The purpose of this document is to consolidate current integrated approaches to turfgrass management in Virginia. The goals are: 1) to form a general working definition of Integrated Pest Management (IPM) for turfgrass management, and 2) to develop a system of assessing how well turf managers adopt IPM guidelines, and if their operations have implemented enough core practices to qualify them as "IPM Practitioners" under these guidelines.

Growers should use this document and its sub-headings as a checklist of possible IPM practices. Growers should count only the activities they perform in their turfgrass pest management practices and aim to be compliant with 80% of the activities listed below.

This document is intended to help turfgrass managers identify areas in their operations that possess strong IPM qualities and also point out areas for improvement. Turf managers should attempt to incorporate the majority of these specific techniques into their usual maintenance practices, especially in areas where they fall short of the 80% goal.

Funding for this project was provided by the National Institute of Food and Agriculture, U.S. Department of Agriculture, under Agreement No. 2011-51120-31171, "Management of the Southern IPM Center 2011"
# PESTS AND DISEASES OF TURFGRASS

<table>
<thead>
<tr>
<th>DISEASES</th>
<th>ARTHROPODS</th>
<th>WEEDS</th>
<th>VERTEBRATES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Major Diseases:</strong></td>
<td><strong>Major Pests:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dollar spot</td>
<td>Bluegrass billbugs</td>
<td>Annual grasses</td>
<td>Geese</td>
</tr>
<tr>
<td>Fairy rings</td>
<td>Chinch bugs</td>
<td>Annual broadleaf weeds</td>
<td>Moles</td>
</tr>
<tr>
<td>Necrotic ring spot (Fusarium blight)</td>
<td>Common armyworms</td>
<td>Biennial weeds</td>
<td>Skunks</td>
</tr>
<tr>
<td>Pythium blight</td>
<td>Sod webworms</td>
<td>Perennial weeds</td>
<td>Raccoons</td>
</tr>
<tr>
<td>Pythium root rot</td>
<td>White grubs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red thread</td>
<td>Black cutworms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rhizoctonia blight (Brown patch)</td>
<td>Bronze cutworms</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Minor Diseases:</strong></td>
<td><strong>Minor Pests:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Algae</td>
<td>Clover mites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anthracnose</td>
<td>Fall armyworms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gray snow mold (Typhula blight)</td>
<td>Greenbugs (aphids)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leaf spot (Blight/Melting out)</td>
<td>Variegated cutworms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nematodes</td>
<td>Winter grain mites</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pink patch</td>
<td>Slugs and snails</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pink snow mold (Fusarium patch)</td>
<td>Ants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Powdery mildew</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red leaf spot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rust</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Slime mold</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stripe smut</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Take-all patch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow patch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yellow turf (Downy mildew)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Annual grasses
- Annual broadleaf weeds
- Biennial weeds
- Perennial weeds
- Geese
- Moles
- Skunks
- Raccoons

- Annual grasses
- Annual broadleaf weeds
- Biennial weeds
- Perennial weeds
- Geese
- Moles
- Skunks
- Raccoons
### I. SITE SELECTION/MAINTENANCE, SOIL MANAGEMENT, FERTILIZATION, & IRRIGATION:

1. Prepare lawn site as recommended, and modify soil if, necessary, by adding topsoil, organic matter, or sand. Remove stones, wood, and other debris, as well as existing sod. Make sure surface area has good drainage.

2. If using seed, use that which is free of weed seed and of high quality and germination. If using sod, use only high quality, pest-free sod from reputable dealers.

3. Choose appropriate turfgrass cultivars for your area and proposed turf use. Consider naturally pest-resistant cultivars containing endophytic fungi. See the National Turfgrass Evaluation Program site for research results: [www.ntep.org](http://www.ntep.org)

4. Calibrate spreaders; check drop rate for seed, fertilizer, and lime.

5. Initiate weed control measures prior to seeding or resodding, if necessary.

6. Clean machinery between lawn preparation sites to avoid weed seed contamination.

7. Collect soil samples for analysis and add fertilizer, as necessary. Avoid over-fertilizing and under-fertilizing, which can make disease and pest problems worse.

8. Maintain soil pH between 6 and 7, and add lime only if necessary.

9. Irrigate as necessary based on expected precipitation and potential for disease development. Turf that is adequately irrigated is better able to fight pests and diseases. Avoid over-watering as this can make disease problems worse.

10. Wet grass thoroughly to completely wet the root zone and encourage deeper rooting, but avoid applying so much water that it runs off or forms ponds. In general, turf should be watered deeply but infrequently.

11. Perform an annual water audit on in-ground irrigation systems, and check that schedule is appropriate for seasonal conditions.

12. Allow cool season turf to go dormant during hot summer months.

13. Take steps to minimize soil compaction, including top-dressing, core aerating, limit foot and equipment traffic when soil is overly moist, rotate mowing patterns, and use flotation tires on heavy equipment.

14. Calibrate sprayers; check flow rates and nozzles prior to pesticide use. Select drift guard nozzles.

15. When applicable, remove the thatch layer to allow pesticides to penetrate the soil.

16. Avoid stressing the turf by cutting grass too closely; damage from diseases and pests can often be camouflaged or outgrown by allowing the grass to grow a little longer.

---

### II. AT-PLANTING IPM PROTOCOLS:

1. Plant seed or sod at the appropriate time of year to encourage best lawn establishment.

2. If seeding, follow recommended application rates for the specific turf species, and spread seeds evenly.

3. If lawn is newly established, apply mulch following seeding to maintain moisture and reduce erosion.

4. Irrigate lawns often enough to keep soil moist while seeds are germinating and seedlings are becoming established.

5. Moisten soil before sod is transplanted. Irrigate sod to a depth of 6 inches immediately after transplanting, and water regularly until roots become established.

6. When revitalizing an established lawn, use a slit seeder to ensure seeds reach the soil.
7. Apply a starter fertilizer NOT a general fertilizer.

### III. GENERAL PEST MONITORING, FORECASTING, & MANAGEMENT:

1. Learn the life cycles and biology of pests and use this information to develop a calendar/map of the turf area depicting when/where pest and diseases may become problematic and might need treatment.

2. Positively identify the presence of other pests and diseases using the appropriate sampling methods (e.g., soapy soil drench, flotation, traps) **BEFORE** implementing disease-management strategies, if necessary.

3. Monitor weather conditions to help predict potential pest outbreaks. Utilize degree-day models for this same purpose. Track soil temperatures to predict weed germination times.

4. Scout turfgrass for potential problems at least every 2 months, and record observations. During periods of greater risk of pest proliferation, scout more often.

5. Outline specific pest and disease management options **BEFORE** pests or diseases become an issue. Be willing to tolerate low pest populations, but be aware of treatment thresholds and when they have been reached.

6. When pesticide use is unavoidable, choose the cheapest, safest chemicals that are effective against target pests while preserving natural enemies.

7. Distinguish beneficial species from pests. Time pesticide application to least impact beneficials (e.g., spray in early morning or at night to avoid foraging bees) and to help prevent secondary pest problems.

8. Consult local diagnostic clinics if pests or diseases cannot be conclusively identified.

9. Wash mowing equipment and shoes between lawns to avoid spreading weed seed and diseases.

10. Use nonchemical control methods, if possible.

11. Keep accurate pesticide application records.

### IV. WEED MANAGEMENT:

1. Maintain dense, healthy turf as a first line of defense against weed invasion.

2. Conserve beneficial natural enemies if possible.

3. Learn to recognize and identify weeds.

4. Use exclusion tactics (e.g., washing mowers between lawns, mowing weeds prior to flowering, collecting clippings when weeds are flowering) to limit spread of weed seeds.

5. Remove small populations of weeds by pulling, digging, or hoeing rather than applying chemicals.

6. If chemical applications are necessary and weed populations are small, apply postemergent sprays (rather than preemergent sprays) to individual weeds rather than broadcast chemicals all over the turf. However, when weeds are widespread, broadcast applications may be necessary.

### V. DISEASE MANAGEMENT: Be sure to correctly identify and regularly monitor diseases **BEFORE** attempting chemical controls.

1. Learn to recognize and identify turfgrass diseases.

2. Use preventive tactics (e.g., washing mowers/shoes/etc. between lawns) to reduce spread of disease.

3. Identify and correct factors that may contribute to disease proliferation.

4. Plant combinations of two or more types of turfgrass to reduce disease potential and improve tolerance.
5. If diseases persist, replant turf using resistant cultivars.

### VI. PEST MANAGEMENT: Be sure to correctly identify and regularly monitor pest populations BEFORE attempting chemical controls.

#### a. Arthropod Management:

1. Positively identify pest species. Seek help from experts, if necessary.

2. Conserve beneficial natural enemies if possible. For example, predatory soil nematodes and Tiphi wasps feed on and help control white grubs and other pests.

3. Sample arthropod pest populations using appropriate methods.

4. Tolerate low population levels and only apply chemicals once action thresholds have been exceeded.

5. Use commercial biological controls, if available. For example, milky spore disease (controls Japanese beetles), *Bacillus thuringiensis* (controls various pests), * Beauveria bassiana* (controls various pests), and nematodes (controls various pests) are sold to control turf pests.

6. Utilize turfgrass cultivars containing endophytic fungi, which are naturally repellent to pests (e.g., sod webworms, chinch bugs, billbugs). Be sure to use fresh seed that has been stored correctly, or else the fungi may not survive.

#### b. Vertebrate Management:

1. Follow all wildlife management laws, get appropriate permits, and attempt to control only non-protected species. Hunt pests only when and where it is legal to do so.

2. Use repellents, baits, physical barriers, exclusion fencing, traps, and other deterrents to repel and/or control vertebrate pests. Combining practices increases success.

3. Mitigate skunk and raccoon damage by controlling grubs, which are an attractive food source.

4. Reduce geese population using legal methods only (e.g., dogs). Be sure to check with a local wildlife officer before enacting controls.

5. Use mechanical traps to control moles.

6. Use putrescent chemicals for birds, deer, and rabbits. Carnivore scent repellents help scare off deer, groundhogs, mice, moles, and rabbits. Be sure to rotate materials to avoid habituation to deterrents and repellents.

### VII. PESTICIDE SAFETY & EFFICACY:

1. Correctly identify and regularly monitor pest populations BEFORE attempting chemical controls.

2. When pesticides are to be utilized, choose one based on toxicity, efficacy, host specificity, reasonable cost, persistence, and safety to applicators, native pollinators, natural enemies, and the environment.

3. Purchase chemicals from a reputable dealer and utilize only those that are registered for treating turfgrass infested with the target pest or disease.

4. Read and follow all pesticide labeling explicitly, including use of appropriate personal protective equipment (PPE). Turf managers and workers should all be aware of the proper use of PPE.

5. Apply pesticides in accordance with resistance management guidelines when resistance development is an issue.

6. Maintain accurate and complete pesticide application records.

7. Make sure equipment is properly calibrated and maintained. Be sure all workers know...
how to use various types of sprayer equipment.

8. Follow proper storage and disposal guidelines. Store pesticides where they will be protected from elements, but preferably not in your home. Contact a local Extension Agent if you have waste pesticides and are unsure how to safely dispose of them.

9. Discuss with a local Extension Agent your legal obligations as they pertain to pesticide usage.

10. Attend specialized training prior to using any fumigants (e.g., programs given by Degesch America, Inc. or local Extension offices).

11. Monitor weather conditions to allow proper drying time and to avoid drift due to windy conditions.

12. When possible, make spot applications to areas that are infested/infected rather than apply pesticides all over the area.

13. Time pesticide applications to avoid impacting honeybees and native pollinators, i.e., in the very early morning, evening, or at night. It is also very important to understand the biology of the target pest and apply pesticides when they will be most effective.

**VIII. TURF MANAGER/WORKER EDUCATION:**

1. Attend local and/or regional grower meetings each year (e.g., Virginia Turfgrass Council Field Days) to learn more about pest identification and management.

2. Join local turf management association(s) and develop relationships with Cooperative Extension Agents.

3. Obtain current fact sheets and guides for turfgrass pest management from your local turf association or Extension Agents. All turf workers should be strongly encouraged to read these. See pubs.ext.vt.edu/456/456-017/Section-6_Turf-1.pdf for the latest VA Coop. Ext. Pest Management Guide – Turf.

4. Participate in local extension workshops, demonstration plots, and/or short courses on turfgrass management, pest ID, and pest management options. Encourage all workers to attend so that they can learn to distinguish harmful pests from harmless arthropods.

5. Earn a pesticide applicator license and regularly attend Pesticide Applicator Recertification Conferences.

6. Subscribe to and read newsletters and/or journals produced by local turfgrass management associations (e.g., VTC Journal is available online via the link found at www.vaturf.org).

7. Implement IPM practices not currently used in your turfgrass management program on a limited number of plots and assess their efficacy.

8. Learn to recognize beneficial insects and/or predators/parasitoids that naturally control pests and be sure workers strive to protect these natural enemies. Also, learn to recognize and protect important flowering plants in ground covers and field borders that provide habitat for beneficial organisms. “Good” weeds include yarrow, Queen Anne’s lace or wild carrot, mustard, false dandelion, and other simple white or yellow flowers.

9. Access the Virginia Turfgrass Council website at www.vaturf.org and stay up to date on current issues and information.
FOR FURTHER INFORMATION:

- Virginia Turf on Facebook, https://www.facebook.com/VtTurf

WRITTEN AND DEVELOPED BY:

Holly Gatton  h Gatton@vt.edu  IPM Project Manager
Virginia Tech Pesticide Programs (MC0409)
Dept. of Entomology
302 Agnew Hall – Building 0109
Blacksburg, VA 24061

Mike Goatley  goatley@vt.edu  Extension Turfgrass Specialist/Associate Professor
Virginia Tech
Dept. of Crop & Soil Env. Science (MC0404)
420 Smyth Hall – 185 Ag Quad Lane
Blacksburg, VA 24061

David McCall  dsmc Call@vt.edu  Research Associate
Virginia Tech
Dept. of Plant Pathology, Phys., & Weed Science
435 Old Glade Rd., 202 PMB, (MC0330)
Blacksburg, VA 24061

Rod Youngman  Former Professor/Extension Specialist
Virginia Tech

Mike Weaver  mweaver@vt.edu  Director/Professor
Virginia Tech Pesticide Programs (MC0409)
Dept. of Entomology
302 Agnew Hall – Building 0109
Blacksburg, VA 24061