Brad Hanson
Cooperative Extension Weed Specialist

Weed Management
Why control weeds?

- Compete for water, nutrients, and light with trees
- Interference is especially problematic during establishment years
- Can affect crop management, irrigation, and harvest operations
- Impacts on other pest problems
- Crop quality concerns?
Complex populations

- Rarely just one weed species present
  - Annual vs perennial vs biennial
  - Grass vs sedges vs broadleaf
- Time of emergence
  - Fall vs spring emergence vs year-round
- Reproductive strategy
  - Seed vs vegetative
Factors affecting orchard weeds

- Orchard age and arrangement
  - Shading and space capture
- Irrigation type, timing, and amount
  - Furrow, sprinklers, micros, drip
- Tillage practices
  - Berms, cross-disking, etc.
- Herbicide options
- Orchard access
Integrated weed management

- Using all available strategies to manage weed populations in a manner that is economically and environmentally sound.
  - cultural
  - mechanical
  - chemical
Goals of IWM

- Both short- and long-term goals
  - Prevent or reduce weed spread
  - Delay and/or suppress weed growth
  - Prevent or suppress weed seed production
  - Reduction of weed seed bank in soil
Weed identification

- Unknown weeds cannot be properly managed
  - No technique controls all weed species
  - Not all weeds cause equal damage (thresholds)
  - Species respond differently to control strategies
    - Even variants within a species (i.e. herbicide resistant biotypes)

Weed Research and Info Center
http://wric.ucdavis.edu

Online weed ID tool
A number of weed books are available.
Several available.

I use a set by XID Services
- UC Davis
- WSSA
- WSWS
- others
Online Weed ID Resources

A few online (FREE) resources are available:

UC Davis Weed Research and Information Center
www.wric.ucdavis.edu
Online Weed ID Resources

http://ipm.ucdavis.edu/PMG/menu.weeds.html

The UC Guide to Healthy Lawns

Begin key

Which illustrated characteristic best matches your weed species?

- Broadleaves: Leaves are wide, veins branch out in different directions
- Grasses: Leaves are narrow, arranged in sets of 2, stems are rounded or flattened
- Sedges: Leaves are narrow, arranged in sets of 3, stems are triangular in cross section

Grass ID characteristics
Sedge ID characteristics
Broadleaf ID characteristics
Weed management

- Orchard and vineyard floors divided into two management zones: middles and crop row
  - Zones may have very different strategies
  - Also may differ during the life of the orchard
How do we manage weeds?

- A few broad categories
  - Exclusion/sanitation
  - Cultural
  - Mechanical
  - Biological
  - Chemical
Sanitation

- Weed management should be an ongoing concern
  - Scout and manage in the orchard
  - Manage weeds on field margins and access roads
  - Clean equipment between sites
  - Scout and prevent seed set of “new” problems
Cultural practices

- Irrigation and fertilizer management
- Canopy management
- Cover crops
- Mulches
- Flaming
- Animals
Cover crops
Cover crop issues

ADVANTAGES
- Winter orchard access
- Reduced soil erosion
  - And pesticide and fertilizer runoff
- Addition of OM
- Soil structure and water/root penetration
- Competes with weeds

DISADVANTAGES
- Need to manage 2nd crop
  - More equipment
- Competes for water and nutrients
- Frost concerns
- Vertebrate and insect pests
- Addition of nutrients (N) may be unwanted (vineyard)
Flaming

- Non-chemical
- High fuel cost
- Just need to “heat” not “burn” weeds
- Best on young broadleaf
- No residual control
- Danger of damage to young trees or vines and irrigation systems
Animals can be used to manage vegetation in some cases

- Can work very well ... or very poorly
  - Expensive (own or rent?)
  - Management effort
  - Animal health and welfare limits weed control
  - Can damage trees or vines (buds) if left too long
  - Food safety concerns
Mechanical control

- Tillage / cultivation
- Mowing
- Hand labor

- T&V rows vs middles
  - equipment options and costs
Cultivation

ADVANTAGES

- Non-chemical tactic
- Organic matter additions and nitrogen release
- Reduces competition for water
- Reduces frost potential
- Easy control in middles
- No “resistance”

DISADVANTAGES

- Fuel and time costs
- Trunk and root injury
- Dust
- Erosion
- Compaction
- Can spread seed and fragments
- Weeds near tree difficult
- Effects on tree vigor?
Mowing

- **Advantages.**
  - Suppresses weeds, reduces seed set
  - Orchard access and erosion benefits

- **Disadvantages.**
  - Frost potential
  - Weeds still use water and nutrients
  - Favors low growing and perennial weeds
  - Favors grasses *(advantages or disadvantages?)*
  - Cost of repeat operations (slow and frequent)
Chemical control
CA orchards and vineyard herbicides usually applied to “strips” under the tree/vine row
- 2-20 ft strip, may treat 20-50% of the floor
- Middles managed with mowing, tillage, or less intensive herbicide program
- Often with a “preharvest” broadcast application
Types of herbicides

- Preemergence (PRE)
  - Applied to bare soil and affect germinating seeds and seedlings
  - Provide residual effects (weeks or months)

- Postemergence (POST)
  - “Burn down” treatments applied to the foliage of emerged weeds
  - Can be “contact” or “translocated” materials
  - Some products have residual control, some do not
Factors affecting herbicide choice

- Availability in the crop (registration)
- Weeds to be controlled (weed ID)
- Toxicity and safety (to crop and non-target)
- Soil type and texture
- Cost
## Herbicides registered in pistachio

<table>
<thead>
<tr>
<th>Preemergence (PRE)</th>
<th>Postemergence (POST)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mission</td>
<td>Shark</td>
</tr>
<tr>
<td>Chateau</td>
<td>SelectMax**</td>
</tr>
<tr>
<td>Alion</td>
<td>2,4-D</td>
</tr>
<tr>
<td>Trellis</td>
<td>Diquat**</td>
</tr>
<tr>
<td>Broadworks</td>
<td>Fusilade**</td>
</tr>
<tr>
<td></td>
<td>Glyphosate</td>
</tr>
<tr>
<td></td>
<td>Rely 280</td>
</tr>
<tr>
<td></td>
<td>Sandea</td>
</tr>
<tr>
<td></td>
<td>Gramoxone</td>
</tr>
<tr>
<td></td>
<td>Pelargonic acid</td>
</tr>
<tr>
<td></td>
<td>Venue</td>
</tr>
<tr>
<td></td>
<td>Treevix</td>
</tr>
<tr>
<td></td>
<td>Poast</td>
</tr>
</tbody>
</table>

*Trade names for example only

** Registered in NB pistachio only
## CA pistachio herbicide use

<table>
<thead>
<tr>
<th>Rank</th>
<th>Top active ingredients (2015)</th>
<th>2009 treated acreage</th>
<th>2015 treated acreage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>glyphosate</td>
<td>249,586</td>
<td>323,493</td>
</tr>
<tr>
<td>2</td>
<td>oxyfluorfen (Goal, Goaltender)</td>
<td>113,934</td>
<td>145,193</td>
</tr>
<tr>
<td>3</td>
<td>saflufenacil (Treevix)</td>
<td>--</td>
<td>112,594</td>
</tr>
<tr>
<td>4</td>
<td>paraquat (Gramoxone)</td>
<td>38,610</td>
<td>74,441</td>
</tr>
<tr>
<td>5</td>
<td>pendimethalin (Prowl H2O)</td>
<td>56,048</td>
<td>73,335</td>
</tr>
<tr>
<td>6</td>
<td>glufosinate (Rely)</td>
<td>55,841</td>
<td>59,702</td>
</tr>
<tr>
<td>7</td>
<td>pyraflufen (Venue)</td>
<td>92</td>
<td>40,000</td>
</tr>
<tr>
<td>8</td>
<td>rimsulfuron (Matrix)</td>
<td>14,435</td>
<td>37,577</td>
</tr>
<tr>
<td>9</td>
<td>indaziflam (Alion)</td>
<td>--</td>
<td>36,562</td>
</tr>
<tr>
<td>10</td>
<td>flumioxazin (Chateau)</td>
<td>23,820</td>
<td>26,960</td>
</tr>
<tr>
<td>11</td>
<td>penoxsulam (PindarGT)</td>
<td>--</td>
<td>22,101</td>
</tr>
<tr>
<td>12</td>
<td>carfentrazone (Shark)</td>
<td>12,828</td>
<td>15,478</td>
</tr>
<tr>
<td>13</td>
<td>oryzalin (Surflan, etc)</td>
<td>26,693</td>
<td>10,408</td>
</tr>
<tr>
<td>14</td>
<td>isoxaben (Trellis)</td>
<td>290</td>
<td>10,173</td>
</tr>
</tbody>
</table>

* strip treatments!

301,967 A total (~239k bearing, 69k NB) in 2015
Conventional herbicides

**ADVANTAGES**
- Can be very cost effective (in some cases)
- Consistent results
- Ease of application (speed)
- Crop safety (generally)
- Erosion benefits (vs tillage)
- Season-long control with some products and combos
- Selectivity can be used to maintain desired cover

**DISADVANTAGES**
- Cost (in some cases)
- Potential for off-site movement with some products
- Regulations and record keeping
- Herbicide resistance can occur
- Crop injury can occur
- Some market sectors have preference against
Herbicide application considerations

- PRE, POST, or PRE/POST mix?
- Tank mixes
- Weed spectrum controlled
- Surfactants and adjuvants
- Coverage (GPA)
- Timing and weed size
- Sprayer calibration (esp. OC nozzles)
- Nozzle selection
- Litter and debris

- Check current herbicide labels
- Scouting and record keeping
- Training and PPE for handlers and applicators
- Potential for off-site movement?
- Double check calculations and recommendations!
Weed challenges in orchards

- Old favorites:
  - Normal mix of annual grasses and broadleaves
  - Challenge with perennial weeds, especially in new orchards or crops with fewer herbicide options
- New weed problems
  - Most of the “new” issues seem to be related to glyphosate resistance and/or shifting populations to tolerant species
- Changing control options
  - Less tillage, some new herbicides, water issues
Extra challenges in young orchards

- Crop less competitive with weeds
- Greater sensitivity to weed competition
- Greater sensitivity to injury from weed control tactics
- Fewer herbicides registered on new plantings
Orchard weed management

- **Weed ID**
  - Understand the problem and biology

- **Use integrated management tactics**
  - Cultural and mechanical approaches
  - Chemical tactics
    - Right herbicide, right target, right time
    - Resistance management considerations
    - Environmental impacts
      - VOC, surface water, ground water
Manage “your” weeds

- Weed management is an annual concern and production cost that must be considered in a local context.
- No “one size fits all” solution for all orchards - integrated weed management requires systemic and long-term thinking.
# T&V herbicide registrations

| Herbicide-Common Name | Site of Action Group¹ | Almond | Pear | Pecan | Peach | Walnut | Apple | Bitter Peach | Cherry | Blueberry | Strawberry | Greenhouse | Brassica | Annual | Circles | Date | Fig | Grape | Kiwi | Date | Durian | Peanut | Plant | Pome | Grape | Date | Date | Date |
|-----------------------|------------------------|--------|------|-------|-------|--------|------|-------------|--------|------------|------------|------------|---------|---------|--------|--------|------|-------|-------|------|-------|--------|-------|-------|-----|------|------|-----|------|
| diclofop (Cassava)    | L/20                   | N      | N    | N     | N     | N      | R    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| diuron (Kamer, Diuron) | C2/7                   | N      | R    | N     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| EPTC (Eptam)          | N/3                    | R      | N    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| flazasulfuron (Mezam) | B/3                    | R      | N    | R     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| fluomaxat (Chateau)   | E/14                   | R      | R    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| indoctrafix (Alion)   | L/19                   | R      | R    | R     | R     | R      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| isoxaben (Teleto)     | L/23                   | N      | N    | N     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| mesotrione (Bicyl)    | F2/16                   | N      | N    | N     | N     | N      | R    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| napropamide (Denmo)   | K5/15                  | R      | N    | N     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| norflurazon (Colais)  | A/15                   | R      | N    | N     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| oryzalin (Surplus)    | K1/3                   | R      | R    | N     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| oxyfluorfen (Goal)    | E/14                   | R      | R    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| pendimethalin (ProwlH2O) | K1/3                  | R      | R    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| penoxsulam (Penk oxide) | B/15                  | R      | R    | R     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| pronamide (Kerb)      | K1/3                   | N      | N    | N     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| rimsulfuron (Matrix)  | B/2                    | R      | R    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| sulfentrazone (Teazle) | E/14                   | R      | R    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| simazine (Prime, Caliber 90) | C1/5               | R      | R    | N     | N     | N      | R    | N           | R      | N          | R          | N          | N       | N       | N      | N      | N    | N     | N     |
| trifluralin (Treflan) | K1/3                   | R      | R    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| carfentrazone (Tark)  | E/14                   | R      | R    | R     | R     | R      | R    | R           | R      | R          | R          | R          | R       | N       | R      | R      | R    | N     | R     |
| clethodim (SelectMax) | A/1                    | N      | N    | N     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| 2,4-D (Clean-crop, Orchard Master) | C/4            | R      | R    | R     | R     | R      | R    | R           | R      | R          | R          | R          | R       | N       | R      | R      | R    | N     | R     |
| diquat (Diquat)       | D/22                   | N      | N    | N     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| fluazifop-p-butyl (Fastact) | A/1            | N      | N    | N     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| glyphosate (Roundup)  | G/22                   | R      | R    | R     | R     | R      | R    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| glufosinate (Kia 280) | H/40                   | R      | R    | R     | R     | R      | R    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| halosulfuron (sandee) | B/2                    | N      | N    | N     | N     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| paraquat (Gramoxone)  | D/22                   | R      | R    | R     | R     | R      | R    | R           | R      | R          | R          | R          | R       | N       | R      | R      | R    | N     | R     |
| pelargonic acid (Systam) | NC²                  | R      | R    | R     | R     | R      | R    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| pyrfluafur (Venue)    | E/14                   | R      | R    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| saflufenacet (Trevis) | E/14                   | R      | R    | R     | R     | N      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |
| sethoxydim (Post)    | A/1                    | R      | R    | R     | R     | R      | N    | N           | N      | N          | N          | N          | N       | N       | N      | N      | N    | N     | N     |

Notes: R = Registered, N = Not registered, NB = non bearing. This chart is intended as a general guide only. Always consult a current label before using any herbicide as labels change frequently and often contain special restrictions regarding use of a company’s product.

¹ Herbicide site of action designations are according to the Heribicide Resistance Action Committee (letters) and the Weed Science Society of America (number) systems. NC = no accepted site of action classification; these contact herbicides are general membrane-disruptors.

Updated annually. Available online - easiest way is to find it is on the UC Weed Science blog.
Brad Hanson
bhanson@ucdavis.edu
530 752 8115
http://hanson.ucdavis.edu/

UC Davis Weed Research and Information Center
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