Weed Management in Hops

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Outline – Weed Management

- New hop yards
- Established hop yards
- What's coming next…

Why Control Weeds?

- Weeds compete with hops for nutrients and water. Also for light in new plantings.
- Can harbor other pests (insect, mites, pathogens)
- Can impede airflow and prevent drying of foliage – promotes some diseases
- Impede stringing/training
- Impede harvest operations

Weed Management in New Hop Yards

- Control perennial weeds in years preceding planting of hops – especially broadleaf perennials (Canada thistle, field bindweed, perennial sowthistle, red sorrel, goldenrod, horsenettle, etc.)

Herbicides – avoid using long residual herbicides in preceding crop that could persist and injure new hops

Tillage – effective, but should avoid spreading rhizomes to noninfested areas

Canada thistle

Field bindweed (morning-glory)

Horse nettle

Perennial sowthistle

Red sorrel

Goldenrod

Weed Management in New Hop Yards

- Preplant tillage, fertilizer, & compost
- Design planting arrangement and trellis system that allows close cultivation to hop rows
- Plant rhizomes (free of weeds) or starts – avoid using rhizomes dug from fields with perennial weeds
- Apply preemergence herbicide

  -**Pendimethalin** (Prowl H_2O)

  Norflurazon (Solicam) - on new hops in PNW only

  Dimethenamid-P – (Outlook) PNW only!

  -**Glyphosate** – prior to hop emergence to control early emerging weeds

Weed Management in New Hop Yards

Transplants - seedlings

- Plant <u>after</u> preemergence herbicides applied.
- Avoid herbicide in planting slot/hole
- Emerged shoots susceptible to herbicide applied over the top (i.e. Prowl and/or Roundup)
- Minimize soil disturbance (herbicide barrier)

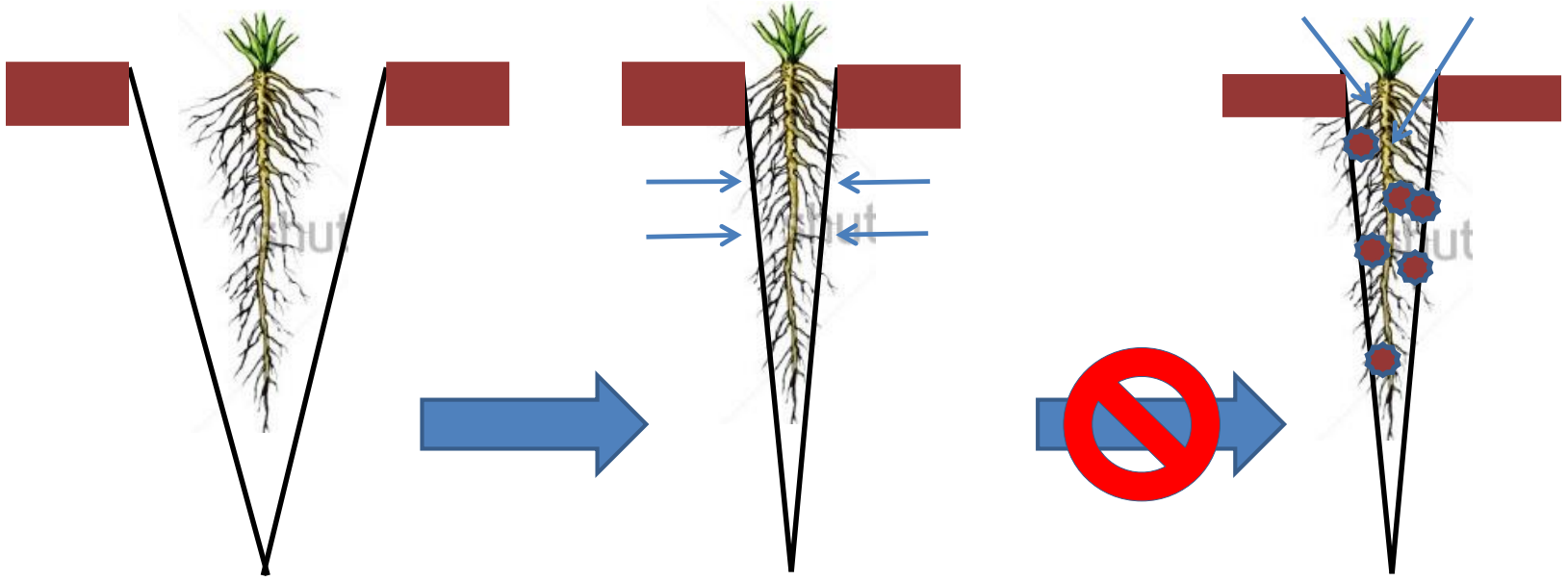
or

rhizomes

- Can plant <u>before</u> preemergence herbicides applied (deeper)
- Avoid herbicide in planting slot/hole

Open and close transplanting slot with minimal disturbance of herbicide barrier

Avoid contaminating transplanting slot with herbicide – inhibits root growth and/or injures plantlet



Hop planting
(rhizomes)

Soil disturbance disrupts herbicide barrier

Apply herbicide <u>after</u> planting

Weed Management in New Hop Yards

- Preemergence herbicides

  Band or Broadcast?

  – Depends on cover cropping plans – If broadcast; herbicide choice must be compatible with cover crop
  – Cultivation plans – may choose to cultivate alleys. Herbicides can reduce amount of cultivation required. Growers choice. Excessive cultivation increases erosion, destroys organic matter, decreases water infiltration & retention. Also can increase & spread verticillium.
  – Can also mow alleys (cover crops and weeds)

Weed Management in New Hop Yards

- Once hops are trained and 6 ft tall, weed control practices are similar to established hops

Annual Weed Control

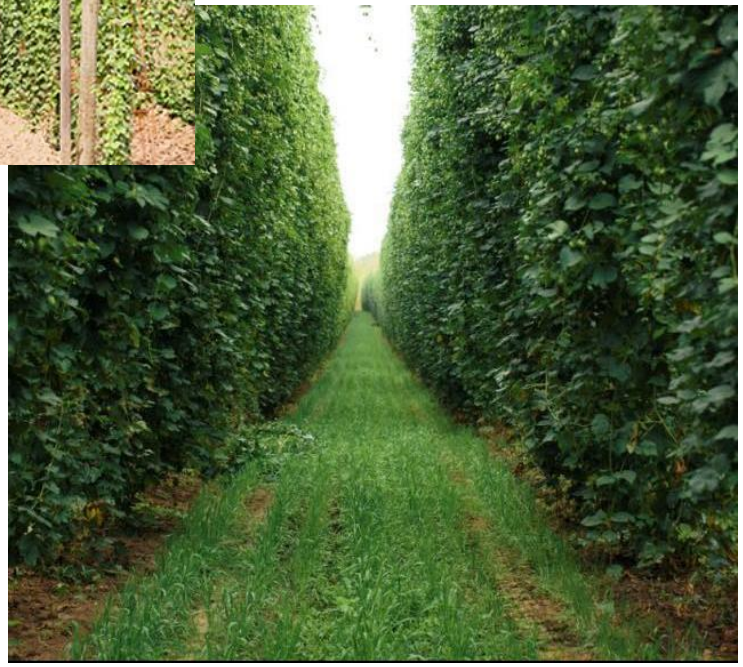
- **Prevent new seed set**. Weeds often produce thousands of seeds per plant. Allowing weeds to set seed results in a thousand fold increase in weeds the next season. **Always control weeds before they set seed**.

Good weed control programs use a combination of the following:

- Mechanical cultivation on a timely basis
- Preemergence herbicides to eliminate weed seedlings as they germinate and sprout.
- Postemergence herbicides to control escape weeds.
- Cover crops to prevent and smother sprouting weeds.
- Mowing or removing weeds before seed set.

Cover Crops

- Smother weeds
- Scavenge nutrients
- Fix nitrogen (legumes)
- Increase organic matter and biological activity
- May reduce plant pathogens and nematodes (mustard, arugula, sudangrass)
- Be careful about planting a perennial cover in alleys – may become a weed and difficult to control in hops



Weed fabric or plastic mulch?

- Effective in controlling weeds.
- Limits ability to amend soil with fertilizers, compost or other organic matter
- Difficult to change hop varieties
- May promote mildew and root rots
- Limits ability to apply fungicides or nematicides to soil

Weed Management in Established Hops

- Late winter, early spring – remove winter annual weeds with cultivation or herbicides.
- Tillage can remove previous year's hop residues, but can also spread verticillium and perennial weeds
- Glyphosate controls most emerged weeds. Apply before hop emergence. (late Feb.-early March in PNW)

Glyphosate injury on newly emerged hops

Tillage/Cultivation

Pros

- Repeated shallow cultivation controls weeds
- Prepares bed for cover crop planting
- Removes previous crop residues

Cons

- Reduces organic matter
- Can spread rhizomes, stolons and tubers of perennials weeds
- Spreads verticillium
- Can damage hop crowns
- Reduces water infiltration rate
- Increases soil erosion

Preemergence Herbicides (Established Hops)

Suppress weeds early in the season to reduce number of cultivations and reduce size of weeds when postemergence herbicides/desiccants are used later in season

- **Trifluralin** (Treflan) - shallow incorporation required
- **Pendimethalin** (Prowl H_2O)
- **Norflurazon** (Solicam) – long persistence
- **Flumioxazin** (Chateau) – mainly broadleaf weeds
- **Dimethenamid-P** – (Outlook) PNW only!

Trifluralin (**Treflan, others**)

- Apply prior to weed and hop emergence (on established hops only)
- Requires mechanical incorporation (shallow)
- Broad spectrum annual grass and some broadleaf control
- Misses most mustards and nightshades

Pendimethalin (**Prowl H_2O, Satellite HydroCap**)

- Apply prior to weed emergence
- Apply prior to main hop emergence or keep off hop foliage
- May apply sequential treatments at least 30 days apart
- Pre harvest interval 90 days
- Broad spectrum annual broadleaf and grass weed control
- If broadcast, may injure small grain cover crops

Norflurazon (**Solicam**)

- Apply prior to weed emergence (late fall or early spring)
- Apply prior to main hop emergence or keep off hop foliage
- May apply from before hop emergence to 1 week after stringing
- Pre harvest interval 60 days
- Broad spectrum annual broadleaf and grass weed control
- Persistent and may injure cover crops if broadcast
- Adjust rates for soil type (see label)
- Hops must be established at least 6 months outside of PNW.

Solicam injury
to hops

Solicam injury
to wheat

Flumioxazin (**Chateau**)

- Apply prior to dormant hops (Nov.-Feb.) or after hop stringing and > 6 ft tall directed to base of hops.
- Broad spectrum annual broadleaf weed control
- Applied to base of hops provides some postemergence weed control and contributes to sucker burn back at base.
- Do not add any adjuvant.
- Only one, 6 oz/A application allowed per growing season (choose between PRE or POST application)
- Pre harvest interval 30 days

Weed Management in Established Hops

- Burn back or remove early shoots before training.
- Helps reduce powdery mildew (early spores on foliage) and downy mildew (flag shoots)

Weed Management in Established Hops

Removal of early shoots

- Mowing, flail chopper
- Desiccants
  - Aim (+ NIS or COC)
  - Scythe or Axxe (organic acids)
  - Gramoxone – PNW only!
- These contact herbicides will also control many small broadleaf weeds postemergence (no soil residual activity)

- First shoots often not the best to train (less lateral branching)
- Removal of early shoots aides in reducing mildew

Weed Management in Established Hops

<u>Postemergence Herbicide Options</u>

- 2,4-D (many trade names)
- Clopyralid (Spur, Stinger)
- Flumioxazin (Chateau)
- Carfentrazone (Aim)
- Glyphosate (Roundup, others)
- Pelargonic acid or nonanoate acid (Scythe/Axxe)

- Clethodim (Select, others) – annual and perennial grasses

2,4-D (many trade names)

- Apply to small broadleaf weeds
- Up to three applications, 30 days between treatments (0.5 lb ae/A each application)
- Avoid spray contact with new hop foliage and apical buds. Direct applications to row middles.
- Translocated in susceptible broadleaf weeds and effective on both annuals and perennials
- 28 day PHI

Clopyralid (**Spur, Stinger**)

- Primarily for control of Canada thistle. Also controls other composite (goldenrod, dandelion, horseweed, sowthistle), legume (clover, vetch), nightshade , and polygonaceae (smartweed, red sorrel) species.
- One or two applications, 21 days between treatments (1/3 to 2/3 pt/A)
- Avoid contact with hop foliage. Can cause leaf cupping in hops.
- 30 day PHI

Carfentrazone (**Aim**)

- Non translocated, contact herbicide. Apply to small broadleaf weeds (< 4 inches)
- Directed, hooded applications between rows
- 0.5 to 2 fl oz/A; Total for season = 7.6 fl oz/A
- Adjust rates for weed species susceptibility (see label)
- Allow 14 days between treatments
- Apply in 20 GPA or more spray volume and add NIS or COC.
- 7 day PHI

Carfentrazone (**Aim**)

Adjust rates for weed species susceptibility (see label)

When used as directed, Aim EC will provide:
Control of the listed weeds up to four (4) inches in height, or as specified.

Weeds Controlled	Aim EC Use Rate fl. oz, (pound active ingredient) per acre
Lambsquarters, common (up to 3 inches tall)	0.5 fl. oz. (0.008 pound active ingredient) per acre
Morningglory, ivyleaf (up to 3 leaves)	
Morningglory, pitted (up to 3 leaves)	
Nightshade, Eastern black	
Pigweed, redroot	
Velvetleaf	
Waterhemp (up to 2 inches tall)	

Carfentrazone (**Aim**)

- Also used for burn back of hop suckers at base of plant (*after stems of trained hops are becoming woody – usually about 6 ft. tall*)
- 2 to 3.2 fl oz/A to basal 18 inches
- Allow 14 days between treatments
- Apply in 20 GPA or more spray volume and add NIS or COC.
- 7 day PHI

Nontreated

2 days after Aim treatment

Aim spotting on hop stems

Weeds too large!

Pelargonic Acid (**Scythe**) or Ammonium nonanoate (**Axxe**)

Contact, high volume, expensive herbicides for burn down of small broadleaf weeds. Grass weeds regrow.

1. Vegetative Burndown: Control of weeds for seedbed or site preparation.

2. Directed and Shielded Sprays: Apply in and around desirable plants avoiding contact of foliage and green bark.

3. Sucker Control: Burn back of unwanted basal sucker growth and foliage growth on bines. Apply only to unwanted vegetative parts. Apply before suckers become woody. WAIT UNTIL TRAINED HOPS HAVE WOODY STEMS.

Glyphosate

- Spot spray perennial weeds.
- Alley ways for control of emerged weeds.
- Prior to hop emergence in hop row.
- **Do not spray on hop foliage.**
- Early spring applications safer than fall applications.

Glyphosate injury on new growth from previous fall application

Postemergence annual and perennial grass weed control

Clethodim (**Select, Intensity, Section, Arrow, Dakota, others**)

- Do not exceed 0.12 lb ai/A in a single application or 0.5 lb ai/A per season
- Adjust rates for grass species
- Apply to actively growing grasses (not stressed)
- 14 or more days between applications
- PHI – 21 days

What's on the Horizon?
(NOT LABELED)

PRE – dormant application

- **Alion (indaziflam)** – broad spectrum preemergence broadleaf and grass herbicide (dormant established hops)
- **Trellis (isoxaben)** – broad spectrum preemergence broadleaf herbicide (dormant established hops)

Hop sucker burn-back

- **Venue (pyraflufen-ethyl)** – contact postemergence broadleaf herbicide, hop sucker control (similar to Aim)
- **Rely 280 (glufosinate)** – nonselective postemergence herbicide, hop sucker control after bines 6 ft. tall

Preemergence Weed Control in Hops

Alion (PRE)

Nontreated

Glufosinate (Rely280)

- Rely 280 (glufosinate) – nonselective postemergence herbicide, hop sucker control
- Excessive hop injury if apply before hops are 6 ft. tall
- Longer suppression of hop sucker regrowth at base of plant than Aim or Gramoxone

Glufosinate (Rely280)

Table 1. Hop burn back, injury above treated zone, height, and yield following several desiccant treatments to Chinook hops in 2016 near Prosser, WA. Treatments were applied June 8, 2016.

No.	Treatment	Rate	Hop Base Burn-back June 20	Hop Injury above treated zone* June 20	Hop Height June 15	Hop Cone Yield Aug. 31
		(lb ai/a)	(%)	(%)	(feet)	(Kg/A)
1.	Nontreated	--	0 e	0 a	9.5 a	635 a
2.	Glufosinate (Rely 280)	0.5	79 b	1 a	10.3 a	675 a
3.	Glufosinate (Rely 280)	0.75	85 ab	1 a	10.2 a	666 a
4.	Glufosinate (Rely 280)	1.0	88 a	0 a	10.0 a	672 a
5.	Paraquat (Gramoxone)	0.5	56 c	1 a	10.3 a	649 a
6.	Carfentrazone (Aim)	0.031	40 d	0 a	9.3 a	585 a

Means within a column followed by the same letter are not significantly different according to LSD at P=0.05.

*Only hops shorter than 5 foot were injured.

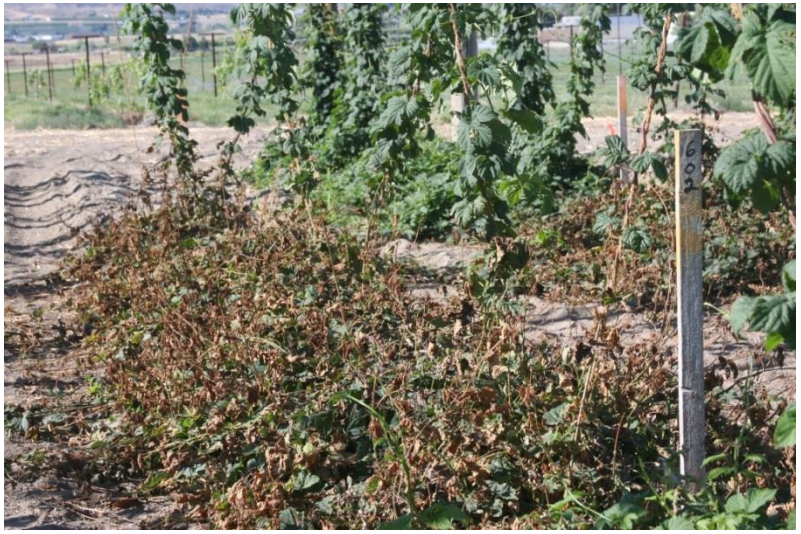
June 21, 2016 (13 DAT)

Nontreated

Aim (2 fl oz/A)

Rely (0.5 lb ai/A)

Rely (1 lb ai/A)



Rely (glufosinate) injury (7 DAT) – Hops ≤ 4 ft tall

Yellow flagging tape marks plants
≤ 4 ft tall when base sprayed.

?Questions?