Spring and Summer Lawn Management Considerations for Cool-Season Turfgrasses

Michael Goatley, Turfgrass Specialist
Shawn Askew, Turfgrass Weed Specialist
David McCall, Turfgrass Research Specialist, Plant Pathology, Physiology, and Weed Science
Peter Schultz, Extension Entomologist, Director of Hampton Roads-AREC

There is no time of year that generates as much excitement in the management of lawns and landscapes as spring. Sales of all lawn and garden products soar as many homeowners strive for the best looking lawn possible. However, the enthusiasm in returning the lawn to tip-top shape should be tempered enough so that sound agronomic and environmental management decisions are made. Smart choices now will result in a healthy, dense turf canopy that will better withstand the environmental extremes of the coming summer months.

Soil testing. Sampling soil to determine pH and nutrient levels is always a prudent choice in developing a management program for a lawn, especially if a soil test has not been done within the past three years. Any time of year is appropriate for sampling. A majority of Virginia's soils are acid and need to be supplemented with periodic applications of lime. For information on how to properly sample your soil, consult *Soil Sampling for the Home Gardener,* Virginia Cooperative Extension publication 452-129, at *http://www.ext.vt.edu/pubs/compost/452129/452-129.html*.

Select the best turfgrass. The primary cool-season species (e.g. Kentucky bluegrass, tall fescue, fine-leaf fescues, and perennial ryegrass) are best adapted to the northern piedmont, the ridge, and mountain regions of Virginia. They also can be grown in the southern piedmont and Tidewater regions, but they will struggle during the heat and drought of the summer months. Use the "Lawns" link under the Home Gardening resources section at the Virginia Cooperative Extension Web page at *http://ext.vt.edu/resources* to find links to publications and articles on how to make the best selection for a grass to fit your needs. For a list of the best adapted cultivars for the state, review the current Virginia/Maryland Turfgrass Recommended Variety lists posted at *http://sudan.cses.vt.edu/html/Turf/turf/publications/publication_page.html*. These select grasses are likely not going to be available at the garden centers of large retailers, so you will need to approach stores that deal in specialty turf products, farmer's cooperatives, or specialty nurseries to obtain these best varieties. And if you cannot locate a variety from the recommended list, all is not lost. Fortunately, most of the cultivars being sold at the garden centers of large retailers are still quality grasses that will likely perform satisfactorily in most parts of Virginia. If you are interested in establishing sod, you can obtain information on the locations of Virginia farms and the grasses they produce in the *Virginia Sod Directory*, publication 418-040 at http://www.cses.vt.edu/html/Turf/turf/publications/publications_page.html. Do some research, utilize the resources in the web links from Virginia Cooperative Extension, and don't be afraid to ask the "tough" questions regarding the suitability and quality of

grasses that are for sale. Always select certified ("blue-tag") seed and/or sod when choosing a grass. A lawn is something you expect to have indefinitely, so a commitment in choosing the best possible grass goes far towards long-term success.

The cool-season grasses will be the first turfgrasses to visibly resume active growth as soil temperatures consistently warm into the 50s (^{o}F). Even early to mid-spring frost events will not significantly slow foliar growth. The renewed vigor in top growth is a result of the plant's effort to quickly maximize its ability to produce food (the biochemical process of photosynthesis). Much of the remaining food reserves that were stored for winter survival are now being used in the early season production of new leaves. The root system will also eventually have a resurgence in growth and development, but it lags far behind shoot development. Left alone, the cool-season turfgrass does a pretty good job of balancing the distribution of food between new leaves and new roots. However, it is highly possible that the turf manager, in the quest to have that best looking lawn, inadvertently alters the balance of growth between shoots and roots and causes more problems than they solve. The development and maintenance of a strong root system will be critical to turf success for the remainder of the season.

Spring establishments. Although the spring is not the ideal time for establishment of cool-season turfgrasses, the majority of cool-season turfgrass seed is sold and planted at this time. The reason spring is not an optimal establishment period is because there is such a small window of opportunity for the development of a mature plant with an extensive root system before the summer months approach. Cool-season turfgrasses are adapted to climates where daytime high temperatures are in the 60-75 ^{o}F range. Much of Virginia will experience daily high temperatures exceeding this range by early June, and the temperatures will remain above optimal levels through at least August. If establishment can be delayed until fall, the chances of success are far greater then. However, there are many situations that require spring establishments (new construction sites, renovation projects following loss of turf over the past fall/winter season, etc.), and the chances for success can be enhanced by considering the following strategies.

For cool-season turfgrasses it is recommended to use *blends* (combinations of two or more different cultivars) for most situations because this broadens genetic diversity (i.e. improves the chances of one grass better tolerating a pest or environmental extreme). There are other situations where certain *mixtures* (combinations of two or more species that have compatible appearance and growth characteristics) can be quite successful. For instance, for lawns with both sun and shade features, it is very common to select seed mixtures containing Kentucky bluegrass and/or perennial ryegrass (for the sunny locations) and fine-leaf fescues (for the shady spots). Note: not all mixtures are appropriate for the best quality lawn turf. For instance, mixtures of tall fescue and fine-leaf fescue, though these two grasses are closely related to each other, are not recommended because their leaf textures are so dissimilar. Uniformity in appearance is one of the first criteria that must be met in gaining an aesthetically pleasing lawn turf.

Timing in establishing cool season grasses. Timing of cool season turfgrass plantings in the spring is absolutely critical for success. Research has shown that when soil

temperatures at a 4-inch depth reach the range of 55 to 65 ^{o}F range is the period offering the best chances for germination and establishment. Of course, this temperature range is also suitable for the germination and establishment of most of our biggest summer annual weeds such as crabgrasses (*Digitaria* spp.), goosegrass (*Eleusine indica* L.), and foxtails (*Setaria* spp.). Options in managing these and other weeds (many of which are warm-season weeds that will be extremely competitive with the cool-season turfgrass) during turf establishment are presented later in the **Weed Control** section.

Soil preparation. For renovations that are needed due to an abundance of weeds, non-selective chemicals such as glyphosate or glufosinate can be applied in advance of planting to control existing vegetation. The temperature must be warm enough that the existing vegetation will absorb and translocate the chemical, so avoid making the application during cold weather. When possible, complete tillage of the soil to a 4- to 6-inch depth is desirable prior to seeding. If soil tests indicate lime or other nutrients are needed, apply them prior to tilling in order to incorporate the material into the profile. A starter fertilizer emphasizing phosphorus (P) levels as compared to nitrogen (N) and typical nutrient ratios of N-P-K in these sources are 1:2:1 or 1:2:2. It is equally important to provide some degree of soil preparation even for interseeding situations into existing turf. A few passes with a coring machine (often called an aerifier) or a vertical mower (often called a dethatcher) can be used to prep the soil prior to planting to encourage seed-to-soil contact. Simply applying seed over the top of an existing turf without any soil preparation usually does nothing more than feed birds and wildlife.

Some level of tillage is also required for successful establishment of sod. A power rake that disrupts only the surface of the soil might be all that is needed for seed establishment. More complete renovations will likely require more extensive tillage. Remember that suitable tillage does not mean destroying the existing soil structure by disking it into powder; ideally the soil will be tilled to a 2 to 4 inch depth, and a few clods will be fine (Figure 1). For a complete discussion on seeding levels and methods in planting a lawn, consult VCE publication 426-718 *Establishing Lawns* at http://www.cses.vt.edu/html/Turf/turf/publications/publications_page.html.

Figure 1. Tilling the soil is critical for success, but leaving some clods is preferred as compared to pulverizing the existing soil into powder.

Initial irrigation and mowing strategies. After planting seed, irrigate lightly and frequently until seed germination is complete. Avoid excessive amounts of water because this could either wash away or drown the seed. As establishment progresses, gradually cut back on the amount of water applied in order to start promoting a deep root system. The irrigation philosophy is similar for sod and plug establishment, but larger amounts of water can be applied less frequently because these plant materials have soil and some root mass intact. The initial irrigation strategy for sprigs is to keep the sprigs essentially saturated until rooting is initiated. Then reduce watering requirements as described above. For further discussion on irrigation management during the summer consult VCE Publication 430-010 *Summer Lawn Management: Watering the Lawn* at http://www.cses.vt.edu/html/Turf/turf/publications/publications_page.html.

Mow turf when it needs to be clipped according to its recommended cutting height and follow the one-third mowing rule that says you never remove more than one-third of the leaf blade at any mowing event. For example, given that the recommended lawn height for tall fescue is 2 to 3 inches, begin mowing as soon as your new lawn reaches a 3 inch height and cut it to no lower than 2 inches. Regular mowing at the low end of the recommended range for the respective grasses promotes tillering of new stems, therefore increasing density. Complete mowing height recommendations and guidelines for clipping recycling are presented in VCE Publication 430-402 *Mowing To Recycle Grass Clippings: Let the Clips Fall Where They May!* at http://www.cses.vt.edu/html/Turf/turf/publications/publications_page.html. Be sure your

mower blade is sharp, properly balanced, and that your soil surface is sufficiently firm so as to not rut or footprint the surface.

Fertility programs.

Cool-season turfgrasses. Application of ½ to 1 pound of water-soluble nitrogen per 1000 square feet during early to mid-spring is acceptable, but additional nitrogen can be detrimental to cool-season turf because it promotes shoot development at the expense of the root system. Furthermore, with efforts focused more than ever on minimizing the potential environmental impact of fertility and pesticide products, it is only logical to supply the nutrients that a plant can efficiently utilize. Heavy, repeated nitrogen fertilization events in the spring can produce a beautiful, dark green turf, but it will increase the likelihood of pest and environmental stresses over the coming summer months.

One alternative in selecting fertilizers for spring treatments on cool-season grasses is to choose products that contain 50% or more water insoluble nitrogen (often called "slow release" nitrogen) that is slowly made available to the plant either by way of controlled chemical or microbial decomposition. This provides a sustained growth response without a flush in shoot growth at the expense of the roots.

For homeowners, many of the fertilizer products to select from to initiate spring fertility programs are "first step" components in a four or five-step complete lawn care program designed for the entire growing season (spring through fall). The quality and handling characteristics of the products are usually exceptional. However, the levels of nitrogen contained in the mid-spring and summer steps in the program often exceed the recommended levels that cool-season turfgrasses can efficiently utilize in the spring and summer months. Consult *Lawn Fertilization in Virginia,* Virginia Cooperative Extension publication 430-011, at *http://www.ext.vt.edu/pubs/turf/430-011/430-011.html* for more information on how to distinguish between nitrogen sources and their recommended seasonal application rates. Supplemental applications of other nutrients (for instance, phosphorus or potassium) and lime should be performed according to soil test results.

Alternatives to nitrogen for a color response? Foliar applications of iron will provide a rapid greening response without a flush of shoot growth on actively growing turf. Since iron is a micronutrient, the nutrient application levels are very low. The color response is short-lived (typically two to three weeks) because the iron-induced color response in the leaves is removed by mowing. Other nutrients such as magnesium and sulfur can also provide a greening response, but applications of these elements should be based on need as indicated by soil tests.

Cultural management programs.

Core cultivation. Core aeration (commonly called "aerifying" or "plugging") is the typical type of cultivation done on homelawns to relieve soil compaction (Figure 2). Aeration is possible as soon as the cool-season grass has resumed active growth in early to mid-spring, but should not be done after temperatures warm to levels where the grass

will likely be under stress. Extensive core cultivation should be done in the late summer to early fall when the turf has optimum recuperative potential.

Figure 2. A walk-behind cultivating machine that is commonly used in lawn aeration.

Core aeration is very disruptive to surface smoothness, but it is the best way to relieve the physical effects of soil compaction and increase soil oxygen levels. Many commercial landscape managers provide core cultivation as part of a service program or homeowners can reserve their own machines through equipment rental stores.

Consider how spring cultivation might affect preemergent weed control if the herbicide has been applied before the aeration. If possible, aerate before the herbicide application in order to minimize the effects on the chemical barrier in the soil. If the spring cultivation is done after aeration, immediately return the cores to the turf canopy by breaking them up using a drag made from chain-link fence or a heavy piece of carpet. Spreading the soil over the turf surface will also help reduce thatch build-up.

Vertical mowing. Vertical mowing is not a means of relieving compaction and improving soil aeration. Instead, it is an excellent technique to prepare the soil as a seed bed for spring plantings. A primary reason for vertical mowing is thatch removal (i.e. vertical mowing is often referred to as "dethatching"). Thatch (Figure 3), an organic layer predominantly comprised of living and decaying stems, signals an imbalance between the growth rate of the turf and how fast the plant material is broken down by soil microbes. Thatch depths exceeding ½ inch require attention because turfgrass roots living in the thatch suffer from moisture stress during dry weather, and many problematic insects and fungi find thatch a favorable environment for their development. However, surface disruption and damage to the existing turf will be extensive, and with the approaching summer months, vertical mowing is not recommended at this time.

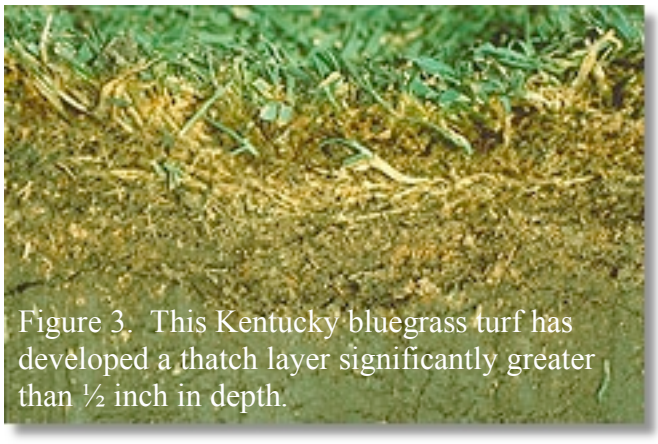

Figure 3. This Kentucky bluegrass turf has developed a thatch layer significantly greater than ½ inch in depth.

The only cool-season lawn grass that will likely have significant thatch accumulation over time is Kentucky bluegrass, a grass that has an aggressive rhizomatous growth habit. High maintenance bluegrass lawns receiving 3 to 4 pounds of nitrogen per 1000 square feet per year are likely to develop thatch over a 2 to 3 year period. Consider vertical mowing to remove thatch in late-summer to early fall at a time when the turf has optimal recovery potential.

Pest management.

The best way to minimize pests is to maintain a healthy, dense turf. This is generally achieved by following sound management programs based on the principles previously discussed. Also, the selection of the proper turfgrass for the situation is obviously critical. The seed of many cultivars of tall fescue and perennial ryegrass are marketed as "endophyte enhanced". What this means is that the seed you are purchasing contains a living fungus that is highly desirable! We most often think of disease and bad looking lawns when we think about fungi and turf, but in this case the fungus within the seed (and ultimately your turfgrass) helps reduce the likelihood of attack by other insect and disease pests (reduce, not eliminate, pest attack). For situations where tall fescue or perennial ryegrass are used, it is well worth paying a few pennies more per pound to purchase "endophyte enhanced" seed.

Proper identification of the pest is obviously crucial in determining how (and even if) a treatment is made. Virginia Tech provides numerous resources in the identification of weed, insect, and diseases. The general instructions on the proper way to collect and to submit a sample for identification are found at http://www.ppws.vt.edu/~clinic/instructions.html. For weed identification, there are two excellent resources available through Virginia Tech web sites that serve as "do it yourself" programs. The *Weed Identification Guide* can be found at http://www.ppws.vt.edu/scott/weed_id/rightsid.htm. This web-site will lead you through the steps in using plant identification keys, as well as providing pictures of the plant. More specifically for turfgrass weeds is www.turfweed.net, a site developed and maintained by Virginia Tech Extension Turfgrass Weed Scientist Shawn Askew.

Pests will still invade turf periodically even with the best management programs in place. The occurrence of diseases and insects is usually sporadic, but it is highly likely that most lawns will have some level of weed pressure. For that reason, more detail is provided for chemical control alternatives for weed management than for disease and insect pests. The following sections detail only the primary pests likely to occur in Virginia's cool-season lawns and successful cultural and chemical strategies to deal with them. Complete details of pesticides, the pests controlled, and the application rates and timing are provided in the Virginia Tech Pest Management Guide found at www.ext.vt.edu/pubs/pmg/.

Weeds.

Preemergent weed control in established turf. Summer annual grasses (crabgrass, goosegrass, foxtail etc.) are the most common targets for preemergent herbicide treatment in spring but many other grass and broadleaf weeds germinate as soil temperatures warm and days grow longer. Rapid growth potential of these summer annual weeds warrants the use of preemergent herbicides to prevent weed germination and subsequent reduction in turfgrass quality. The key in effectiveness of preemergent herbicides is timing applications before weeds emerge. Mother Nature provides reminders for proper

preemergent herbicide treatment timing in the form of the following ornamental plants: daffodils, forsythia, and dogwoods (Figure 4). Prolific blooming of these spring plants is the period when preemergent herbicides should be applied for crabgrass and other summer annual weeds, with forsythia and daffodils being early in the window of application, and dogwoods being at the end of the recommended application period. There are several preemergent herbicides available for lawn applications and table 1 lists some of the most common products.

Figure 4. Spring blooming plants such as the daffodil provide an excellent signal for timing a preemergent crabgrass herbicide

Table 1. Preemergent herbicide options available for homelawn applications by either homeowner and/or professional applicators.

Common chemical name	Some popular trade names[z]
Benefin	Statesman, Balan™
Dithiopyr	Dimension™, Vigaro™
Pendimethalin	Scott's Haltz™, Pendulum™
Prodiamine	K-Gro, Sam's Choice, Barricade™
Oxadiazon	Ronstar®

[z] Listing of a product does not imply its endorsement, nor does its exclusion imply failure in control by Virginia Cooperative Extension personnel. Always follow label directions.

An organic compound that is marketed for preemergent crabgrass control is corn gluten meal. This material is also usually about 8-10% by weight nitrogen, and normal application rates to gain weed control will also typically supply approximately one pound of nitrogen per 1000 square feet. The limitation with this product is that it has rarely provided better than 60% weed control in research trials at Virginia Tech and exceeds recommendations for spring nitrogen fertility of cool-season grasses. Breakthroughs in crabgrass control are likely to occur and additional fertilizer should be avoided.

In addition to applications of herbicides alone, there are many formulations of "weed and feed" materials (products with a preemergent herbicide impregnated on a fertilizer carrier) that are popular in spring lawn applications. It is recommended that if you select weed and feed materials with high percentages of nitrogen that you choose sources that are predominantly slow release nitrogen (as indicated on its label). This reduces the chance of overstimulating the shoot growth of cool-season turfgrasses at the expense of the root system.

It is necessary for any preemergent herbicide to be watered in soon after application to the turf surface. Most products must receive at least ¼ inch of water within 48 hours of application or the herbicide will begin to decompose due to the effects of the sun.

Crabgrass control at seeding. If spring seeding of cool-season turfgrasses is desired, none of the preemergent herbicides listed in Table 1 can be applied prior to or at seeding of turfgrasses. However, some of these herbicides can be safely applied at vegetative establishments by sprigging or plugging of warm-season grasses (consult the label). Of the group of preemergent herbicides listed in Table 1, oxadiazon is the safest material to apply during vegetative establishment.

There are two products that have unique uses in spring and summer establishments. One is siduron (Tupersan™), a preemergent crabgrass herbicide that can safely be applied either just prior to or at seeding of cool-season turfgrasses only. The other option is quinclorac (Drive™), a herbicide that can be applied either just before or at seeding of most cool-season and warm-season turfgrasses or after emergence of both turf and weedy grasses. As a postemergent herbicide, quinclorac requires a proper adjuvant such as crop oil concentrate or methylated seed oil. It is essential to follow label directions very carefully with either of these chemicals in order to maximize crabgrass control without damaging or killing turf seedlings.

Postemergent crabgrass control in late spring and summer.
The previously mentioned Drive™ is an excellent early postemergent crabgrass herbicide with safety to both cool and warm-season grasses. There are also several arsonate products (for example, products containing MSMA) that can be used when temperatures are between 80° and 90 ° F. Additional products include fenoxaprop or fluazifop in the active ingredients list. These herbicides only control grass weeds and should not be applied in conjunction with any herbicide that controls broadleaf weeds or they will fail to control the target weedy grass. These four active ingredients; fenoxaprop, fluazifop, MSMA, and quinclorac are available in ready-to-use and concentrate formulations under such trade names as Greenlight, Scott's, Bayer Advance, Ortho, and many others. For professionals, these products are available as Drive, MSMA Turf, Acclaim, Fusilade, Ornamec, and many others.

Spring and summer broadleaf weed control. In mature turf, applications of broadleaf herbicides can usually be made as soon as temperatures warm such that the weed is actively growing. Typically, this will be when air temperatures are $\geq 70^{o}$ F. Some of the most popular broadleaf herbicides and their combinations are listed in Table 2.

Table 2. Some popular broadleaf weed herbicides used in cool-season turfgrasses[z].	
Common chemical name(s)	Trade name
2,4 dichlorophenoxyacetic acid (2,4-D)[y]	Many products available
Dicamba[y]	Banvel™ and others
Mecoprop (MCPP)[y]	Many products available
Triclopyr	Turflon
Carfentrazone	Quicksilver
2,4-D + dicamba + MCPP	Trimec, Three-Way
2,4-D + dicamba + MCPP + carfentrazone	Speedzone
2,4-D + clopyralid + dicamba	Millennium Ultra
2,4-D + Triclopyr + clopyralid	Momentum
Carfentrazone + 2,4-D	Powerzone™
2,4-D + Triclopyr	Chaser
Triclopyr + clopyralid	Confront™
Metsulfuron	Manor, Blade (only in bluegrass)
[z] Listing of a product does not imply its endorsement, nor does its exclusion imply failure in control by Virginia Cooperative Extension personnel. Always follow label directions.	
[y] Two and three-way combinations of these and other similar chemistries are readily available and their combinations are often desirable due to synergistic activity.	

Controlling weeds before they flower is an excellent way to keep them from completing their life cycle and producing seed. This strategy applies to either perennial (e.g. dandelions, clover, plantains, etc.) or annual weeds. However, if the primary weed problem consists of winter annual plants (for instance weeds such as henbit, chickweed, or geranium) that have already flowered, then the herbicide will not reduce future populations since the weeds have completed their life cycle.

As temperatures warm, many broadleaf herbicides require extra caution because of the potential for damage to the turf (particularly cool-season grasses), but also other desirable landscape and garden plants. Pay extra attention to environmental conditions such as wind and relative humidity in the summer because of the potential for off-site movement onto desirable plants. It is often recommended to delay broadleaf herbicide treatments until the early fall because of potential damage to neighboring plants. In spring and early summer, ornamental plants are young and succulent or producing new buds and tissues that are highly susceptible to herbicide vapors. In fall, perennial plants consist mainly of old and tough tissues that are less susceptible to herbicide injury. In addition, susceptible tissues are just weeks away from a killing frost. Thus, herbicide drift is much less visible and problematic in fall compared to early summer. Proper treatment timing will depend both on the need to control weeds and to prevent damage to desirable vegetation on the lawn border.

Control of sedges and "grass-like" plants. Sedges can be distinguished from grasses by their triangular stem. Sedges are highly competitive in poorly drained soils or over irrigated sites, but they can be a problem anywhere in the landscape. Sedges often occur in home lawns equipped with automated irrigation. If you use your irrigation system

more than ten times per year, you may be overwatering and contributing to sedge problems. There are both annual and perennial sedges, but the primary sedge of importance in Virginia is the perennial plant yellow nutsedge. One of the most broad spectrum sedge control products is halosulfuron (Manage™), which controls most annual and perennial sedges. Other herbicides for sedge control include MSMA (many trade names) and bentazon (Basagran, Lescogran). Bentazon and MSMA only control annual sedges and yellow nutsedge, require timely application to young sedge shoots, and are only effective when treated at least two times. Treat sedges when they are actively growing in late spring through summer. In rainy years, sedge problems will increase and more herbicide treatments will be needed to achieve equivalent levels of sedge control when compared to dry years. Wild garlic is another grass-like plant that is commonly found as a weed in home lawns. Wild garlic sprouts from bulbs in the fall and is most prevalent in winter and early spring. In warm-season turfgrass, glyphosate (Roundup, other names) is often applied to control winter weeds while turfgrass is dormant. However, glyphosate does not control wild garlic and this weedy plant is often the only green plants remaining on dormant turfgrass after glyphosate treatment. The best herbicide for wild garlic control is 2,4-D or products that contain high rates of 2,4-D. In cool-season turfgrass, wild garlic is often noticed by the "onion" smell that occurs during spring mowings. Wild garlic can be controlled in cool-season turfgrass with 2,4-D also.

Diseases.

The first step in disease control is to properly identify the pest. Cultural management and chemical control options may vary from one disease to another. Pictures of the disease symptoms (leaf spots, patches, etc.) or signs (the fungus itself) of the predominant spring and summer diseases in Virginia lawns are provided here, but you might be facing another pest entirely. Utilize the disease diagnosis services mentioned under the **Pests** heading if you are unsure of the disease that might be attacking your turf. Be aware that a disease might not be caused by a fungus, such as the "dull mower disease" shown in Figure 5. Providing as much information as possible will lead to a more rapid and accurate diagnosis. Information that is particularly useful includes patterns of the disease, symptoms or signs as seen in the field, chemical application history, and weather patterns when symptoms were first noticed. Providing digital images can also be very

Figure 5. Tall Fescue is particularly susceptible to "dull mower disease". Keep mower blades sharp to reduce this "disease"!

useful. A picture is worth a thousand words! The most important aspect of dealing with diseases is not knowing how to control them, but how to reduce the severity by sound preventive maintenance strategies. Turfgrass that is healthy and under less stress will be better fit to fight off disease than turf in poor condition. Cultural practices which can promote healthier plants and reduce disease severity generally include deep, infrequent irrigation in the early morning, avoiding heavy fertilization in the spring, and reducing compaction through core cultivation.

Dollar spot can first become visible in the spring during the first warm, moist periods of the season, and can continue to develop through early fall. As said previously, dollar spot often indicates a deficiency in nitrogen fertility.

Figure 6. The cottony-like mycelia of dollar spot that often appears under heavy dew conditions in the morning.

Applications of nitrogen will not cure the disease, but allows the plant to "out grow" the disease. The cottony-like web of the fungus is clearly visible early in the morning when dew is present. Limited infections do not usually cause massive turf loss, but the plant can be weakened such that it is subject to serious environmental stress later in the summer. The physical sign of dollar spot is a cottony-like fungal growth that can be confused with webs spun by spiders or insects (Figure 6). To confirm the damage is caused by the dollar spot fungus, inspect the leaves for the characteristic hour-glass lesions as shown in Figure 7. Dollar spot is often an indication of low nitrogen

Figure 7. The characteristic "hour glass"-shaped lesions of dollar spot on unmowed Kentucky bluegrass.

fertility, and increasing nitrogen levels is a good way to manage dollar spot in most warm-season turfgrasses, but is risky in cool-season turf because it can encourage other diseases (particularly Rhizoctonia blight, i.e. brown patch**.**

Another common spring disease is leaf spot, caused by various fungi that can attack turf in similar environmental conditions as dollar spot. Disease is typically most severe in mid to late spring. As its name implies, the initial symptoms are dark, water-soaked spots that appear on the leaves (Figure 8). If the fungus only attacks the leaves, it is more of a nuisance than a concern. However, if the disease is severe, the disease can move into the growing points of the plants and can begin killing the plants (as is illustrated in Figure 8). Again, realize that dollar spot and most leaf spot diseases are typically considered "nuisance" diseases – something to notice and pay attention to, but rarely to treat. However, if their infections become severe, they can possibly lead to turf damage later in the summer when environmental conditions are more stressful.

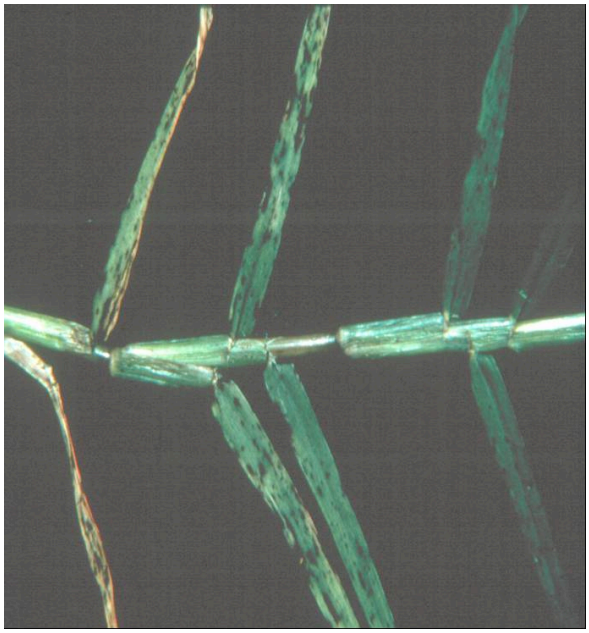

Figure 8. The dark, water-soaked lesions of a leaf spot disease are beginning to rapidly blight this stem.

One of the most serious and noticeable diseases that routinely strikes Virginia's homelawns each year is *Rhizoctonia blight*, i.e. brown patch. Typical symptoms of brown patch are a circular area (often referred to as a "smoke ring" or "halo") as pictured in Figure 9. The blighted leaves have no characteristic banding or spotted lesions as previously described for dollar spot or leaf spot. This disease typically occurs in the summer during hot, wet weather. It is of particular importance on cool-season turfgrasses that receive heavy spring nitrogen fertilization. In areas with a history of high incidence of Rhizoctonia blight, heavy spring applications of nitrogen fertilizers should be avoided.

Figure 9. The characteristic "smoke-ring"-symptom of Rhizoctonia blight.

Figure 10. The classic "frog-eye" symptom of Fusarium blight on Kentucky bluegrass.

Two summer diseases that can be serious on cool-season turfgrasses are summer patch (Figure 10) and Fusarium blight. Both summer patch and Fusarium blight occur more frequently when soils are compacted such as turf in high traffic areas or near paved areas and buildings. A characteristic symptom often associated with Fusarium blight is a "frog-eye" patch containing a healthy ring of turf within a circular shaped area of blighted leaves. However, this symptom is not consistent for all outbreaks of summer patch and/or Fusariium blight. Carefully manage irrigation schedules in order to promote deep rooting in these hot, dry areas.

The following table details the major homelawn diseases in Virginia lawns and some of the most effective chemicals for their control. For a complete listing of all chemicals and diseases, consult the pest management guide as listed in the table.

Table 3. Fungicides recommended for the control of the most problematic diseases on cool-season turfgrasses in Virginia lawns.[z]

Common chemical name[y]	Trade name[x]	Dollar Spot	Leaf spot	*Rhizoctonia* Brown Patch	Summer Patch
Triadimefon	Bayleton™	X			X
Myclobutanil	Eagle™	X		X	
Azoxystrobin	Heritage™		X	X	
Mancozeb	Fore Rainshield™		X	X	
Propiconazole	Banner™	X			
Flutolanil	Prostar™			X	

[z]For a complete listing of diseases and control recommendations, consult the VCE Pest Management Guide at www.ext.vt.edu/pubs/pmg/.

[y]Listing of a product does not imply its endorsement, nor does its exclusion imply failure in control by Virginia Cooperative Extension personnel. Always follow label directions.

Insects. On an annual basis, the most likely insect pests to cause appreciable damage to cool-season turfgrasses are grubworms, chinch bugs, and caterpillars such as armyworms, cutworms and webworms. While all of these pests can cause damage, their occurrence in numbers significant enough to warrant chemical treatment is unusual. Again, proper identification of the pest and an understanding of where the pest is feeding (above ground or below ground) is necessary to maximize control. If you suspect an insect is feeding on your turf, a soap flush is an excellent way to sample above ground pests. Simply remove both ends of a large coffee can and drive the cylinder into the soil at least an inch deep (Figure 11). Fill the can half way with a soapy water solution (1/2 ounce of liquid dish detergent per gallon of water works well) and watch for the pests to float to the surface. If you do not know what the pest is, the Virginia Tech Insect Identification Lab can help.

Figure 11. A soap flush used to aid in the identification of surface insect pests.

The most significant insect pest to attack Virginia turfgrasses is most often the grubworm or white grub. When disturbed in the soil the grub will curl into a "C" shape and lay motionless for a brief period as pictured in Figure 12. White grubs are the larval stages of several different scarab beetles and they come in many different sizes ranging from less than 0.25 inch in length for grubs of the Black Turfgrass Aetinius to over 1 inch in length for the grubs of the Green June beetle. Most grubs have an annual life cycle similar to that pictured in Figure 12. Grubs feed on turfgrass roots with chewing mouthparts. Because of the damage to the roots, the most noticeable symptom is wilting of the turf during dry periods.

Figure 12. A white grubworm, the larval stage of many forms of beetles that feed on turfgrass roots.

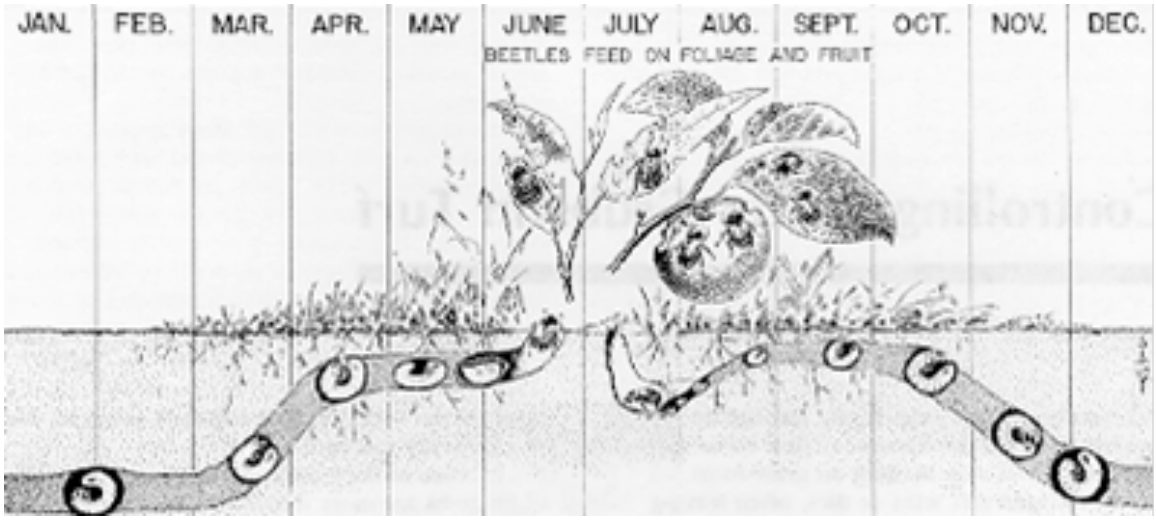

Figure 13. The stages of activity during the life cycle of most annual beetles. It is recommended that most chemical applications be made from mid-July through August in order to maximize control.

A typical life cycle of most beetles is provided in Figure 13. Over winter the grubs go several inches deep in the soil to survive the cold and then begin to migrate to the surface as the soil temperatures warm in the spring, all the time feeding on plant roots. By late spring they will reach their maximum size as worms before they go through their final metamorphosis from grub to beetle. Due to their size, chemical control is very difficult at this time. As winged, adult beetles emerge, most are only interested in mating in order to lay eggs for the next generation. However, the Japanese beetle (Figure 14) is a serious adult pest, feeding on many trees, shrubs, ornamentals, and vegetables around the landscape. The adults are often treated with insecticides for the damage they cause on these plants, but control of the adults is still fairly inconsequential regarding grubs that will attack turfgrass root systems.


Figure 14. The adult Japanese beetle, a significant pest on many landscape plants.

Spring is not the best time to treat grubs because their large size makes them difficult to control. The optimum time to treat for grubs is in mid-July through mid-August after the

next generation's eggs have hatched and the immature grubs are very small and near the soil surface. Insecticides must be watered into the soil according to label directions in order to be effective.

Any insecticide application should be carefully considered before treatment because of the potential for killing non-target, beneficial insects. In particular, it is not always necessary to treat for grubs because if only a few are present, their damage to turf is negligible. Scout the turf using a shovel to lift the sod in a one square foot area if you suspect grubs might be causing damage. Numbers of 6-10 grubs per square foot justify treatment for most grubs. Still, just because you see a few grubs when you are digging in your lawn and garden in the spring does not mean that you should chemically treat.

Figure 15. Upon hatching, all stages of chinch bugs can feed on plants with piercing, sucking mouthparts.

Chinch bugs (pictured in Figure 15) feed on turfgrasses above ground by piercing and sucking mouthparts. They are gold and black in color and are typically 0.25 inch in length. Both immature and adult chinch bugs feed on grasses, usually feeding on the stems under the protection of the leaf sheaths. This can make them difficult to see, so soap flushes as previously described can be beneficial. There can be multiple generations of chinch bugs over the summer and damage is most likely going to be in full sun areas. The turf will take on a mottled yellow cast that can be confused with a disease (the loss of color is due to the injection of a toxin by the insect into the stem). Since chinch bugs feed above ground, foliar applications of insecticides are recommended and irrigation or rainfall after the application is typically not recommended.

The most common caterpillars to attack turf are sod webworms, fall armyworms, and cutworms. These pests feed above ground on leaves and stems with chewing mouthparts. Most appear in mid to late summer and while their damage can be significant (particularly in dry periods), chemical treatment is often not necessary. The caterpillars will eventually pupate into moths that will transform into a moth as an adult. The fall armyworm can be identified by an inverted 'Y' on its head and it can be seen feeding on foliage at any time of day, typically notching the leaf as it feeds (Figure 16). Cutworms live in a hole in the ground but emerge from the hole to clip the foliage off at the soil surface and return to its hole. Similarly, sod webworms also reside in a hole in the ground and clip the turfgrass stem off at the soil surface. An important identification feature is the silken web that they spin to camouflage their hole (Figure 17). The web can be confused with the fungus that causes dollar spot or that of a spider, so check for leaf lesions or a hole in the ground to properly identify the pest before making any attempt at

control. Since all of the caterpillars discussed here feed above ground, surface applications of insecticides are recommended.

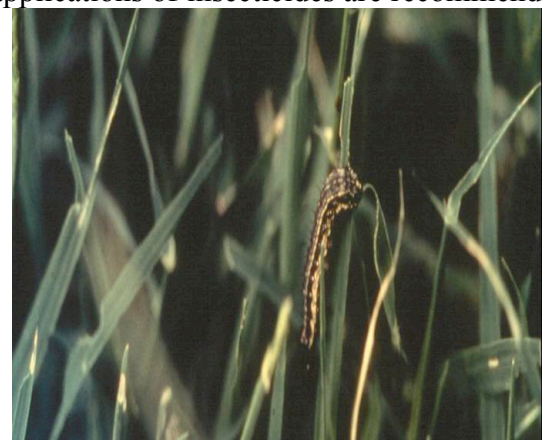

Figure 16. The characteristic notching pattern on the leaves as a result of feeding by the fall armyworm.

Figure 17. The characteristic web of the sod webworm visible in the early morning dew.

The non-target effects of any insecticide should be carefully considered before treatment because of the possibility that beneficial insects might also be controlled. Fortunately, many of the newest generation insecticides have greatly improved in their specific target pest and their safety in the environment. Apply insecticides only when damage (or potential damage) warrants treatment. If chemicals are necessary, Table 4 details some of the most popular chemicals recommended by Virginia Cooperative Extension entomologists for the major turf pests.

Table 4. Insecticides recommended for the control of the most problematic insect pests in Virginia lawns.

Common chemical name	Trade name	Grubworm	Chinch bug	Caterpillars
Carbaryl	Sevin™		X	X
Imidacloprid	Merit ™	X	X	
Halofenozide	Mach 2™, Grubex™	X		X
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There are numerous biological control alternatives that have demonstrated significant activity on these pests also. The products that have shown the most activity are certain entomopathogenic nematodes, a bacterium called *Baccillus thuriengensis,* and a fungus called *Beauvaria bassiana*. These biological control products require careful selection (particularly regarding shelf life and the target pest) and application in order to be

effective. They typically do not provide pest control as complete as standard insecticides, but they are specific to target pests, do not harm beneficial insects, and are safe in the environment. Single applications of biologicals are rarely successful in significant control. A commitment must be made to regular applications of these products in order to replenish their populations in the environment.