**Landscape Weed Management**
- Site Preparation
- Sanitation & Exclusion
- Mulches
- Preemergence Herbicides
- Postemergence Herbicides
- Hand weeding

**Preemergence Weed Control**
Before Weeds Emerge
-- more importantly --
Before Weeds Germinate

**Preemergence weed control options**
- Mulches prevent germination and excluding light
- Preemergence Herbicides prevent seedling establishment

**Application timing is everything to effective control**
- Preemergence means before weeds germinate.
- Applications must be made about 2 weeks before germination
- Timing depends on the weed’s life cycle

**Life cycle of an annual weed**
- Seed
- Plant sets Seed
- Plant Flowers
- Plant Dies
- Seedling

**Preemergence Herbicides Prevent Seedling Establishment**
- No Herbicide
- With Herbicide
Life cycle of a winter annual weed
- Seed
- Seedling
- Plant
- Flowers
- Plant dies
- Plant sets seed

Life cycle of a summer annual weed
- Seed
- Seedling
- Plant
- Flowers
- Plant dies
- Plant sets seed

Life cycle of a biennial weed
- Seed
- Seedling
- Plant over-winters
- Plants flower and set seed in 2nd season
- Vegetative growth

Life cycle of a perennial weed
- Seed
- Seedling
- Plant
- Flowers
- Roots overwinter
- New plant spreads
- Plant sets seed

Timing PRE Applications
- Summer annual weeds – late winter
- Winter annual weeds – late summer

Herbicide residual – most PRE’s last 8 to 12 weeks (some 16)
- Preemergence herbicides stay in the soil preventing weed growth
- Over time herbicides are degraded by microorganisms
- Reapplication is required when the herbicide concentration is below that required to control the target weeds
**PRE Herbicides for Landscapes**
- Many PRE’s for grasses and small seeded broadleaf weeds
- Fewer for broadleaf weeds
- Broadleaf herbicides are generally more injurious to ornamentals

**Common PRE herbicides**
- Dinitroanalines
- Others
  - Pennant Magnum
  - Devrinol
  - Ronstar
  - Dacthal
  - Gallery
  - Snapshot

**Dinitroanaline herbicides**
- Good combination of safety and efficacy
- Control SA & WA grasses & some broadleaves, henbit, chickweed spurge.
- Efficacy varies on some broadleaves including ragweed, groundsel, & others.
- Weak on nightshades, galinsoga, purslane
- Do not control nutsedges or other perennials

**Dinitroanaline herbicides**

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Formulation</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trifluralin</td>
<td>Treflan or Preen</td>
<td>GR only</td>
</tr>
<tr>
<td>Pendimethalin</td>
<td>Pendulum, Corral</td>
<td>GR or spray</td>
</tr>
<tr>
<td>Prodiamine</td>
<td>Barricade, Regalkade*</td>
<td>GR* or Spray</td>
</tr>
<tr>
<td>Oryzalin</td>
<td>Surflan, XL*</td>
<td>GR* or Spray</td>
</tr>
<tr>
<td>Benifin + trifluralin</td>
<td>Team Pro</td>
<td>GR</td>
</tr>
</tbody>
</table>

Also ingredients in most other combination herbicides: Jewel, Snapshot, Freehand, Rout, and others

**Surflan (oryzalin)**
- Preemergence grass and broadleaf weed control
- 3 to 4 months residual control
- Safe on most woody ornamentals
- Injures many herbaceous perennials and bedding plants

**Granular Oryzalin**
- XL: benifin + oryzalin
- Surflan Coated Granules
- Preemergence grass and broadleaf weed control
- 3 to 4 months residual control
- Safe on most woody ornamentals and some herbaceous
**Barricade (Prodiamine)**
- Preemergence control of annual grasses and some broadleaves in woody and herbaceous ornamentals
- Rec. rate: 2.3 lb per acre or 0.84 oz per 1000 sq. ft.
- Strengths: annual grasses, spurge, oxalis. Weak on bittercress, ragweed, morningglory & groundsel

**Regalkade 0.5G**
- ai: prodiamine 0.5% (same as Barricade)
- preemergence control of annual grasses and some broadleaves
- Rec. rate: 150 to 300 lb / A
- strengths: annual grass control, spurge
- weak on bittercress and groundsel
- Granular formulation much safer on herbaceous perennials than the spray

**Pendulum or Corral (pendimethalin)**
- Preemergence control of annual grasses and some broadleaf weeds
- GR formulations safer on herbaceous ornamentals (except shasta daisy)
- Weak on groundsel & ragweed

**Treflan or Preen (trifluralin)**
- Preemergence control of annual grasses and few broadleaf weeds
- Safest herbicide on herbaceous ornamentals
- Weak on groundsel, ragweed, morningglory & other broadleaves

**Balan and Team-Pro**
- Balan for turf only
- Team Pro (Balan + Treflan) is labeled for use in landscape beds. Not widely used.

**How do dinitroanilines differ?**
1. **Annual broadleaf weed control**
   - Surflan is generally better
   - On spurge – Barricade is slightly better
   - On horseweed – Pendulum is better
   - Treflan is the weakest
How do dinitroanilines differ?

2. Safety on ornamentals
   - Granules are safer than sprays
   - Treflan / Preen is the safest on woody and herbaceous
   - Pendulum GR and Regalade G are safe on many herbaceous
   - Surflan is generally most injurious (particularly herbaceous)

Other modes of action
   - Pennant Magnum – preemergence control of yellow nutsedge (and annual grasses).
   - Devrinol – safe on woody and herbaceous but weak on broadleaf weeds

PRE Yellow Nutsedge control: Pennant Magnum 7.6 EC (s-metolachlor) OR Tower 6EC (dimethenamid-p)
   - Apply before ornamentals break bud (to avoid foliar injury)
   - Relatively short residual (~2 - 3 months)
   - PRE control of annual grasses, yellow nutsedge and some broadleaf weeds
   - Do not control purple nutsedge

EC herbicide injury to tender spring growth

Freehand 1.75G (dimethenamid-p + pendimethalin)
   - Preemergence control of annual grasses and small seeded broadleaf weeds
   - Suppression of yellow nutsedge
   - Safe on most woody ornamentals.
   - Herbaceous plants ???
**Pennant Magnum vs. Freehand**

- EC Form.
- Yellow nutsedge suppr.
- Ann. Grasses
- Few broadleaf weeds controlled
- Well known plant safety

- GR Form.
- Yellow nutsedge suppr.
- Ann. Grasses
- Better on broadleaf weeds
- We are still learning about plant safety

**Other modes of action – Gallery**

- PRE broadleaf weed control
- Not grasses
- Safe on woody ornamentals, injures many herbaceous
- Typically used in GR formulation with Treflan = Snapshot TG

**Snapshot TG = Preen Pro**

- ai: isoxaben 0.5% + trifluralin 2%
- preemergence control of annual grasses and broadleaves
- Rec. rate: 100 to 200 lb / A
- broad spectrum preemergence weed control; less burn than OH2, Rout, Ronstar or Regal OO
- Weak on bittercress & phyllanthus

**Other Modes of action – Ronstar**

- Better on annual broadleaf weeds than dinitroanalines
- More expensive and injurious to herbaceous ornamentals.
- Weak on spurge and chickweed

**DO NOT USE Princep or Atrazine in landscape beds**

- Many ornamentals are injured from root uptake of these herbicides
- If using in the turf, keep away from landscape beds
- Shade trees in treated lawns will typically be OK

**How to choose a PRE herbicide**

1. Ornamental Plant Safety
2. Efficacy on the target weeds
3. Weeds not controlled
4. Preferred formulation (GR vs Spray)
5. Economics
6. Proximity of susceptible species
7. Environmental issues
Two approaches to Landscape weed management

- KISS – Keep It Simple S……
- Optimized
  - Choose the most effective options for the site

Simple (KISS) Approach:
- Mulch
- Treflan / Preen
- Hand weed and spot spray escapes

Optimized Approach

- Mulch
- Select broadest spectrum herbicide for the site
  - Woody beds
  - Herbaceous perennial beds
  - Bedding plants

Comparison of PRE Herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Crabgrass</th>
<th>Bitter-cress</th>
<th>Horseweed</th>
<th>Grounsedge</th>
<th>Oxalis</th>
<th>Nutsgedge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surflan</td>
<td>G</td>
<td>G</td>
<td>F</td>
<td>G</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>Barricade</td>
<td>G</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>Pendulum</td>
<td>G</td>
<td>F</td>
<td>G</td>
<td>P</td>
<td>G</td>
<td>P</td>
</tr>
<tr>
<td>Treflan</td>
<td>G</td>
<td>F</td>
<td>F</td>
<td>P</td>
<td>F</td>
<td>P</td>
</tr>
<tr>
<td>Devrinol</td>
<td>G</td>
<td>F</td>
<td>P-F</td>
<td>P-F</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>Pennant</td>
<td>G</td>
<td>F</td>
<td>P</td>
<td>P</td>
<td>F</td>
<td>G</td>
</tr>
<tr>
<td>XL</td>
<td>G</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>G</td>
<td>P</td>
</tr>
</tbody>
</table>

Woody Ornamentals

- Tolerant of broad spectrum herbicides such as Snapshot, Gallery, Ronstar, Rout, Regal OO etc.
- Select herbicide for safety on ornamentals and weeds controlled
**Regal OO**

- ai: oxyfluorfen 2% + oxadiazon 1%
- preemergence control of annual grasses and broadleaves
- Rec. rate: 100 lb / A
- broad spectrum preemergence weed control
- weak on crabgrass; burns like OH2 & Rout

**Rout**

- ai: oxyfluorfen 2% + oryzalin 1%
- preemergence control of annual grasses and broadleaves
- Rec. rate: 100 lb / A
- broad spectrum preemergence weed control
- burns tender foliage -- do not use on herbaceous plants

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**Bedding Plants**

- Tolerance to herbicides varies among species
- Check labels and Extension recommendations
- Hort Info Leaflet #644

http://www.ces.ncsu.edu/depts/hort/hil/

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**PRE herbicides for summer bedding plants**

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**Herbaceous Perennials**

- Few herbicides registered
- Herbicide tolerance varies among species
- In diverse plantings -- the simple approach is generally the safest

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**PRE herbicides for herbaceous perennials**

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Source: HIL 644 -- Weed management in annual color beds
Where to get more information?
- Cooperative Extension
- AG-427
- HIL 644
- Trade journals and your peers

How to use the resources
- Weed Control Suggestions In Christmas Trees, Woody Ornamentals and Flowers – AG-427
- NC Extension publication $7.50 ea.

AG-427 Includes:
- General weed biology
- Calibration
- Herbicide information
  - Weeds controlled & Not controlled
  - Recommended uses and doses
- Tables of weed susceptibility
- Tables of ornamental safety

How to use AG-427
- Table 1 for efficacy
- Tables 3 (woody) and 5 (for herbaceous) safety
- Cross reference between tables

Example:
- What preemergence herbicide would you use to control bittercress in pansy beds?

<table>
<thead>
<tr>
<th>Step 1: what herbicides are safe on pansies?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 5. Preemergence herbicide registrations on herbaceous ornamentals</td>
</tr>
<tr>
<td>Species</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Astilbe</td>
</tr>
<tr>
<td>Dahlia</td>
</tr>
<tr>
<td>Marigold</td>
</tr>
<tr>
<td>Pansy</td>
</tr>
</tbody>
</table>

R= registered, I = injury has been observed
Step 2: which of these herbicides controls bittercress best?

Table 1. Preemergence herbicide efficacy on annual weeds

<table>
<thead>
<tr>
<th>Species</th>
<th>Barricade</th>
<th>Gallery</th>
<th>Pendulum</th>
<th>Pennant</th>
<th>Surflan</th>
<th>Treflan</th>
<th>XL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bittercress</td>
<td>F</td>
<td>G</td>
<td>F</td>
<td>P</td>
<td>G</td>
<td>P</td>
<td>F</td>
</tr>
<tr>
<td>Chickweed</td>
<td>G</td>
<td>G</td>
<td>G</td>
<td>F</td>
<td>G</td>
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<td>G</td>
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<tr>
<td>Crabgrass</td>
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<td>G</td>
<td>G</td>
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<td>G</td>
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<tr>
<td>Henbit</td>
<td>G</td>
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<td>G</td>
<td>F</td>
<td>G</td>
<td>G</td>
<td>G</td>
</tr>
</tbody>
</table>

Example:

- What preemergence herbicide would you use to control bittercress in pansy beds?
- XL is the best alternative

Study Questions

- How do preemergence herbicides control weeds?
- When should a preemergence herbicide be applied? And, how does this relate to a weed’s life cycle? Specific examples.
- Why are dinitroaniline herbicides the most commonly used herbicides in landscape plantings?
- Give 4 examples of dinitroaniline herbicides labeled for use in landscape beds. List the strengths and weaknesses of each.

Study Questions

- What publication is the most appropriate source for information on herbicides for use in ornamental plantings?
- Given the species of weeds and ornamental plants – be sure you know how to use the tables from that publication to develop a herbicide recommendation.
- Which would be safer on herbaceous ornamentals? And Why? Surflan vs XL, Pendulum 2G vs Treflan 5G, Barricade vs. Regakade; Gallery vs. Snapshot TG?
- You need to control mostly broadleaf weeds in a woody landscape bed. Which herbicide(s) have the greatest likelihood of controlling these weeds -- Gallery, Surflan, Ronstar, Snapshot TG, or Treflan? Explain your answer (s). How would your answer change for annual bedding plants?