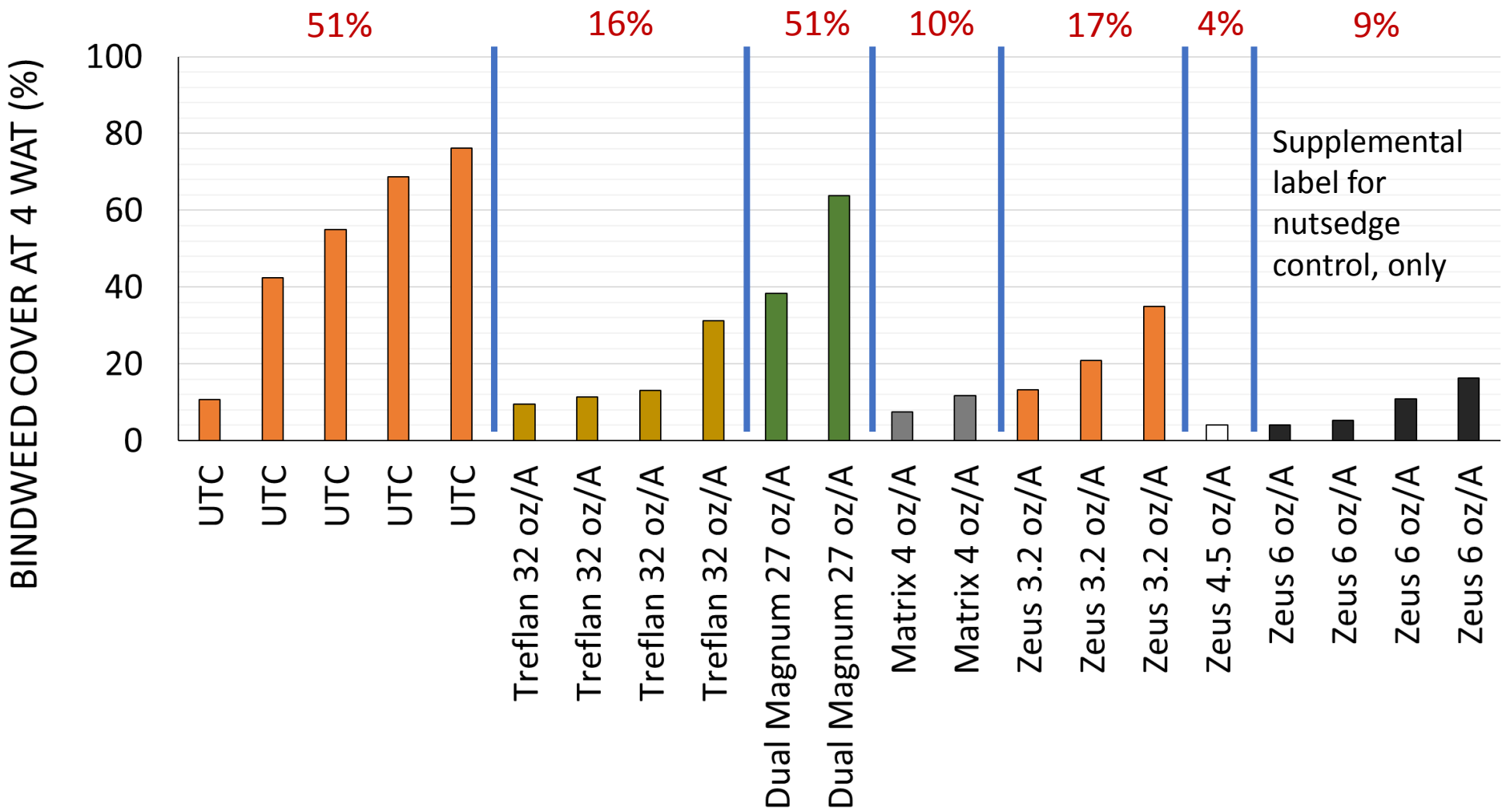
Residual Herbicides and Bindweed Suppression

- Emerging seedlings are 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 Processing Tomato Trials

(LOWER VALUES ARE BETTER)



Suppression of Perennial Bindweed Vines with T&V Dormant-Season Soil-Applied Herbicides

(LOWER VALUES ARE BETTER)

Herbicide	Rate	Timing	Dec	Jan	Feb	Mar	Apr
			Bindweed density per m^2				
UTC	na	na	0.0	0.0	2.2	5.0	5.3
Alion	3.5 oz/A	Dormant	0.0	0.0	0.5	2.7	6.3
Alion	5 oz/A	Dormant	0.0	0.0	0.4	2.3	5.5
Pindar GT	2.5 pt/A	Dormant	0.0	0.0	0.0	0.6	5.6
Pindar GT	3 pt/A	Dormant	0.0	0.0	0.0	0.2	4.9
Matrix	4 oz/A	Dormant	0.0	0.0	0.1	1.2	2.2
Zeus	6 oz/A	Dormant	0.0	0.0	0.2	0.5	1.7

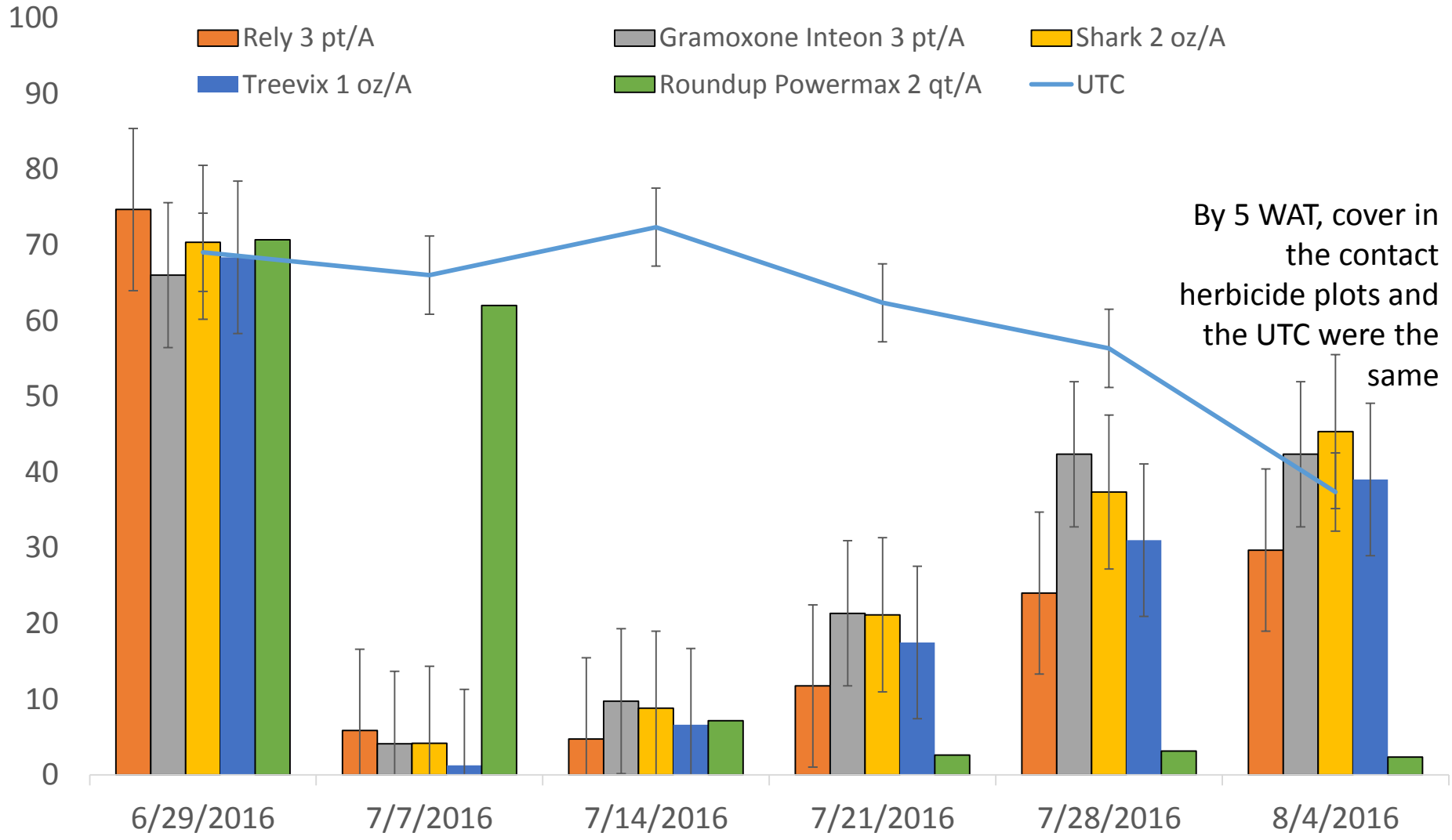
Soil Cracks Allow Bindweed Vines to Emerge, Potentially Missing Treated Zones

Post-emergence Herbicides (herbicida de aplicación foliar)

Options can be limited…

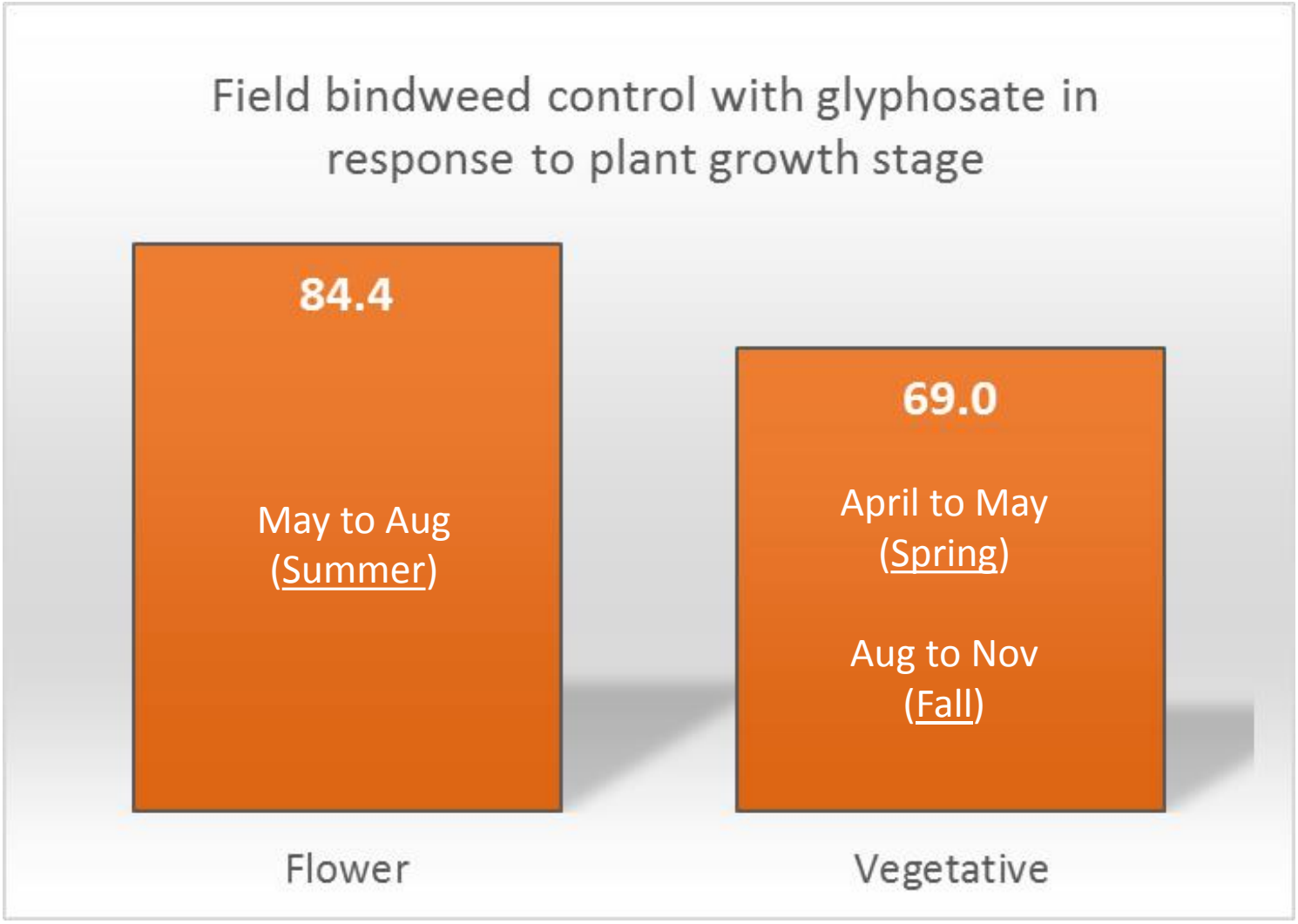
(las opciones son limitadas…)

Perennial vine cover (% area) following POST herbicide applications



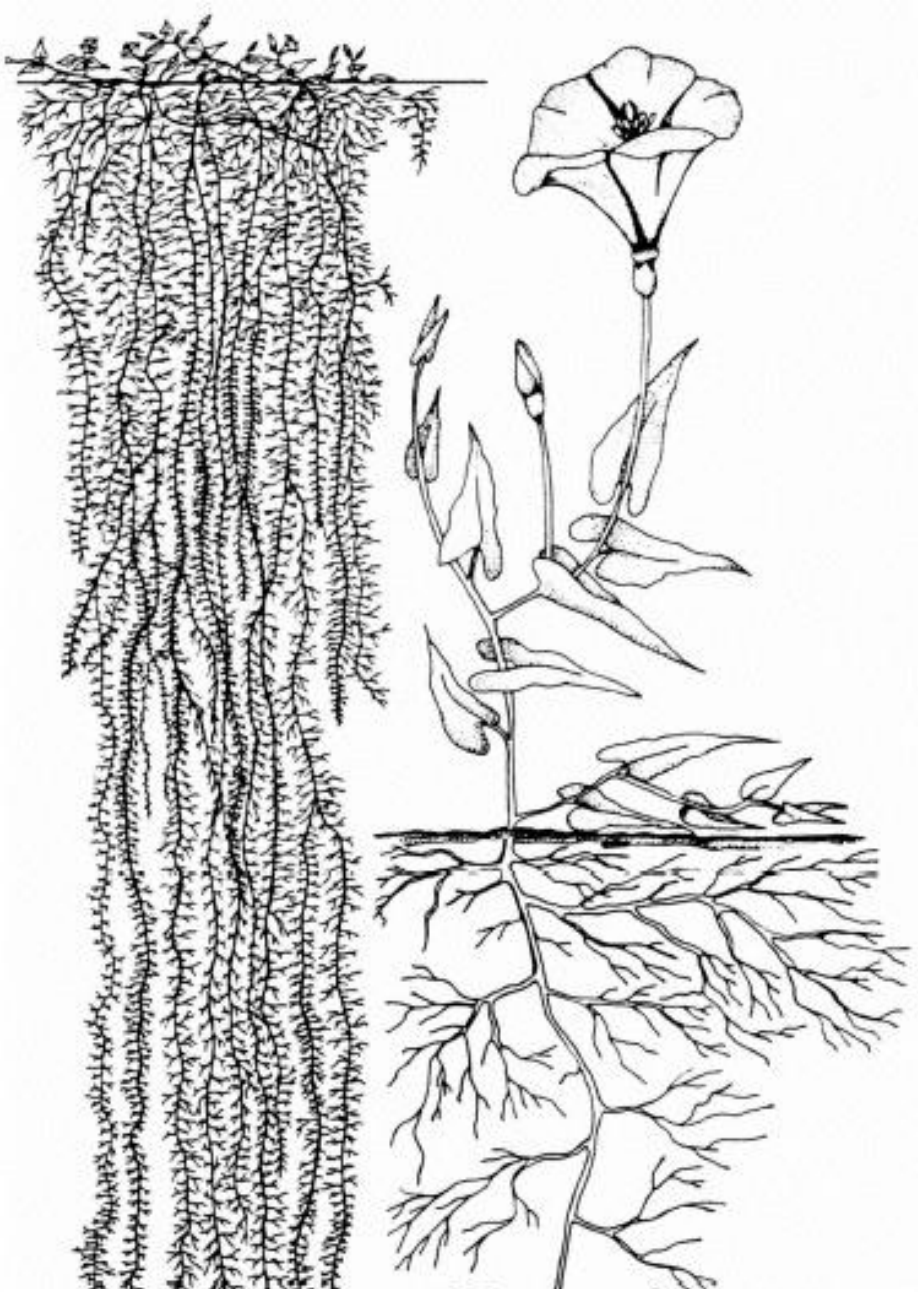
Field bindweed control with glyphosate can be affected by the timing of applications

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



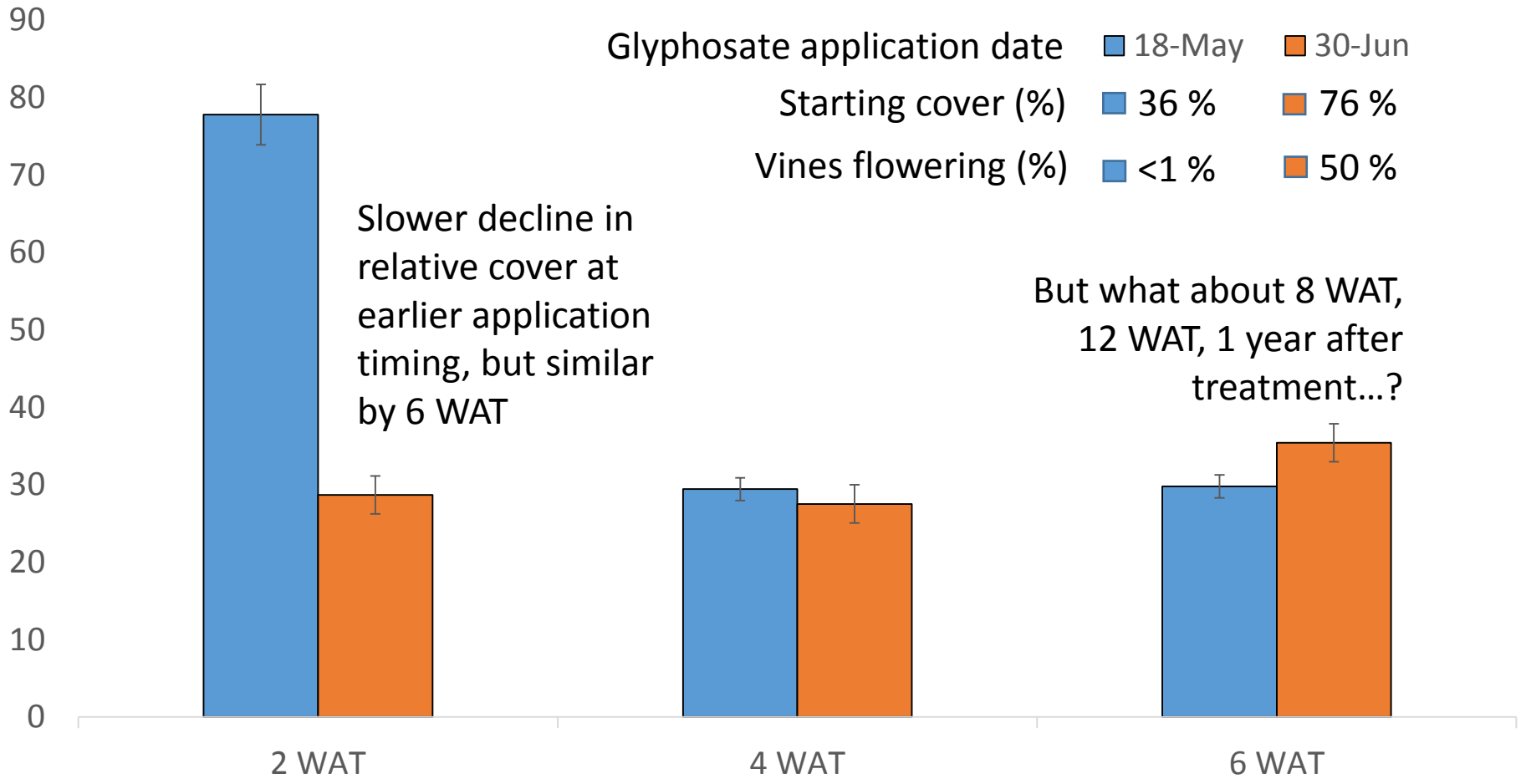
Why Flowering?

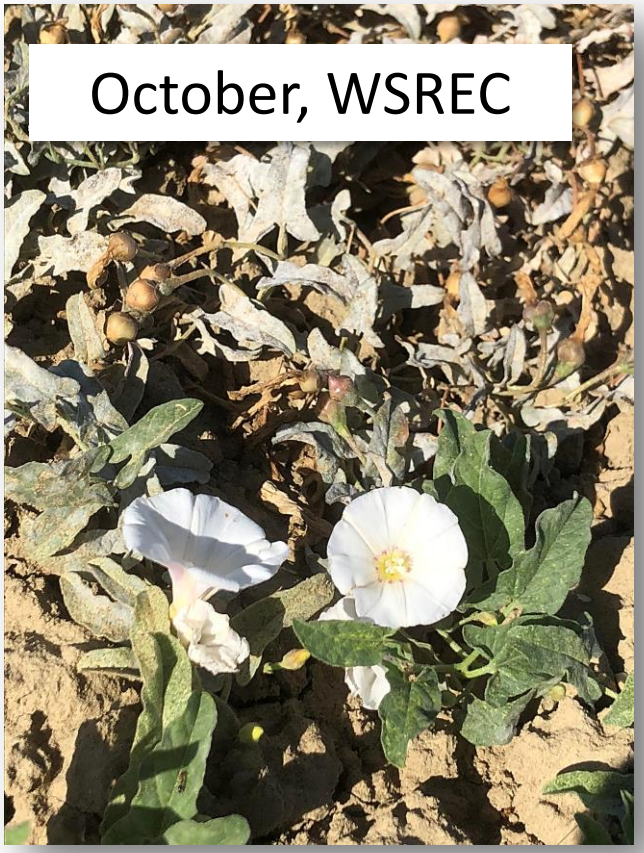
- Several reasons:
- *Surface area for herbicide capture*
- *Vigorous plant growth*
- *Movement of photosynthetic materials to meristems, including root growing points*
- *Glyphosate is phloem transported*

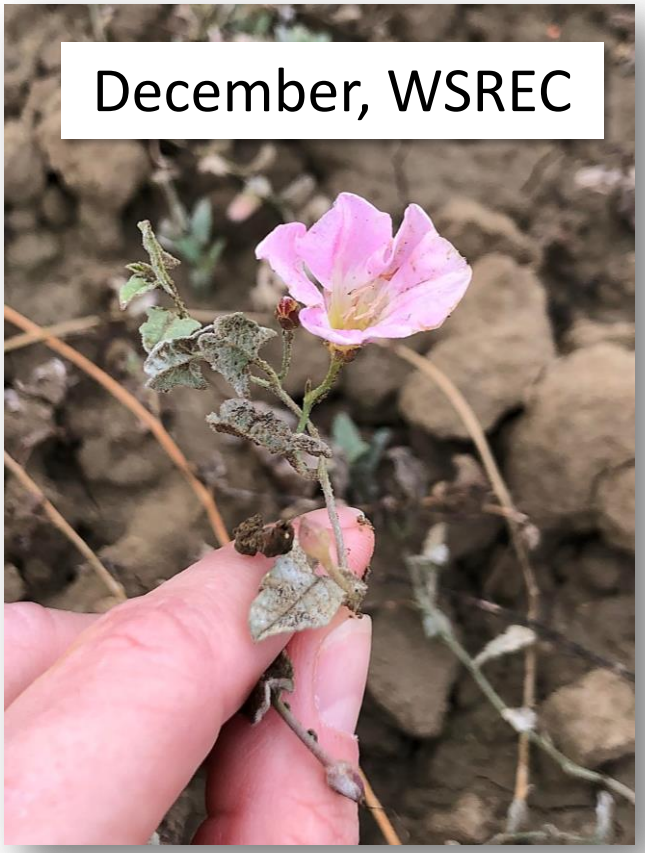


Root system of field bindweed, *Convolvulus arvensis.*
Redrawn from B. F. Kiltz. 1930. *J. Amer. Soc. Agron.* 22:216-234.

Bindweed Cover as a Percent (%) of the UTC Following Glyphosate Applications



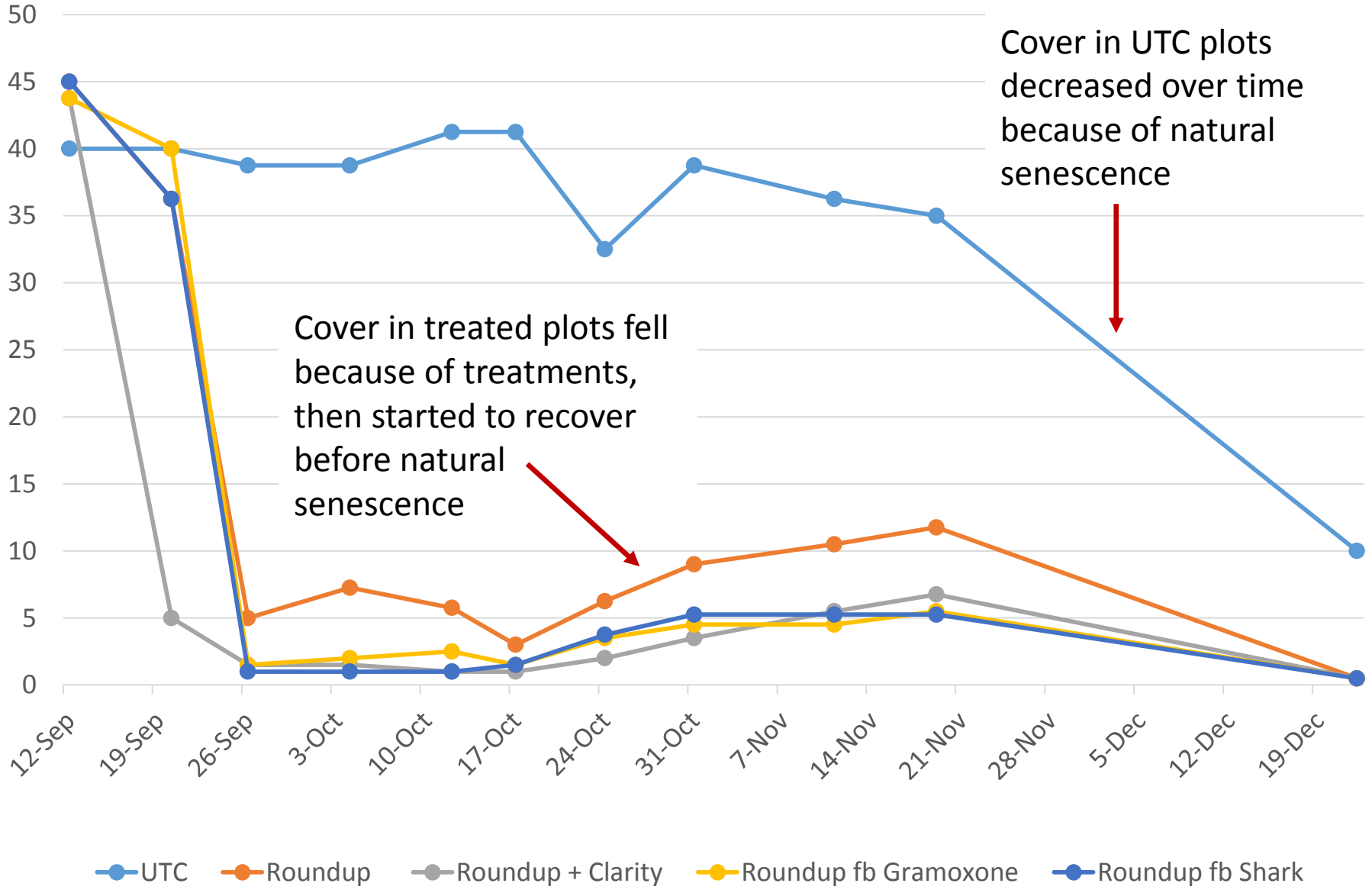




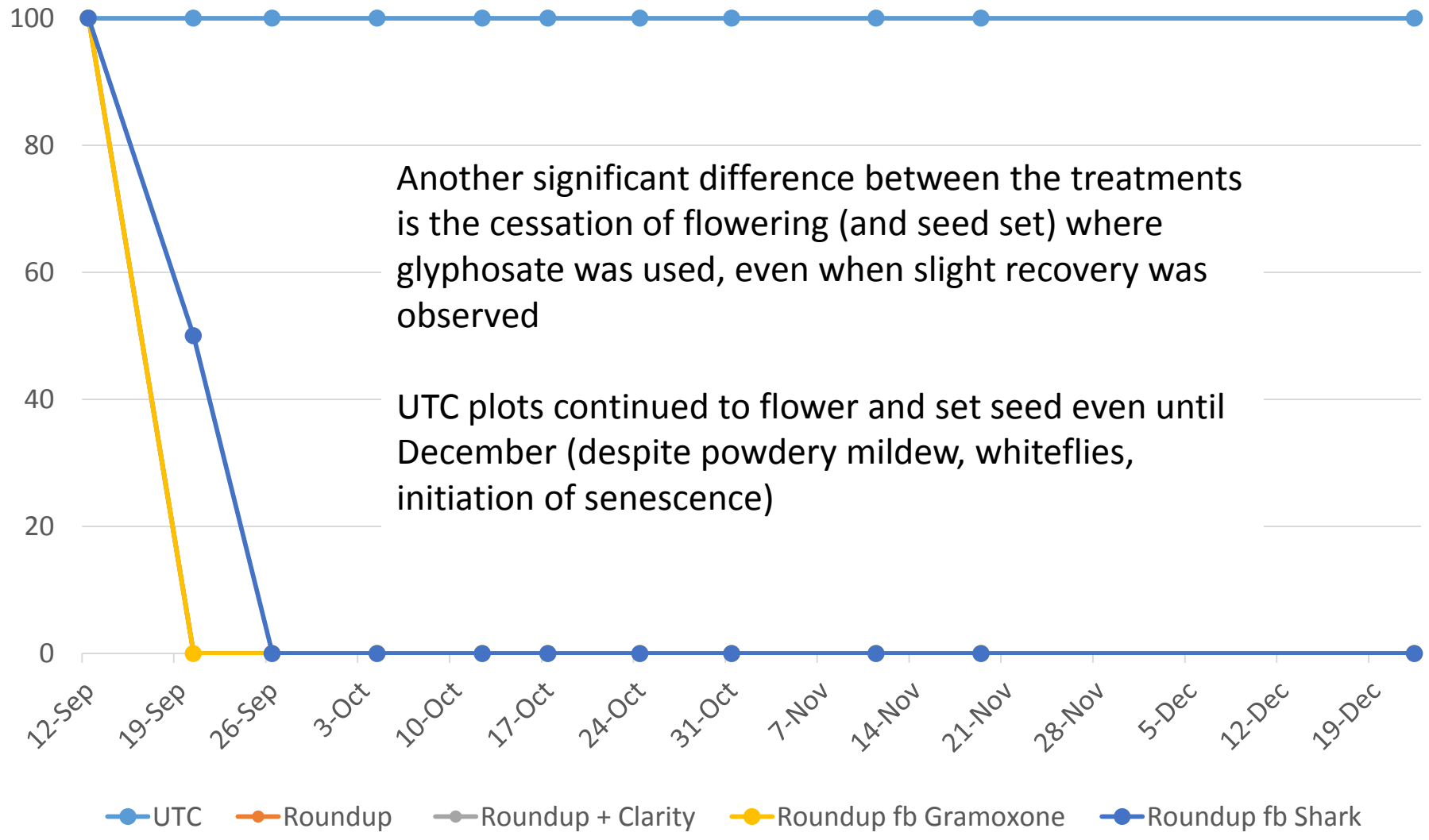
In SJV, we do see vigor decrease in response to powdery mildew, whiteflies…

…but are late season applications ineffective?

Percent (%) Field Bindweed Cover



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)

Contact herbicide performance can be affected by timing

Less rapid regrowth following June application vs May application

Bindweed cover as percent (%) of UTC

Spray Date	Herbicide	Rate	2 WAT	4 WAT	6 WAT
18-May	Rely 280	3 pt/A	13	51	95
18-May	Gramoxone Inteon	3 pt/A	24	71	112
18-May	Treevix	1 oz/A	5	27	81
30-Jun	Rely 280	3 pt/A	9	14	17
30-Jun	Gramoxone Inteon	3 pt/A	4	11	23
30-Jun	Treevix	1 oz/A	7	14	20

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Theoretical Bindweed Control Curve

Emerging shoots mean phloem movement away from roots

Natural senescence, disease, and pest infestations reducing vigor and biomass for capture

Percent (%) Control

Root bud dormancy from apical dominance and onset of unfavorable growing conditions?

Insufficient biomass to capture herbicides?

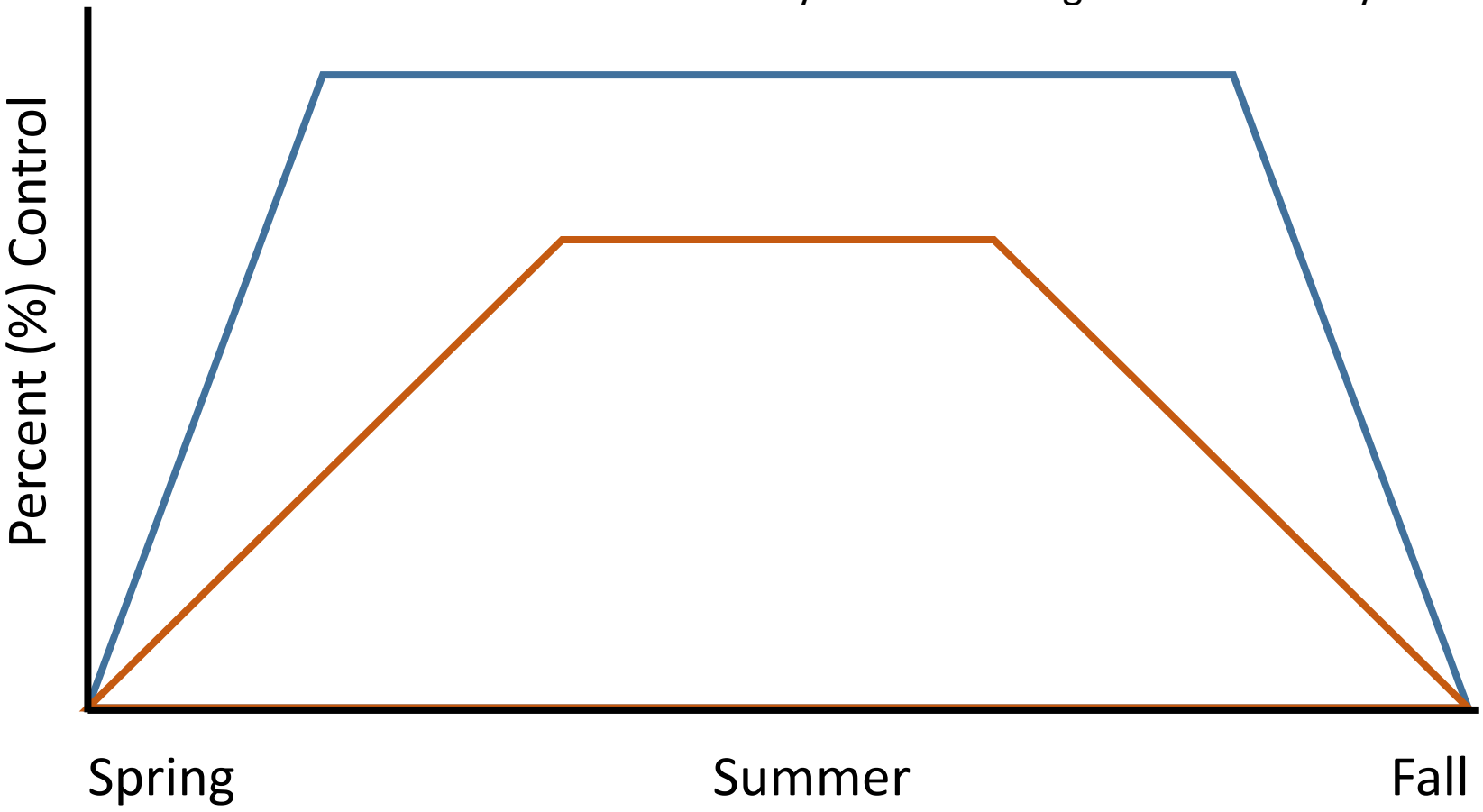
Spring

Summer

Fall

Theoretical Bindweed Control Curve

How do we achieve this?
How do we increase in growth and vigor?
How do we break root bud dormancy and facilitate greater sensitivity?



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 cotton 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"

Climate Change

- Studies (Ziska et al. 2004, Ziska & Teasdale 2000, Ziska et al. 1999) have demonstrated decreasing herbicide efficacy with rising CO2.

- Canada thistle exhibited a greater root to shoot ratio and subsequent dilution of glyphosate when grown at elevated CO2 levels (Ziska et al. 2004).

- What does this mean for bindweed (and other weed species) going forward? How id rising CO2, rising and extreme temp events, variable precipitation going to affect weeds and weed control?

Thank you so much for your time!

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