Berry Pest Management

Dr. Zach Miller
Protect your investment

- Main Objective:
  - Return of investment
  - Maximize growth
  - Minimize time to maturity-harvest
  - Site-Specific needs assessment and management plans
Orchard Planning makes dreams come true

- Fencing
- Bird Protection
- Weed Management
- Plant Selection
- Irrigation
- Potential Returns
Main threats to plant health/production

Weeds, Rodents/Deer, Birds, and Disease
Two major types of wildlife fencing

- Woven wire
- Electric
# Pros and Cons

<table>
<thead>
<tr>
<th>Fence Type</th>
<th>Cost</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Woven Wire</td>
<td>High: $4-6 per foot, $4700-7000/2 acres</td>
<td>Low- occasionally mowing</td>
</tr>
<tr>
<td>Electric</td>
<td>Low: $1.50-2.20, $1800-$3000/2 acres</td>
<td>High- must keep vegetation off fence.</td>
</tr>
</tbody>
</table>

[http://agresearch.montana.edu/warc-guides/Orchard_Infrastructure.html](http://agresearch.montana.edu/warc-guides/Orchard_Infrastructure.html)
Bird Protection

- Can remove 50 to 99% of the crop
  - Aronia less attractive to birds
- Exclusion vs. Deterrents
- Two types
  - Row cover
  - Orchard Cover-Full Exclosure
Orchard Cover-Full Exclosure

- E.g. Smart Net System
  - Advantages:
    - Can work under net
    - Better for mixed orchards/U-pick
    - Better bird protection-can’t reach fruit
  - Disadvantages
    - Cost: need to add ~10 ft. tall posts every 50 ft.
    - ~$3,700 per acre

WWW.smart-net-systems.com
250-890-0841 Canada
Row cover

• Advantages:
  • Cost: $850-1,800/acre.
    • Netting: $800-1,200/ac
    • Support, stakes: $630/ac.
  • Allows mechanical harvest.

• Disadvantages
  • Less effective: birds can reach fruit
  • Can’t work under net- must remove to prune, spray, monitor, and harvest
Weed Impacts

- Direct:
  - Competition for water and nutrients:
    - Especially intense in establishment years
    - Lost returns on inputs/investment
    - Weeds can block irrigation→water stress

- Indirect:
  - Provide food/habitat for rodents-winter browsing to roots and trunk
Weed Management

- Weed types
- Critical period for control
- Management tool kit:
  - Herbicide types
  - Application
- Orchard floor vegetation management planning
- Rodent control
- Take the Hard-easy approach:
  - Vigilant control early will make things easier in the end.

http://treefruit.wsu.edu/crop-protection/weed-control/
Know your enemy

- Scouting weeds:
  - Determine management
  - Monitor results

- Major weed types:
  - Growth form:
    - Grass
    - Broadleaf
  - Live span:
    - Annual (winter vs summer)
    - Biennial
    - Perennial
Weed Growth Forms

Monocot

Dicot-Broadleaf Weeds
Weed Life Span

- **Annuals**
- **Biennials** - 2 year life cycle - often noticed too late to control

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**Winter Annuals**

- Fall
- Winter
- Spring
- Summer

**Summer Annuals**
Perennial Weeds

- Spreading Perennial are the most difficult to control
  - E.g. Quack Grass, Canada Thistle, Field Bindweed
  - Use **Systemic Herbicide** that will break down (i.e. glyphosate)
- Multiple applications—Fall most critical

**REMOVE BEFORE PLANTING**
Weed competition has greatest effects when:

- **Orchard Establishment** - small root system, creates lag in growth
- When plants need resources during the growing season
  - Flowering
  - Fruit set
  - Fruit enlargement (yield, size)
  - Growth (next years yield)
  - Flower bud initiation (next years yield)

**MAY-JULY**

- Weed competition in fall can help plants harden off/prepare for winter
Early weed control is critical
Weed Management Tool Kit

Prevention: sanitation, stopping weed seed production

Mechanical: tillage, mulches, mowing

Biological: competition, bio-control

Chemical
Table 4-14. Advantages and disadvantages of weed management tools

<table>
<thead>
<tr>
<th>Tool</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
</table>
| Cultivation/hoeing | - effective, especially on small weeds  
                        - non-selective - controls all emerged growth   
                        - equipment readily available                  | - may damage soil structure  
                        - may spread perennial weeds  
                        - may damage trees/roots  
                        - provides only short-term control              |
| Mulching         | - effective if properly managed  
                        - non-selective - suppresses all emerging weeds  
                        - holds soil moisture as well  
                        - provides long-term control                  | - availability of mulch  
                        - cost of mulch/application  
                        - attractive to rodents  
                        - may affect tree nutrition  
                        - must be free of weed seeds                |
| Mowing           | - rescue treatment  
                        - quick suppression  
                        - equipment available  
                        - reduce seed spread                       | - weeds may still compete  
                        - quick regrowth  
                        - several mowings required  
                        - may damage young trees                   |
| Herbicides       | - effective  
                        - easy to apply  
                        - can be selective  
                        - timely                                      | - require 2% soil organic matter  
                        - directed spray equipment  
                        - effects on pest complex  
                        - cost varies                                |

http://www.omafra.gov.on.ca/english/crops/facts/weedman.htm
Herbicide types

- **Pre-emergent: PRE**
  - Effects weed seeds (not established perennials)
  - Applied fall, early spring
  - Require incorporation (water, tillage)

- **Post-emergent: POST**
  - Contact: Not moved within plant
    - Effective on annual weeds
    - Less risk for crop damage
    - Paraquat, Glufosinate (Cheetah, Rely), Organic herbicides
  - Systemic: moved within the plant
    - Effective on annual and perennial weeds
    - Glyphosate (Roundup-many others)-no residual
    - 2,4-D, clopyralid (Stinger)-soil residual-can harm some cultivars if used mid season w/ irrigation

- Some herbicides are both PRE-POST
Herbicide types

- Selectivity: Based on mode of action (MOA)
  - Some MOA’s work on all plants- Non-Selective, Broad spectrum
  - Other MOA’s work on some plants- Selective
    - Often grass or broadleaf
    - But can be more selective.
    - Know weeds, Read labels.
PREEMERGENCE WEED CONTROL

Grasses
Barnyardgrass
Chapgrass, large
Foxtail, Giant
Foxtail, Green
Foxtail, Yellow
Quackgrass
Wheat, Volunteer

Broadleaves
Chamomile, False
Dandelion, common (seeding)
Forsame, Redscab
Fleabane, hairy
Groundsel, common
Kochia
Mallow, common
Marshall/marshweeds
Mustard, Birdsfoot
Mustard, Black
Pigweed, Redroot
Pigweed, Smooth
Puncturevine
 Purslane, Common
 Spurge, Prostrate
 Spurge, Spotted

PREEMERGENCE PARTIAL WEED CONTROL

Grasses
Wild Oat

Broadleaves/Sedges
Cocklebur
Dandelion, common (established)
Lamb'squarters, common
Nightshade, Black
Nightshade, Hair
Nutsedge, yellow
Pigweed, Prostrate
Ragweed, Common
Velvetleaf

POSTEMERGENCE WEED CONTROL

Grasses (1-2 inches)
Barley, Volunteer
Barnyardgrass
Bluegrass, Annual
Foxtail, Brittle
Foxtail, Giant
Foxtail, Green
Foxtail, Yellow
 Panicum, Fall
Wheat, Volunteer

Broadleaves (1-3 inches)
Chamomile, False
Chickweed, common
Herbit
Kochia
Mustard, Blue
Mustard, Wild
Pigweed, Redroot
Pigweed, Smooth
Purslane, common
Shepherd's-purse
Wild Radish

POSTEMERGENCE PARTIAL WEED CONTROL

Grasses
Johnsongrass, weedy
Millet, wild
Oat, wild
Quackgrass

Broadleaves/Sedges
Cocklebur
Dandelion, common
(-5 inches in diameter)
Lamb'squarters, common
Mallow, common
Nightshade, hairy
Nutsedge, yellow
Pigweed, prostrate
Ragweed, common
Smartweed, Pennsylvania
Thistle, Canada

DuPont® Matrix® SG
WATER SOLUBLE GRANULE
For Weed Control In Citrus Fruit, Stone Fruit, Tree Nuts, Pome Fruit, Grapes, Potatoes, Potatoes grown for seed, and field grown Tomatoes
Maximizing Control

- Weed size/stage: smaller is more susceptible
- Weeds need to be actively growing
  - Water
  - Heat
- Herbicide must contact weeds
  - Dust
  - Hairs
- Adjuvants:
  - Hold herbicide on plant, prevent breakdown
  - Increase uptake
  - Nitrogen, surfactants, oils, penetrants, wetting agents, spreader-stickers
  - Follow labels
Other Considerations

- Soil factors- Organic Matter and temperature affect herbicide movement/breakdown

- Crop/Cultivar. E.g. Rose/Apple family more tolerant of synthetic auxins (clopyrlid)

- Age of plants:
  - younger plants have more tender bark and shallower root system.
    - Protect with careful application, guards.
    - Avoid root active PRE and POST products in new orchards.
  - Some products registered only for young, NON-BARING orchards.

- Weed shifts/Herbicide resistance
# Ten important herbicide modes of action

<table>
<thead>
<tr>
<th>Mode of action</th>
<th>WSSA group</th>
<th>Key herbicides</th>
<th>Number of resistant species</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACCase</td>
<td>Group 1</td>
<td>Poast, Select, Fusilade</td>
<td>44</td>
</tr>
<tr>
<td>ALS</td>
<td>Group 2</td>
<td>Sandea, Matrix, Solida, Pruvina</td>
<td>142</td>
</tr>
<tr>
<td>Shoot inhibitors</td>
<td>Group 3</td>
<td>Surflan, Prowl, Kerb</td>
<td>12</td>
</tr>
<tr>
<td>PGR</td>
<td>Group 4</td>
<td>2,4-D, Stinger</td>
<td>31</td>
</tr>
<tr>
<td>PS II</td>
<td>Group 5</td>
<td>Simazine, Sinbar</td>
<td>72</td>
</tr>
<tr>
<td>PSP</td>
<td>Group 9</td>
<td>Glyphosate, Roundup, many others</td>
<td>25</td>
</tr>
<tr>
<td>PS I</td>
<td>Group 22</td>
<td>Gramoxone</td>
<td>29</td>
</tr>
<tr>
<td>GS</td>
<td>Group 10</td>
<td>Rely, Finale</td>
<td>2</td>
</tr>
<tr>
<td>PPO</td>
<td>Group 14</td>
<td>Goal, Chateau, Treevix, Aim, Venue</td>
<td>6</td>
</tr>
<tr>
<td>Cellulose inhibitors</td>
<td>Group 20/29</td>
<td>Casoron, Gallery, Alion</td>
<td>1</td>
</tr>
</tbody>
</table>

*Source: International Survey of Herbicide Resistant Weeds. At www.weedscience.com*
## Cost

**Soil Active (preemergent) Herbicides for use in Orchards**

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Brand Name</th>
<th>Cost per treated acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>diuron</td>
<td>Karmex</td>
<td>$4</td>
</tr>
<tr>
<td>dichlobenil</td>
<td>Casoron</td>
<td>$128</td>
</tr>
<tr>
<td>indaziflam</td>
<td>Alion</td>
<td>$21</td>
</tr>
<tr>
<td>norflurazon</td>
<td>Solicam</td>
<td>$30</td>
</tr>
<tr>
<td><em>oryzalin</em></td>
<td><em>Surflan</em></td>
<td><em>$10</em></td>
</tr>
<tr>
<td><em>pendimethalin</em></td>
<td><em>Prowl</em></td>
<td><em>$10</em></td>
</tr>
<tr>
<td><em>pronamide</em></td>
<td><em>Kerb</em></td>
<td><em>$57</em></td>
</tr>
<tr>
<td>simazine</td>
<td>Simazine 90DF</td>
<td>$6</td>
</tr>
<tr>
<td>terbacil</td>
<td>Sinbar</td>
<td>$41</td>
</tr>
</tbody>
</table>

*bold and italic recommended for new plantings*
Application

Granular applicators

Banded over row

Rotary spreader - broadcast

Drop spreader - broadcast
Integrated Weed Management

- Prior to Planting:
  - In row: build soil, reduce weeds
    - Wait for weeds to emerge-control, fall sprays to remove perennials
    - Cover crop
    - Tillage
    - Fall-control perennials with systemic herbicide (just after first frost)
  - Establish alleys:
    - Grass- sod forming, easy weed control
Integrated Weed Management

- Post planting first few years-critical period
  - Keep clean of weeds to drip line (2-4 ft.)
    - Chemical:
      - fall-early spring
        - Control winter annuals with contact herbicide
        - PRE-soil applied (8-12 weeks of weed control)
    - Clean up escapes with contact herbicide or hoeing.
    - Fall systemic if needed for perennials
  - Mechanical
    - Mulch (may need to remove for winter)
    - Tillage- applied every 3-4 weeks
    - Not effective for perennial weeds
Integrated Weed Management

- Established orchard
  - Will be more competitive (shade-deeper roots)
    - Control winter annuals, perennials in the fall
    - Fall or early Spring- apply broad spectrum contact herbicide followed by mulch or PRE herbicide
    - Control weeds as needed up to July (Critical period).
Small Mammals (Rodents)

Feed on bark of younger trees

Feed on tree roots
Rodent Control

- Alter Habitat
  - Reduce food and cover (vegetation/snow)
    - Remove vegetation around trunks
    - Mow or till alley and orchard border
    - Avoid plants favored by gophers
  - Encourage predators
    - Cats, Snakes, Raptors, Foxes

- Protect Young Trees - tubes or paint

- Monitor (Apple slices - U of Illinois)
  - 1 per 20-30 plants
  - 24 hrs
  - % apples w/ teeth = % trees damaged
  - Treatment threshold (20-25%) ITRPG
Bait/Trapping

- Traps:
  - Along runs/tunnels
  - Voles/mice: provide cover over traps
- Baits/Poison
  - 2 types
    - Acute baits: Zinc phosphide
      - More effective for meadow voles
    - Anticoagulants (Chlorophacinone and Diphacinone)
- Application:
  - Broad cast
  - Bait stations
  - Hand
Disease Management

- Relatively minor concern due to our dry climate
- Recognize symptoms and treat early to limit damage.
- Saskatoon-Juniper rust (*Gymnosporangium* spp.) has been the most common disease
Saskatoons

- Common Diseases
  - Juniper rust
  - Entomosporium leaf and berry spot
  - Powdery Mildew
  - Fire Blight
Currants

- No disease seen in our trials
- Anthracnose (dark-brown to black dots on leaf surface-yellowing of leaves)
- Septoria leaf spot (in early stages looks similar to anthracnose, but spots expand and have light center and brown border)
- Powdery Mildew
Protect your investment

Main Objective:

- Return of investment
- Maximize growth
- Minimize time to maturity-harvest

Site-Specific: needs assessment and management plans

Weeds, Rodents/Deer, and Birds,
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Constraint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tillage</td>
<td>Effective</td>
</tr>
<tr>
<td></td>
<td>Reduces rodent habitat</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Flaming</td>
<td>Can control weeds around trunk</td>
</tr>
<tr>
<td></td>
<td>Reduces rodent habitat</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Inert mulches</td>
<td>Effective for most weeds</td>
</tr>
<tr>
<td></td>
<td>Can improve soil quality</td>
</tr>
<tr>
<td></td>
<td>Conserves moisture</td>
</tr>
<tr>
<td>Living mulches</td>
<td>Add biodiversity</td>
</tr>
<tr>
<td></td>
<td>Benefit soil quality</td>
</tr>
<tr>
<td></td>
<td>Legumes can fix N</td>
</tr>
<tr>
<td></td>
<td>Theoretically low maintenance</td>
</tr>
<tr>
<td>Organic herbicides</td>
<td>Can control weeds around trunk</td>
</tr>
<tr>
<td></td>
<td>No physical damage to tree, roots</td>
</tr>
<tr>
<td></td>
<td>Reduces rodent habitat</td>
</tr>
<tr>
<td></td>
<td></td>
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