What is a weed?

- A plant that:
  - Interferes with growth of desirable plant
  - Persistent
  - Negatively affects human activity
Is this a weed?
Is this a weed?
Why do weeds occur?

Competition for limited resources...
Why do weeds compete well?

- Broadleaves
  - Prolific seed head production
  - Prostrate Growth
  - Tap Root
How to manage weeds:

- Chemical
- Mechanical
- Biological
- Cultural
Integrated Weed Management (IWM)
Integrated Weed Management (IWM)

- Chemical
- Mechanical
- Biological
- Cultural
Primary Cultural Practices

- Mowing
- Fertilization
- Irrigation
Turfgrass Cultural Practices

• Mowing

• Irrigation

• Fertilization
Summary of Presentation!

- Healthy Turf = Less Weeds
- If you have to spray = make it count

Cultural practices reduce weed encroachment.
They will not kill weeds.
Weeds

- Grasses
- Broadleaves
- Sedges
Grasses

- (Monocots)
  - One cotyledon
  - Two-ranked leaves
  - Parallel veins
  - Basal meristem
Grasses

• annual bluegrass
  • *Poa annua*
• common bermudagrass
  • *Cynodon dactylon*
• bahiagrass
  • *Paspalum notatum*
• smooth crabgrass
  • *Digitaria ischaemum*
• southern sandbur
  • *Cenchrus echinatus*
Broadleaves

• (Dicots)
  • Two cotyledons
  • Netted veins
  • Meristem is terminal bud
Broadleaves

- spotted spurge
  - *Euphorbia maculata*
- purslane
  - *Portulaca oleracea*
- horseweed
  - *Coryza canadensis*
- moss verbena
  - *Verbena tenuisecta*
- white clover
  - *Trifolium repens*
Sedges

- Three-ranked leaves
- Triangular cross-section
Sedges

- yellow nutsedge
  - *Cyperus esculentus*
- green kyllinga
  - *Kyllinga brevifolia*
- purple nutsedge
  - *Cyperus rotundus*
Life Cycles

Summer Annuals

Winter Annuals

Biennials

Perennials

Spring  Summer  Fall  Spring  Summer  Fall  Spring  Summer  Fall
### Annuals

**Summer Annuals**
- Germinate in the spring
- Seed and die in the fall

**Winter Annuals**
- Germinate in the fall
- Seed and die in the spring
Annuals

• Fiberous (branching)
  • Maximize surface area
  • Nutrient uptake (not storage)
Perennials

- More than two growing seasons
- Tap root
  - Nutrient storage
• Two growing seasons

Rosettes are often biennials:
common mullein

1\textsuperscript{st} growing season

2\textsuperscript{nd} growing season
Herbicides:

- Chemicals used to control weeds
  - Suppress, interrupt growth, or kill.

Advantages:
- Less labor

Options:
- Pre-emergence
- Post-emergence
- Selective & Non-selective

Disadvantages:
- Health and Environmental risks
- Desired plant injury possible
- May persist in soil
- Resistance possible
Herbicide Types:

- Pre-emergence
  - Non-selective
  - Selective
- Post-emergence
  - Non-selective
  - Selective
Herbicide Types:

**Pre-emergence Herbicides**

- Effective use of pre-emergence:
  - Control germinating weeds

  - **Timing**
  - **Coverage (water-in)**

![Diagram showing pre-emergence barrier and weed seeds prior to germination]
Pre-emergence Herbicide Timing

- Prior to weed seed germination
- Base of chemical weed control program
- Control annual grasses and certain annual weeds
- Generally effective for 3 to 6 months
Crabgrass (*Digitaria sp*)

**Application Timing**

• Germination reported to occur when:

  • Soil temps are:
    • 60°F for 3-5 days as ¼” level
    • 57 to 64°F at a 1” depth
    • 73°F at a 1” depth = lots of germination

• Air temperature models:
  • 200 GDD at 50°F base
How to calculate GDD?

• Example:
  • **Crabgrass Germination Timer (GDD50) range of 200 to 600 GDD**

  • GDD = (Max daily temp + Min daily temp) / 2 - base temp

  • Example 1:
    • March 1st High temp = 55F; Low temp 40F
    • (55 + 40)/2 = 47.5
    • 47.5 – base temp (50) = -2.5; negative numbers = zero GDD’s

  • Example 2:
    • March 1st High temp = 60F; Low temp 45F
    • (60 + 45)/2 = 52.5
    • 52.5 – base temp (50) = +2.5; negative numbers = 2.5 GDD’s

• When total > 200 GDD – Crabgrass will likely start germinating!

Dr. Ron Calhoun – Michigan State University
How to calculate GDD?

• 2016 Corvallis data:
  • 200 GDD (base 50) reached on April 23\textsuperscript{rd} 2016

• Need to apply pre-emergent at least 2 weeks before:

• Lewis-Brown Farm
  • May 16\textsuperscript{th} 2 leaf stage
Phenological Timing

Jim Brosnan, Ph.D. @UTTurfWeeds · 6h
Forsythia in bloom means crabgrass is on its way. Act accordingly. #PRE #weeds #TNturf
Crabgrass (*Digitaria sp*)

- Summer Annual

- Pre-emergent Herbicides:
  - Pendimethalin
    - *(Pendulum)*
  - Prodiamine
    - *(Barricade)*
  - Dithiopyr
    - *(Dimension)*
  - Some early post emergence (1 tiller)
Herbicide Types:
Pre-emergence Herbicides
Herbicide Types: **Pre-emergence Herbicides**

- Isoxaben (Gallery)
  - Broadleaves
- Mesotrione (Tenacity)
  - Annual grasses
  - Annual bluegrass
  - Some broadleaves
- Pendimethalin (Pendulum)
  - Annual grasses
  - Some broadleaves
- Dithiopyr (Dimension)
  - Summer annuals
  - Crabgrass
Natural Control (Frost in this case)

Scott Schurman @KCCGROUNDS · Sep 13
First frost of the season = dead crabgrass.
Herbicide Types: **Pre-emergence Herbicides**

- Non-selective pre-emergence
  - Spring
    - Pendulum (pendimethalin)
  - Inter-seed

Knotweed – Summer annual

Fall – After 1st frost
Herbicide Types: **Pre-emergence Herbicides**

- Non-selective pre-emergence
  - Spring
    - Pendulum (pendimethalin)
  - Inter-seed

- Knotweed – Summer annual
- Fall – After 1st frost
Herbicide Types:

• Pre-emergence

• Post-emergence

• Non-selective

• Selective
Post-emergent herbicides:

• Spray healthy, actively growing weeds
  • Best not to mow before or after
  • Irrigate prior to, but not after

• Spray at the appropriate time
  • Depends on life cycle
  • Spray twice for perennial weeds
Herbicide Types:
Post-emergence Herbicides

- Non-selective
  - Glyphosate (Roundup)
  - Glufosinate-ammonium (Finale)
  - Pelargonic-acid (Scythe)
  - Diquat
Contact

• Contact
  • Destroy only the plant tissue in contact with
  • Faster acting (good “burn down”)


Herbicides

- Contact
  - Good “burn down”
Grasses, Broadleaves and Sedges

• Contact
  • Effective on...
    • Annuals
    • Spurge
    • Purslane
    • Horseweed
  • Ineffective on...
    • Perennials
    • Sedge
    • Bermudagrass
    • White clover
Systemic

- Systemic
  - Translocated through the plant
  - Slower acting
  - More effective than contact
Importance of rotations ...

- Glyphosate (Roundup)
  - Glyphosate resistant crops...
    - Soybean
    - Corn
    - Cotton

- Not rotating chemistries has resulted in...
  - Resistant weeds
    - Palmer amaranth
    - Horseweed
Importance of rotations

• Some numbers:
  • 1957 –  
    • 1st herbicide resistant weed recorded (2,4-D)
  • 155 – # of weeds w/ herbicide resistance in the USA
  • 16  – # of weeds in the USA resistant to glyphosate
    • (United Soybean Board)
  • 250 weeds species w/ herbicide resistance globally
    • (HRAC)
  • Practice Integrated Pest (Weed) Management (IPM) or (IWM)
    • i.e. = Do not rely on one control method

Spreading dayflower
(Commelina diffusa)
Importance of rotations

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 1</th>
<th>3 years later</th>
<th>After spraying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before spraying</td>
<td>After spraying</td>
<td>Before spraying</td>
<td>After spraying</td>
</tr>
<tr>
<td><img src="Image1" alt="Plant before spraying" /></td>
<td><img src="Image2" alt="Plant after spraying" /></td>
<td><img src="Image3" alt="Plant after spraying" /></td>
<td><img src="Image4" alt="Plant after spraying" /></td>
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</tbody>
</table>
Herbicide Types:

• Pre-emergence

• Post-emergence
  • Non-selective
  • Selective
Selective Post-emergence Herbicides

• Broadleaf
  • 2,4-D
  • Dicamba
  • MCPP
  • Triclopyr
Selective Post-emergence Herbicides

- Grasses
  - MSMA
    - Summer annuals
  - Foramsulfuron (Revolver)
    - Cool-season grasses
  - Fluazifop (Fusilade)
  - Mesotrione
    - Warm-season grasses
  - Quinclorac (Drive)
    - Crabgrass – maybe up to 3-leaf stage
  - Tenacity
    - Bentgrass out of ryegrass or bluegrass
Selective Post-emergence Herbicides

• Sedge
  • Halosulfuron (Sedgehammer)
  • Sulfosulfuron (Certainty)
  • MSMA
If you spray = Make it count

• Consider herbicide formulation

• Sprayer set up

• Spray healthy, actively growing weeds

• Spray at the appropriate time
Herbicide formulation

- Amine
- Ester
Herbicide formulation

• Amine
  • Slow absorption
  • Low solubility in waxes
  • High solubility in water
  • Low crop injury potential
  • Preferred if temperatures are > 85 F
Herbicide formulation

• Ester
  • Fast absorption
  • High solubility in waxes
  • Low solubility in water
  • Preferred if temperatures are < 85 F

• High crop injury potential!
• Volatilize in warm weather.
  • Avoid spraying plants are producing leaves
  • **Triclopyr can especially be a concern**
Use appropriate herbicide formulation

Sprayer set up properly
- Water carrier – correct pH?
- Adjuvants?

Spray healthy, actively growing weeds
- Best not to mow before or after
- Irrigate prior to, but not after

Spray at the appropriate time
- Depends on life cycle
- Spray twice for perennial weeds

If you spray = Make it count
Perennial Broadleaves

- Spring Applications –
  - Not the ideal time
False dandelion

- Apply in the fall (October 4 = 10/4 Good Buddy)
Perennial Broadleaves

• Fall applications best!
• May need 2 applications.

10 – 4
good buddy!
• Typical herbicide to manage **weeds** in established turfgrass?

• Nonselective?
  • or
• Selective?
• Typical herbicide to manage **perennial weeds** in turfgrass?

• Pre-emergence?
  • or
• Post-emergence?
Review

• Typical herbicide to manage **crabgrass** in turfgrass?
  • Pre-emergence?
    • or
  • Post-emergence?
Standard 3-way mix
(2,4-D + MCPP + Dicamba)

• Best to apply in the late summer, early fall
• Sometimes 2 applications needed
False or Catsear Dandelion
(*Hypochoeris radicata*)

- Perennial (Spring seeding)
- Solid stem
- 3-way Trimec Herbicide
  - Repeat applications often necessary
Broadleaf Plantain
(Plantago major)

- Perennial
- 3-way Trimec Herbicide
  - Repeat applications often necessary
Common Dandelion  
(*Taraxacum officinale*)

- Perennial
- Hollow stem
- 3-way Trimec Herbicide
  - Usually good control with one Fall application
Spotted Spurge

(*Ephorbia maculata*)

- Summer Annual
- Germinates @ 50 °F, dies from first frost
- Early in season best.
- 3-way Trimec Herbicide
  - Repeat applications may be necessary
Mouseear Chickweed
(Cerastium vulgatum)

• Perennial
• Fairly easy to control
• Timing is flexible
• 3-way Trimec Herbicide
  • Repeat applications often necessary
White Clover
*(Trifolium repens)*

- Perennial
- Grows well in N- Deficient Soils
- Use mixtures that include one of the following:
  - Clopyralid
  - Fluroxypyr
  - Triclopyr
  - Carfentrazone
    - Repeat applications often necessary
Black Medic
*(Medicago lupulina)*

- Treat in Spring
  - (Annual)
- Treat before or at early flowering stage
- Use mixtures including one of the following:
  - Clopyralid
  - Fluroxypyr
  - Triclopyr
  - Carfentrazone
Woodsorrel
(*Oxalis corniculata*)

- Perennial
- Can be difficult to control.
- Fall timing best.
- Repeat application often necessary.
- Use mixtures with:
  - Triclopyr
English Daisy

*(Bellis perennis)*

- Perennial
- Can be difficult to control
- Fall timing absolutely essential!
- Repeat application often necessary
- Mixtures should include one of the following:
  - Dicamba
  - Clopyralid
  - Fluroxypyr
  - Triclopyr
Yarrow

• Two application necessary
• Fall timing best
• Use mixtures with:
  • Triclopyr
Goatsheads
(Puncture Vine)

• Summer annual
  • Germinates in the late spring/early summer
  • Estimated 200 to 5000 seeds per season

• Post-emergence in lawns:
  • Triclopyr
  • Sulfentrazone
  • Dicamba
  • 2,4-D
Summary:

- Dense turf =
  - Less weeds

- If you have to spray = Make it count
Perennial Weeds

- Apply in the fall (October 4 = 10/4 Good Buddy)
- May need two applications to eradicate weeds
Any Questions?

Turfgrass
Weed Management

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