Bindweed Biology, Ecology, and Management

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History of Human Interactions with Bindweed
Field bindweed is not a new/modern problem

- Greeks and Romans in the first century had names for it:
  - *periklumenon* = “circling plant”
  - *volucrum majus* = “worm in vines”

- Botanic name (*Convolvulus arvensis*) was introduced by Linnaeus in his *Species Plantarum* (1753):
  - *convolvere* = “to entwine”
  - *arvens* = “of the field”
First noted in North America in Virginia in 1739
Bindweed plant parts were present in bricks used to build the Juan Jesus Vallejo adobe in Fremont (1838-1842)
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History of Bindweed in the US

CA Weed control specialist (1911)
“The wild morning glory is one of the most troublesome weeds in vineyard, orchard and other cultivated soils.”
Rumor has it that it was brought to Oregon, purposely, as a groundcover...
I hate to be the one to tell you this...

...We’ve been having a hard time controlling field bindweed for a long while.

• “A great many farmers are looking for some easy method of killing bindweed, and in the mean time are letting it cover the fields and festoon the trees of the orchard.”

• “They are looking for some magic ‘remedy’ that will completely eradicate the weed with a small amount of exertion on their part.”

• “It must be understood that such a formidable enemy as this weed requires heroic treatment.”

• USDA Farmers’ Bulletin 368 (1908)
Bindweed Biology
Perennial vine, mostly prostrate
Field bindweed belowground

- Extensive root system
  - *Vertical roots (deep)*
  - *Lateral roots (shallow)*

- Depths up to 30’ but 70% in top 2’

- Drought tolerant

- Large nutrient reserves to facilitate regrowth

Adventitious buds on the roots form ‘new’ plants
Bindweed perennialization

Bindweed develops a vertical taproot as well as lateral roots of varying sizes and longevities.

Buds develop along the lateral roots, which can later sprout and give rise to secondary stems.
Rhizome buds per plant over time
(Sosnoskie 2017, unpublished data)

Bindweed starts to develop the buds that will establish new crowns within four weeks following seedling emergence.
The roots are a problem, but they aren’t the only one...
Field bindweed produces, on average, 500 seeds/plant.

Seeds can survive up to 50 years in the soil.
Bindweed management is an exercise in persistence and patience
Physical removal was the earliest strategy for control

- Cutting top growth

  - 1908
    - *H.R. Cox, USDA Farmer’s Bulletin*
    - Top growth of bindweed must be kept cut down in order to starve the roots

  - 1924
    - Continually cut the tops back so that the plants cannot develop green leaves

  - 1911
    - *F. T. Bioletti, University of California Circular*
    - To control field bindweed, as many as 30 cuttings are necessary
Cultivation to eradicate field bindweed
Timmins and Brun, 1951, Agron. J., pgs 371-375

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<td>Cult. every 2 weeks</td>
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<td>21</td>
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<tr>
<td>Cult. Every 3 weeks</td>
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*Cultivation depth = 3-5”*

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<td>Cult. Every 3 weeks</td>
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*Cultivation depth = 3-5”*
Cultivation to eradicate field bindweed
Timmins and Brun, 1951, Agron. J., pgs 371-375

Number of cultivations to eradicate

Hays, KS

Cultivation 4” deep
18.6 days between cultivations
22 (over 372 days)

Cultivation 8” deep
21.2 days between cultivations
17 (over 318 days)

Cultivation 12” deep
23.2 days between cultivations
16 (over 325 days)

Deeper cultivations were more expensive and resulted in soil quality degradation
Herbicides aren’t the ‘easy’ solution
Killing field bindweed with sodium chlorate

W. L. Latshaw and J.W. Zahnley

(1928) KS State Circular 136

• Effective, but could be dangerous and expensive

• Trials in 1950’s found use rates of almost 1000 lbs/A

• Still required treatment over multiple years
Modern Herbicides also Require Persistence and Attention to Detail
Field bindweed control with POST herbicides is affected by the timing of applications


Field bindweed control with glyphosate in response to plant growth stage

- **Percent Control**: 84.4%
  - **Plant Stage**: Flower
  - **Application Timing**: May to Aug

- **Percent Control**: 69.0%
  - **Plant Stage**: Vegetative
  - **Application Timing**: Aug to Nov
  - **Another Application Timing**: April to May
Flowering is associated with both abundant aboveground growth \textbf{AND} high plant vigor.

- **April to May**
  - Minimum vine length = 14.4 cm
  - Vine vigor = 75% Good to Excellent

- **May to August**
  - Minimum vine length = 21.9 cm
  - Vine vigor = 79% Good to Excellent

- **August to November**
  - Minimum vine length = 17.0 cm
  - Vine vigor = 69% Fair to Poor
Aboveground growth is necessary for herbicide capture

With a systemic product like glyphosate, fewer leaves means less herbicide to be translocated to meristems

Poor vigor can result in reduced translocation and physiological activity, which affects glyphosate performance.
Management
Physical, Cultural, and Biological Strategies

• Cultivation/Mowing/Hand-weeding
  • Must be applied approximately every 14 days to exhaust root reserves
  • Infrequent cultivation can move rhizome pieces around and facilitate spread (Pieces as small as 1-2 inches can establish new plants...)

• Mulch/Landscape Cloth
  • Can be effective but needs to be sufficiently deep or overlapped to ensure that light doesn’t reach bindweed shoots (Vines can grow through plant holes/use crop as a trellis...)

• Biological Control
  • *Phomopsis convolvulus* (fungus)
  • *Tyta luctuosa* (moth)
  • *Aceria malherbae* (mite)

  Haven’t been shown to be widely effect on their own...
Herbicides that have been shown in some systems to provide temporary suppression of bindweed

(often dependent on rate, timing)

- Isoxaben
- Rimsulfuron
- Dichlobenil
- Oryzalin
- Glyphosate
- 2,4-D
New Pest Control Options in the Pipeline

Not a lot of new labels were issued for blueberry growers this past year, according to Oregon State University’s Joe DeFrancesco, and one of them, the fungicide Prolivo, has a better fit in strawberries than blueberries because it is primarily for powdery-mildew control. Still, in a report at the 2017 Oregon Blueberry Field Day, DeFrancesco said some encouraging developments are occurring on the crop protection front for blueberries.

High on the list of products in the pipeline that could benefit Oregon blueberry growers in the near future is an herbicide that is good at controlling bindweed. Quinstar, manufactured by Albaugh of St. Joseph, Missouri, is a systemic herbicide that is good for control of annual grasses, annual broadleaves and perennial broadleaves, especially bindweed and morning glory, DeFrancesco said. He added that it also has good suppression activity on Canada thistle and dandelions.

Currently, EPA is reviewing residue trial data of Quinstar, with a decision anticipated this fall whether to allow use of this product in blueberries, DeFrancesco said.
Deep Thoughts...

- Perennial weeds, like bindweed, are not likely to be controlled with a single tool or a single application of a tool.

- One of the best strategies for managing perennials is to invest effort into their control prior to establishing a crop (which will only complicate efforts and potentially reduce available options).

- Weed control performance is going to be affected by plant biology; we need to understand this better to improve management going forward.
"That's your idea of weed control?"