Weed Management in Christmas Trees

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Presentation Outline

- Importance of weeds
  - Definition of a weed
  - Weed classification
- Current herbicide options
  - Preemergence
  - Postemergence
- Future research chemicals
  - Preemergence
  - Postemergence
- Weed identification quiz
Importance of Weeds

What is a Weed?
Why to Control Weeds?
What is a Weed?

Common definitions:
- Plant whose virtue has not been discovered
- Plant growing where it is not wanted
- Plant out of place
- Plant that is objectionable or interferes with the activities or welfare of man (WSSA)

Monarch butterfly on milkweed
What is a Weed?
Why to Control Weeds?

- Competition
  - For water
  - Nutrients
  - Light
    ✓ leading to reduced crop growth and quality
Why to Control Weeds?

- Harbor insect and disease pests
- Interfere with pruning and harvest
  - poison ivy, brambles
- Health hazard
  - poison ivy
- Provide cover for rodents
Weed Classification
## Weed Classification

<table>
<thead>
<tr>
<th>Morphology</th>
<th>Family name</th>
<th>Growth period</th>
<th>Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>- grasses</td>
<td>- asteraceae</td>
<td>- winter</td>
<td>- terrestrial</td>
</tr>
<tr>
<td>- broadleaf</td>
<td>- poaceae</td>
<td>- summer</td>
<td>- aquatic</td>
</tr>
<tr>
<td>- sedges</td>
<td>- malvaceae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Life cycle</td>
<td>- polygonaceae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- annual</td>
<td>- leguminaceae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- biennial</td>
<td>- onagraceae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- perennial</td>
<td>- rubiaceae</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Morphology

cheeseweed/little mallow

broomesedge/poverty grass

yellow nutsedge
Can a Postemergence Grass Herbicide Control Sedges?

- Yes or No
  - No
    - A grass herbicide controls only grasses
      - Envoy plus, Select, Fusillade DX
Annuals: complete their life cycle in 1 year. Examples: annual grasses - crabgrass, foxtails, barnyard grass – annual broadleaves - pigweed, ragweed etc.
Biennials: complete life cycle in 2 years. In the first year, complete vegetative growth. In the second year, produce flowers and seeds e.g. wild carrot, etc.
Perennials: live many years by overwintering rootstocks, rhizomes, tubers, e.g. quackgrass, field bindweed, goldenrod, smooth bedstraw, etc.
Yes and No

- Yes: some, when growing from seed
  - Quackgrass, Canada thistle, and field bindweed from seed
- No, when growing from rhizomes, tubers
  - Quackgrass, Canada thistle, and field bindweed from rhizomes
Family Name

asteraceae  poaceae  malvaceae
Family Name

polygonaceae  leguminaceae  onagraceae
Family Name

Rubiaceae
Will Herbicide “Stinger” Control Smooth Bedstraw?

☑ Yes or No
  ○ No.

☑ Why?
  ○ Bedstraw belongs to rubiaceae family
    AND
    Stinger (clopyralid) has activity only on weeds belonging to asteraceae, leguminaceae, and polygonaceae families.
Herbicides Currently in Use
Preemergence Herbicides
Preemergence Herbicides

- Preemergence herbicides kill weeds before they emerge from the soil. They kill germinating weeds and not the weed seeds.
### Preemergence Herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Product name</th>
<th>Mode of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indaziflam</td>
<td>Specticle flo, Marengo</td>
<td>Cellulose biosynthesis inhibitor</td>
</tr>
<tr>
<td>Isoxaben</td>
<td>Gallery</td>
<td>Cellulose biosynthesis inhibitor</td>
</tr>
<tr>
<td>Flumioxazin</td>
<td>Sureguard</td>
<td>Protoporphyrinogen oxidase inhibitor</td>
</tr>
<tr>
<td>Oxyflourfen</td>
<td>Goal 2XL, Goal Tender, Galligan</td>
<td>Protoporphyrinogen oxidase inhibitor</td>
</tr>
<tr>
<td>Oxadiazon</td>
<td>Ronstar 2 G</td>
<td>Protoporphyrinogen oxidase inhibitor</td>
</tr>
</tbody>
</table>
## Preemergence Herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Product name</th>
<th>Mode of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pendimethalin</td>
<td>Pendulum 3.3 EC</td>
<td>Seedling root growth Inhibitor</td>
</tr>
<tr>
<td>Oryzalin</td>
<td>Surflan AS</td>
<td>Seedling root growth Inhibitor</td>
</tr>
<tr>
<td>Trifluralin</td>
<td>Treflan</td>
<td>Seedling root growth Inhibitor</td>
</tr>
<tr>
<td>Napropamide</td>
<td>Devrinol 50 DF</td>
<td>Seedling shoot growth Inhibitor</td>
</tr>
<tr>
<td>S-metolachlor</td>
<td>Pennant Magnum</td>
<td>Seedling shoot growth Inhibitor</td>
</tr>
</tbody>
</table>
## Preemergence Herbicides

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Product name</th>
<th>Mode of action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simazine</td>
<td>Princep 4L, Princep 90 DF</td>
<td>Photosystem II Inhibitor</td>
</tr>
<tr>
<td>Atrazine</td>
<td>Atrazine 4L, Atrazine 90 DF</td>
<td>Photosystem II Inhibitor</td>
</tr>
<tr>
<td>Hexazinone</td>
<td>Velpar</td>
<td>Photosystem II Inhibitor</td>
</tr>
<tr>
<td>Hexazinone + Sulfometuron</td>
<td>Westar</td>
<td>Photosystem II + ALS Inhibitors</td>
</tr>
<tr>
<td>Oxyfluorfen + Prodiamine</td>
<td>Biathlon</td>
<td>PPO and seedling root growth inhibitors</td>
</tr>
</tbody>
</table>
Preemergence Herbicides

- Grass active
  - Surflan AS, **Pennant Magnum**, Pendulum 3.3 EC, Pendulum Aquacap, Treflan, Devrinol
- Broadleaf active
  - Atrazine, Gallery, **Gemini**, Goal 2XL, Marengo, Simazine, Specticle Flo, Sureguard, Westar, Velpar
Preemergence Herbicides

- Indaziflam
  - Marengo, Spectacle flo, Alion
- Flumioxazin
  - Sureguard, Sureguard SC
- Isoxaben
  - Gallery
Preemergence Herbicides

- Isoxaben + Prodiamine
  - Gemini
- Hexazinone + Sulfometuron
  - Westar
- Prodiamine + Oxyfluorfen
  - Biathlon
Indaziflam
Specticle FLO (Indaziflam)

- Active ingredient
  - 7.4%
- Rate/ac
  - 6 – 10 floz
- Max seasonal use rate
  - 18.5 floz
Marengo (Indaziflam)

- **Active ingredient**
  - 7.4%

- **Rate/ac**
  - 7.5 – 15.5 fl oz

- **Max seasonal use rate/ac**
  - 18.5 fl oz
- **Active ingredient**: 19.05%
- **Rate/ac**: 3.5 – 6.5 floz
- **Max seasonal use**: 10.5 floz/ac
Indaziflam

Strengths
- Broader weed control spectrum
  - Grasses and broadleaf weeds
  - Triazine resistant weeds
    - Lambsquarters, redroot pigweed etc
  - Longer weed control duration
    - 6-8 months
- Excellent crop tolerance
  - Labelled rates and species

Weaknesses
- In consistent control of Horseweed, common ragweed, yellow foxtail in CT trials.
<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Ingredient</td>
<td>51%</td>
</tr>
<tr>
<td>Flumioxazin*</td>
<td></td>
</tr>
<tr>
<td>Other Ingredients</td>
<td>49%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Active Ingredient: Flumioxazin

Other Ingredients:

Total: 100.0%

For use in container and field grown conifers (including Christmas trees) and deciduous trees, around established woody ornamentals in landscapes, to maintain bare ground non-crop areas, conifer and poplar re-forestation sites, and dormant turfgrass.
Flumioxazin

- Over-the-top
  - Before bud-break or after hardening off
- Rate/ac
  - 8 - 12 oz/floz
- Max seasonal use
  - 24 oz/ac
    - 2 applications of 12 oz OR
    - 3 applications of 8 oz
Tolerant conifers (OTT)

- Concolor, Douglas, Fraser, Grand, Noble, Turkish, Eastern White Pine, Norway spruce, Colorado blue spruce
- BALSAM?
  - Directed/Test on small scale
Weeds Controlled

- Simazine
- Flumioxazin

**Strengths**
- Excellent broadleaf activity
  - Broader spectrum of weed control than Simazine
- Controls many grasses
- Controls emerged weeds < 2” in height
- Longer weed control duration
  - 6-7 months under ideal conditions
Isoxaben

- Tree species:
  - BF, Concolor Fir, WS, NS, CS, CBS, WP, SP
  - DF, FF?

- Weeds controlled:
  - ~60 broadleaf species
Isoxaben

- Over-the-top
  - Before bud-break or after hardening off
- Rate/ac
  - 0.66 – 1.33 lb
- Max seasonal use
  - 4 lb/ac
    - 60 d interval between applications
Isoxaben + Prodiamine

- **Over-the-top**
  - Before bud-break or after hardening off
- **Rate/ac**
  - 38 – 87 floz

### Table 2. Amount of Gemini 3.7 SC to Apply to Container and Field Grown Ornamental Plantings, and Christmas Tree Farms

<table>
<thead>
<tr>
<th>Amount to Apply (Broadcast)*</th>
<th>When to Apply</th>
<th>Comments/Instructions</th>
</tr>
</thead>
</table>
| 38 - 87 fl. oz/acre or 0.9 - 2.0 fl. oz./1,000 sq ft | In fall or spring before weeds germinate or after weeds are removed. | • Use the higher rate for longer control.  
• Gemini 3.7 SC can be applied more than once per year as long as the total amount of product applied does not exceed 87 fl. oz./acre (2.5 lbs. active ingredient/acre) per year. |
Hexazinone + Sulfometuron

- **Active Ingredients**
  - Hexazinone: 68.6%
  - Sulfometuron methyl: 6.5%

- **Rate/ac**
  - 6-12 oz
Hexazinone + Sulfometuron

- Tree species
  - Fraser Fir, Douglas Fir, Colorado blue spruce, Scotch pine, White pine
  - Balsam Fir - No injury (2016 Trials)

- Colorado spruce
  - Injured in CT trials.
Hexazinone + Sulfometuron

- **Suppression**
  - Yellow nutsedge, quackgrass, field horsetail, wild carrot, goldenrod, Canada thistle, pink sorrel

- **Caution**
  - Calibration
  - Tree age
Oxyflorfen + Prodiamine

Preemergence control of weeds in field and container ornamentals, grounds maintenance and other specified non crop areas. Also for evergreens (broadleaf and needle) limited to Christmas tree farms and conifer farms.

ACTIVE INGREDIENTS:
- Oxyflorfen: 2.00%
- Prodiamine: 0.75%

OTHER INGREDIENTS:
- 97.25%

TOTAL: 100.00%
Oxyflorfen + Prodiamine

- Granular herbicide
- Rate/ac: 100 lb
- Controls grassy and broadleaf weeds
  - Crabgrass, green foxtail, yellow foxtail, barnyardgrass, goosegrass, fall panicum, horseweed, pigweed, sowthistle, shepherd’s purse

FIELD GROWN ORNAMENTALS, CHRISTMAS TREE AND CONIFER FARMS

Apply Biathlon at 100 pounds per acre per application. Apply immediately after planting or in the spring prior to weed seed germination or weed removal. A maximum of two applications may be made per growing season. Do not reapply at less than 3 month intervals for field grown ornamentals and less than 2 month intervals for Christmas trees. For conifer seedlings do not apply more than 100 pounds per acre per season. Biathlon is not recommended for use on bare root stock if irrigation is not available.
Current Postemergence Herbicide Options
Postemergence broadleaf herbicides

- Clopyralid
  - Stinger 3L, Lontrel 3L, Clopyralid 3
- Triclopyr
  - Garlon 3 A, Triclopyr 3 A
- Glyphosate
  - Roundup Original, Roundup Pro 4L, others
- **Labelled species**
  - BF, FF, DF, GF, NF, BS, WP
- **Postemergence control:**
  - Weeds up to 6” tall or 5 leaf
    - asteraceae
    - leguminaceae
    - polygonaceae
Clopyralid

- Will not control
  - weeds larger than 6 inch in size
  - grasses and sedges
  - many biennial and perennial weeds
  - woody vines
Clopyralid

- **Rate/ac**
  - 8 – 10.7 floz

- **Cost/ac (banded on 3’ row)**
  - Varies with manufacturer, product rate, packing size, and application method

<table>
<thead>
<tr>
<th>1 floz</th>
<th>Cost/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1.31</td>
<td>$16-21 Or $8-10.5</td>
</tr>
<tr>
<td>$2.50</td>
<td>$23-30 Or $12-15</td>
</tr>
<tr>
<td>$2.00</td>
<td>$10.5-14 Or $5.3-7.0</td>
</tr>
</tbody>
</table>
Will Clopyralid Control Mile-A-Minute?

Polygonaceae
BF, FF, BS, WS are more tolerant than DF and WP

Rate/ac
- 2-5 pints (0.75-1.75 lb ai)/acre.

Application timing
- Late summer or early fall after conifer terminal growth has hardened off.
Triclopyr

- Weeds controlled
  - bindweed, burdock, curly dock, Canada thistle, dandelion, plantains, white clover, wild lettuce.

Canada thistle  Virginia creeper  Wild grape  mugwort
Glyphosate

SPECIMEN LABEL

Monsanto

Roundup® Original
HERBICIDE

*Glyphosate, N-(phosphonomethyl)glycine, in the form of its isopropylamine salt. 41.0%
OTHER INGREDIENTS: 59.0%

100.0%

* Contains 480 grams per litre or 4 pounds per U.S. gallon of the active ingredient, glyphosate, in the form of its isopropylamine salt. Equivalent to 356 grams per litre or 3 pounds per U.S. gallon of the acid, glyphosate.

INGREDIENTES

INGREDIENTE ACTIVO:
*Glifosato, N-fosfonometilglicina, en forma de su sal de isopropilamina. 41.0%
OTROS INGREDIENTES (incluyendo surfactante). 59.0%
100.0%

*Contiene 480 gramos por litro o 4 libras por galón del ingrediente activo glifosato, en forma de su sal de isopropilamina. Equivalente a 356 gramos por litro o 3 libras por galón del ácido glifosato.

Credit® 41
Non-Selective Herbicide

For use in certain cropping systems, including Roundup Ready® Alfalfa, Canola, Corn, Cotton, Soybeans, and Sugar Beets; For reduced tillage and fallow systems; and many noncrop areas.

ACTIVE INGREDIENT:
*Glifosato, N-fosfonometilglicina, en la forma de su sal de isopropilamina. 41.0%
OTHER INGREDIENTS: 59.0%
TOTAL: 100.0%

*Contains 480 grams per litre or 4 pounds per U.S. gallon of the active ingredient glyphosate, in the form of its isopropylamine salt.
Glyphosate

1.0 INGREDIENTS

ACTIVE INGREDIENT:
*Glyphosate, N-(phosphonomethyl)glycine,
in the form of its potassium salt.......................... 48.8%

OTHER INGREDIENTS:..................................... 51.2%

*Contains 660 grams of the active ingredient glyphosate, in the form of its potassium salt, per liter or 5.5 pounds per U.S. gallon, which is equivalent to 540 grams of the acid, or 500 pounds per U.S. gallon (39.8% by weight).
32 floz of Roundup original = 21 floz of Roundup powermax.

Calculate required amount based on the acid component not the active ingredient component.
Max seasonal use rate
(roundup original)
- 2 qts/ac true firs
- 1.0 - 1.5 qts/ac (DF, WP)

Semi-directed applications
- Minimize contact to basal 12-14 inch
- 30 GPA solution
  - Fall application
Glyphosate

- Weed species shift
  - Species naturally tolerant to glyphosate
- Resistant Weeds
  - Horseweed, common ragweed, pigweeds
Postemergence Control of Grassy Weeds

- Fluazifop
  - Fusilade DX
  - Ornamec
- Clethodim
  - Select, Envoy, Envoy plus
Postemergence Control of Grassy Weeds

- **Fusilade**
  - 24 floz/app
  - Two apps/yr
  - 48 floz/yr

- **Envoy Plus**
  - 16-32 floz/app
  - Two apps/yr
  - 64 floz/yr
Future Research Chemicals

Preemergence Herbicides
Cleantraxx (penoxsulam + oxyfluorfen)

<table>
<thead>
<tr>
<th>Group</th>
<th>Active Ingredient</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>penoxsulam: 2{(2,2-difluoroethoxy)}N-{5,8-dimethoxy[1,2,4] triazolo[1,5-c]pyrimidine}</td>
<td>0.85%</td>
</tr>
<tr>
<td>14</td>
<td>oxyfluorfen: 2-chloro-1{(3-ethoxy-4-nitrophenoxyl}4{(trifluoromethyl} benzene</td>
<td>40.31%</td>
</tr>
<tr>
<td></td>
<td>Other Ingredients</td>
<td>58.84%</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100.00%</td>
</tr>
</tbody>
</table>

Trademark of The Dow Chemical Company (“Dow”) or an affiliated company of Dow
Cleantraxx (penoxsulam + oxyfluorfen)?

- Pre and postemergence control
  - ~ 70 weed species
    - Grasses, broadleaf weeds, and woody tree seedlings
      - 4 leaf or 4” tall
    - Field bindweed suppression

- Pre rate/ac
  - 1.5-3.0 pt

- Post rate/ac
  - 3.0- 4.5 pt
Lumax (atrazine + s-metolachlor + mesotrionl)?

Atrazine @ 1-2 lb ai/ac
S-Metolachlor @ 4.8 lb ai/ac
Mesotrionl @ 0.75 lb ai/ac
<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Cost per Container</th>
<th>Cost per Acre (3' band application)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simazine</td>
<td>~ $60/2.5 gal</td>
<td>$6 - 9</td>
</tr>
<tr>
<td>Surflan AS</td>
<td>~ $167/2.5 gal</td>
<td>$17 - 22</td>
</tr>
<tr>
<td>Pennant Magnum</td>
<td>~ $224/gal</td>
<td>$19 - 24</td>
</tr>
<tr>
<td>Goal 2XL</td>
<td>~ $179/2.5 gal</td>
<td>$14 - 18</td>
</tr>
</tbody>
</table>

Herbicide costs were adapted from Kellysolutions.com
Preemergence Herbicide Costs

- **Cost**
  - Westar
    ~ $692/15 lb
  - Sureguard
    ~ $745/5 lb
  - Gallery 75 DF
    ~ $100/lb
  - Lumax
    ~ $190/2.5 gal

- **Cost/ac (banded application)**
  - Westar @ 6-12 oz
    $5.75 - 11.5
  - Sureguard @ 10-12 oz
    $31 - 37
  - Gallery 75 DF @ 0.66-1.0 lb
    $22 - 33
  - Lumax @ 3-4 qt
    $19 - 25

Herbicide costs were adapted from Kellysolutions.com
Preemergence Herbicide Costs

- Cost
  - Specticle flo
    ~ $1550/gal
  - Marengo SC
    ~ $1115/0.5 gal
  - Alion
    ~ $420/1qt

- Cost/ac (3’ banded application)
  - Specticle flo @ 6-10 floz
    $24 - 40
  - Marengo @ 6-10 floz
    $35 - 58
  - Alion @ 3.5-6 floz
    $15 - 26

Herbicide costs were adapted from Kellysolutions.com
Potential Postemergence Herbicides
Potential Postemergence Herbicides

Callisto® Herbicide

- Active Ingredient: Mesotrione (CAS No. 104208-82-8) 40.0%
- Other Ingredients: 60.0%
- Total: 100.0%
- Contains 4 lb of active ingredient mesotrione per gallon.

Octane® 2% SC Herbicide

- Active Ingredient: Pyraflufen ethyl [ethyl 2-chloro-5-(4-chloro-5-difluoromethyl)-1-methyl-1H-pyrazol-3-yl]-4-fluorophenoxyacetate] 0.1%
- Other Ingredients: 99.9%
- Total: 100.0%
- Contains 0.177 lb pyraflufen ethyl per gallon (20 grams per liter).

Specimen Label

Pindar GT Herbicide

- Active Ingredient:
  - [4:2,2']-dichloroethoxy]-4-(3,4-dichloro-2-butyl)toluene: 0.85%
  - Benzenesulfonamide: 42.51%
  - Other Ingredients: 56.64%
- Total: 100.0%

WideMatch® Herbicide

- Trademark of Dow AgroSciences LLC

Dow AgroSciences
What plant is this?

A. Honeysuckle
B. Oriental bittersweet
C. Wild grape
D. Virginia creeper
Answer: Wild grape
What plant is this?

A. Honeysuckle
B. Oriental bittersweet
C. Trumpet creeper
D. Virginia creeper
Answer: Virginia creeper
What plant is this?

A. Mile-a-minute  
B. Oriental bittersweet  
C. Trumpet creeper  
D. Virginia creeper
Answer: Oriental bittersweet
What plant is this?

A. Common burdock
B. Curly dock
C. Common ragweed
D. Horseweed
Answer: Horseweed
Weed Identification Quiz

What plant is this?

A. Evening primrose
B. Asiatic dayflower
C. Pink sorrel
D. Cocklebur
Answer: Asiatic dayflower
Weed Identification Quiz

What plant is this?

A. Common burdock
B. Horsenettle
C. lambsquarters
D. Cocklebur
Answer: Horsenettle
Weed Identification Quiz

What plant is this?

A. Milkweed
B. Canada thistle
C. Common ragweed
D. Horseweed
Answer: Common ragweed
Weed Identification Quiz

What plant is this?

A. Yellow toadflax
B. Common ragweed
C. Butter and eggs
D. Kochia
Answer: Yellow toadflax
What plant is this?

A. Canada thistle  
B. Common ragweed  
C. Horseweed  
D. Wild radish
Answer: Canada thistle
Weed Identification Quiz

What plant is this?

A. Canada thistle
B. Common ragweed
C. Horseweed
D. Wild radish
Answer: Wild radish
Online

- Identifying Weeds in Christmas Trees
  [http://www.ipm.msu.edu/agriculture/christmas_trees/identifying_weeds_in_christmas_trees](http://www.ipm.msu.edu/agriculture/christmas_trees/identifying_weeds_in_christmas_trees)

Books

- Weeds of the Northeast – Cornell Press
- Weeds of the South - University of Georgia Press