1. Mark Shour – Iowa State University PSEP, mshour@iastate.edu, 515-294-5963
   a. Worker Protection Standard
      i. PERC website: http://pesticideresources.org/wps/doesitapply.html
   b. Recognition of Sensitive Areas
      i. Protecting bees from pesticides – ENT 0045
         https://store.extension.iastate.edu/product/Protecting-Bees-from-Pesticides
      ii. Pesticides in the nation’s streams and ground water, 1992-2001
         https://pubs.usgs.gov/circ/2005/1291/
         https://pubs.acs.org/doi/10.1021/es5025367
      iv. How to keep herbicides out of groundwater and surface water. Christina Curell
         http://msue.anr.msu.edu/news/how_to_keep_herbicides_out_of_groundwater_and_surface_water_1
         https://p2infohouse.org/ref/20/19700.htm

<table>
<thead>
<tr>
<th>Risk of groundwater contamination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low risk</td>
</tr>
<tr>
<td>High risk</td>
</tr>
</tbody>
</table>

**Pesticide characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water solubility</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soil adsorption</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Persistence</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

**Soil characteristics**

<table>
<thead>
<tr>
<th></th>
<th>Fine clay</th>
<th>Coarse sand</th>
</tr>
</thead>
<tbody>
<tr>
<td>Texture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organic matter</td>
<td>High content</td>
<td>Low content</td>
</tr>
<tr>
<td>Macropores</td>
<td>Few, small</td>
<td>Many, large</td>
</tr>
<tr>
<td>Depth to groundwater</td>
<td>100 feet or deeper</td>
<td>20 feet or less</td>
</tr>
</tbody>
</table>

**Water volume**

<table>
<thead>
<tr>
<th></th>
<th>Small volumes at infrequent intervals</th>
<th>Large volumes at frequent intervals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rain, irrigation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2. Adam Thoms, Iowa State University Horticulture-Turfgrass, athoms@iastate.edu, 515-294-1957

a. New pesticides and their labels

1. Names
   a. Trade name – for marketing; registered with US Patent Office
   b. Common name – active ingredient
   c. Chemical name – actual chemical composition

2. Active versus inert ingredients
   a. Active – what controls the pest; labeled as percent of weight
   b. Inert – aids in effectiveness, safety to applicator, extends shelf life, acts as solvent, limits foaming, etc.

3. Signal words – Caution, Warning, Danger – based on acute toxicity

4. Toxicity units
   a. ppt – parts per thousand = 1 drop in 8 ounces
   b. ppm – parts per million = 1 drop in 40 gallons
   c. ppb – parts per billion = 1 drop in small pool
   d. ppT – parts per trillion = 1 drop in a pond

<table>
<thead>
<tr>
<th></th>
<th>Highly Toxic</th>
<th>Moderate Toxic</th>
<th>Low Toxicity</th>
<th>Very Low Toxicity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Danger-Poison</td>
<td>Warning</td>
<td>Caution</td>
<td>Optional= Caution</td>
</tr>
<tr>
<td>Acute Oral (LD₅₀)</td>
<td>≤ 50 mg/kg</td>
<td>&gt; 50- 500 mg/kg</td>
<td>&gt; 500 – 5000 mg/kg</td>
<td>&gt; 5000 mg/kg</td>
</tr>
<tr>
<td>Inhalation (LC₅₀)</td>
<td>≤ 0.05 mg/L</td>
<td>&gt; 0.05 -0.5 mg/L</td>
<td>&gt; 0.5- 2.0 mg/L</td>
<td>&gt;2.0 mg/L</td>
</tr>
<tr>
<td>Dermal (LD₅₀)</td>
<td>≤ 200 mg/L</td>
<td>&gt; 200- 2000 mg/L</td>
<td>&gt;2000-5000 mg/L</td>
<td>&gt; 5000 mg/kg</td>
</tr>
<tr>
<td>Primary Eye Irritation</td>
<td>Corrosive or irritation ≥ 21 d</td>
<td>Clearing in 8-21 d</td>
<td>Clearing ≤ 7 d</td>
<td>Clearing less than 1 d</td>
</tr>
<tr>
<td>Primary Skin Irritation</td>
<td>Corrosive (tissue breakdown/scar)</td>
<td>Severe irritation at 72 h</td>
<td>Moderate irritation at 72 h</td>
<td>Mild or slight irritation at 72 h</td>
</tr>
</tbody>
</table>

5. Toxicity of commonly used herbicides
   a. atrazine – 1869 to 3090 mg/kg
   b. 2,4-D – 805 (salt) or 700 (ester) mg/kg
   c. dicamba – 4600 mg/kg
   d. glyphosate > 5000 mg/kg
   e. imazapyr > 5000 mg/kg
   f. oryzalin >10,000 mg/kg
   g. paraquat – 129 to 157 mg/kg
   h. triclopyr – 692 mg/kg

6. Toxicity of commonly used substances
   a. Aspirin – 50 to 500 mg/kg
   b. Caffeine – 50 to 500 mg/kg
   c. Capsicum – 500 to 5000 mg/kg
   d. Ethyl alcohol – 5000 mg/kg
   e. Nicotine (tobacco) – 0.5 to 1.0 mg/kg
   f. Table salt – 500 to 5000 mg/kg
   g. Theobromine (in chocolate) – 50 to 5000 mg/kg

7. Label basic mistakes
   a. Watch temperature and mowing heights
   b. Check use rates – ounces/1000ft², pint/ acres, g/1000ft²
   c. Check for additives – MSO, COC, adjuvants etc.
   d. Make note of clipping restrictions
   e. Irrigation instructions?
   f. Increase droplet size if possible
   g. Don’t spray with wind
   h. Watch dripline of trees – some toxic to tree roots
8. Nonsystemic/contact fungicides
   a. Applied to foliage to prevent or halt infection by forming a protective barrier on the surface
   b. Good disease control; resistance not a problem
   c. Must be re-applied due to weathering, photolysis, mowing

9. Systemic fungicides
   a. External barrier plus internal protection – translocation
      i. Acropetal – upward movement of pesticide in plant
      ii. Basipetal – downward movement in a plant
   b. Can persist in plant, low concentrations used, lasts 3-4 weeks
   c. Pathogen resistance can develop; costly

10. New pesticides in 2018
    a. Sure Power selective herbicide
       i. 2,4-D, triclopyr, fluroxypyr, flumioxazin
       ii. Multiple turf sites for hard to control weeds such as thistle, white clover, wild violet, and yellow nutsedge
    b. Secure Action fungicide
       i. fluazinam and acibenzolar
       ii. Induces host plant resistance
       iii. Improvement of dollar spot control; also for anthracnose, brown patch, leaf spot, red thread, snow mold, pink patch, stem rust, algal scum, bacterial wilt
    c. Dismiss NXT herbicide
       i. carfentrazone and sulfentrazone
       ii. multiple turf sites
       iii. much reduced phytotoxicity compared to Certainty and Celero

11. New pesticides for 2019
    a. Arylex – halaxifen-methyl
    b. Defender – florasulam
    c. Relzar – halaxifen-methyl and florasulam
    d. GameOn – halaxifen-methyl, 2,4-D, fluroxypyr
    e. SwitchBlade – fluroxypyr, dicamba, halaxifen-methyl
    f. Vexis – pyrimisulfan and penoxsulam

b. Warm-season grassy weeds
   i. Goosegrass – *Eleusine indica*
      1. https://blogs.k-state.edu/turf/tag/goosegrass/
   ii. Bermudagrass – *Cynodon dactylon*
   iii. Windmill grass – *Chloris verticillata*
      1. https://www.extension.iastate.edu/turfgrass/blog/windmill-grass-chloris-verticillata
   iv. Nimblewill – *Muhlenbergia schreberi*
      1. https://extension.psu.edu/nimblewill-muhlenbergia-schreberi
   v. General articles on weed control:
      1. https://www.extension.iastate.edu/turfgrass/weed-control-home-lawns
      2. https://store.extension.iastate.edu/product/4383
      3. https://store.extension.iastate.edu/Product/14892
3. Donald Lewis, Iowa State University Entomology, drlewis@iastate.edu, 515-294-1102 – Ant control on golf greens and ornamental beds

4. Tim Van Loo, Iowa State University Athletics Grounds Program Coordinator, vanlooti@iastate.edu, 515-294-3662 – Growth regulators on athletic fields
   b. https://sportsturfonline.com/2017/05/02/why-every-sports-turf-manager-should-consider-pgrs/

5. Dave Minner, former Iowa State University Turfgrass Specialist, dminner@iastate.edu – Mole control techniques

6. Jesse Randall, former Iowa State University Extension Forester, randallj@iastate.edu – Evergreen disease management
   a. https://store.extension.iastate.edu/Product/5005
   c. https://hortnews.extension.iastate.edu/pine-wilt