Establishment of Lawns with Compost and Microclover in the Chesapeake Bay Watershed

Lawns are an important component of the urban environment and play a major role in reducing runoff in developed areas. However, some export of sediment and nutrients can occur from new lawns, particularly on sites with compacted soils, steep slopes, poorly-timed fertilizer applications, and excessive rates of nitrogen fertilizer.

One approach to reducing nutrient export from newly-established lawns is the use of organic soil amendments that improve water infiltration, and lawn species, such as turf-type tall fescue, that require fewer nitrogen inputs. The recent development of a fine-leaved species of white clover, commonly referred to as microclover, offers an alternative means of supplying nitrogen to turfgrasses in new lawns.

This publication provides a stepwise approach to establishing new lawns with compost and microclover, and includes information on site preparation, soil modification with compost, seeding, and care of newly-established tall fescue/microclover lawns.

Site Preparation

Site preparation for a new lawn begins after home construction activities have ceased and before topsoil has been replaced (if it was removed and stockpiled prior to construction). Place brightly colored flags or fences around vulnerable objects such as utility lines and trees, and remove large rocks and wood that may interfere with soil preparation and establishment.

Rough Grading: Rough grading involves leveling or contouring soil to provide the general grade or slope of the lawn and the removal of depressions. The final grade should allow surface water to drain away from buildings yet be gradual enough to allow easy maintenance, outdoor activities, and reduced potential for runoff. Typically, grading begins on the subsoil (the soil layer beneath topsoil), before the topsoil is replaced. Rough grading can also be performed on topsoil if it was not removed and stockpiled prior to construction activities (Figure 1).

On sites where homes have been built into hillsides, drainage swales are needed around buildings. Where steep slopes exist, consider installing retaining walls, ground covers that do not require mowing, or rain gardens.

Often, the subsoil at the new home site is severely compacted due to construction activities. Excessive compaction can greatly reduce water infiltration, increase water runoff, and ultimately result in a weak and thin lawn. Special equipment may be needed to break these soils apart and facilitate grading and tillage. If the soil is only slightly compacted, it can be loosened with a chisel plow or large rototiller.

Figure 1. Establishing a rough grade for a new lawn.

Once the desired subgrade is established, the topsoil can be replaced. Spread the soil as evenly as possible, bringing it to the desired level as indicated by marks on grading stakes. Typically, a minimum of 4 to 6 inches - firmed or settled depth - of good quality topsoil is needed to establish high quality turfgrass. Ideally, 2 inches of the topsoil should be incorporated into the upper 2 to 3 inches of the subsoil to provide a gradual transition between the subsoil and topsoil. This step can reduce subsoil compaction and increase drainage at the topsoil-subsoil interface.

Soil Modification with Compost

Modification of topsoil with compost will improve soil quality and infiltration. In clay soils, good quality compost can improve soil structure, reduce surface crusting and compaction, and provide nutrients. In sandy soils, compost increases water and nutrient retention, supplies nutrients, and increases soil microbial activity. These improvements promote faster turfgrass establishment, improved turfgrass density and color, increased root growth, and less need for fertilizer, herbicide applications, and irrigation.

Compost selection: Before selecting a compost, it is important to note that the soil amending characteristics of products can differ dramatically. Composts are made from many different sources, including tree leaves and grass clippings (yard trimmings),

sewage sludge (biosolids), animal manure, paper mill by-products, and food residuals, just to name a few. Compost quality varies depending on the source and how it is produced.

Because of quality differences among compost products, it is important to have some basis for determining suitability for use in constructing a new lawn. Ideally, the product in question has been field tested at a university and/or has been used successfully by other turfgrass managers. Using compost with a proven track record can take some of the guess work out of the selection process provided that the product is consistent from batch to batch.

Whether you are using a field-tested product or one that has never been used on turfgrass, obtain a sample of the compost prior to use and examine it for undesirable objects and peculiar or offensive odors. If the producer does not have an analysis of chemical and physical properties, submit a representative sample to a laboratory that will conduct appropriate tests and provide recommendations that you can understand. In Maryland, a nutrient analysis of compost is generally required by state turfgrass fertilizer regulations before the product can be applied. Some basic guidelines for evaluating the suitability of a compost product for use in lawn establishments are provided in Table 1.

Table 1. Guidelines for Choosing a Compost.*

Appearance and odor	
Color:	Brown to black (similar to a dark topsoil)
Particle size:	Approximately 3/8 to 1/2 inch; free of large wood pieces, stones, plastic, and glass
Structure:	Loose and crumbly
Odor:	"Earthy"; avoid products with strong ammonia or sulfur odors
Physical characteristics	
Moisture content:	30 to 50 percent; excessively wet composts do not mix well with soil
Organic matter:	Greater than 30 percent and well decomposed
Ash content:	Less than 70 percent
Chemical properties	
Carbon to nitrogen ratio:	Below or equal to 30:1
Nitrogen:	Typically 0.5 to 3.0 percent
Phosphorus:	Variable, usually about 0.2 percent
pH:	6.0 to 7.5
Metals:	Determined by state and federal agencies
Soluble salts:	Depends on turf species, type of salt, concentration, and application method. Consult test lab or other expert to determine how this will affect the turf.

***Use this information only as a general guide. Some composts have properties that do not fall within these guidelines yet are acceptable in certain situations. Others, though they may fit these criteria, may have serious drawbacks.**

Methods of compost application and incorporation: In most cases composts are applied to the soil surface as a 1-inch layer (approximately 3.1 cubic yards per 1000 sq. ft.) or a 2-inch layer (about 6.2 cubic yards per 1000 sq. ft.), then incorporated into the soil to a depth of 4 to 6 inches. To obtain maximum performance from your application, make sure that the compost is thoroughly mixed with the soil, is not forming a layer at the soil surface, and is not forming large clumps in the soil.

Depending on the product, this may require more than one pass with rotary tilling equipment. The lower rate (1-inch layer) is better suited for marginal to good soils, whereas the higher rate (2-inch layer) would be more appropriate for very sandy soils, clay soils, or soils low in organic matter. We have found that if more than 2 inches are used, it may be difficult to mix the material 4 to 6 inches into the soil. On clay or compacted soils, it is helpful to rototill the soil first, then apply the compost to the surface and till again (Figure 2).

Figure 2. Tilling soil prior to application of compost (left), and spreading compost in a 2-inch layer (right).

It should be noted that in Maryland, the amount of compost that can be applied for turfgrass establishment is regulated by the Maryland Department of Agriculture. The amount is restricted by the amount of nitrogen and phosphorus in the product, and/or by the depth and method of incorporation. If compost is incorporated to a depth of 6 or more inches using a multi-shank ripper and subsoiler, 1 to 2 inches can be applied prior to incorporation. However, if other equipment is used for compost incorporation, or if compost in incorporated to a depth less than 6 inches, the amount of compost that can be applied is restricted by the nutrient content of the compost. Compost cannot be applied in amounts greater than the nutrient recommendations from soil tests for the site, and in accordance with nutrient management recommendations as administered by the Maryland Department of Agriculture. Typically in these cases, only about 1/8 of an inch compost can be applied prior to incorporation.

Most composts supply enough nutrients for good turfgrass establishment without additional fertilizer, especially when applied in a 2-inch layer and incorporated into the soil. Although most composts raise the pH of slightly acid soils, soils with a very low pH (below 5.5) may require additional lime. A soil test prior to soil preparations can provide guidance on lime and nutrient requirements, and is required in Maryland before compost applications can be made.

Following surface application, till the compost into the soil. Tilling is typically performed with a rototiller and serves to mix compost into topsoil while loosening soil for better root growth (Figure 3). Tilling should be done on moist, but not wet soils. The depth of tilling for most turfgrass establishments should be at least 4 inches. One or two passes with a rototiller is usually sufficient to mix the compost and loosen soil. Tilling should break the soil into small aggregates, creating a loose, crumbly structure. Excessive tilling can turn soil into a powder, destroying soil structure and resulting in surface crusting and a poor quality seedbed.

Figure 3. Tilling compost into soil with a rototiller (left), and appearance of soil after tilling (right).

Table 2 provides suggested volumes of compost per unit area when applied at 1 or 2 inches to soil surface and incorporated into soil.

Table 2. Suggested amounts of compost (cubic yards) per unit area applied to soil surface and tilled into soil prior to establishment.

Unit area in square feet	Cubic yards of compost required for 1-inch layer	Cubic yards of compost required for 2-inch layer
1,000	3.1	6.2
5,000	15.5	31
10,000	31	62
20,000	62	123
40,000	123	247

Fine grading: Following rough grading, incorporation of compost, and tilling, the soil should be ready for fine grading. Fine grading involves firming and smoothing the soil surface in preparation for seeding or sodding. Firming can be accomplished by dragging a heavy mat over the surface several times. The weight of the mat will firm the soil and the dragging will smooth the surface. If a mat is not available, a light-weight roller or a cultipacker can be used instead. Mechanical firming should be done when the soil is relatively dry and with lightweight equipment so as not to overly compact the soil. Stones larger than 2 inches in diameter should be removed by hand with a stone rake and shovel, or mechanically with a landscape rake (Figure 4).

Figure 4. Landscape rake for firming soil surface and removing stones.

After firming the soil and removal of stones, begin smoothing the remaining high areas and depressions. For small lawns, do this by hand raking with a grading rake. Grading rakes are designed for moving small amounts of soil and should not be used for stone removal. If you are establishing a lawn on a large area, soil blades, harrows, cultipackers, landscape rakes, brushes, or steel mats can be used to smooth the soil surface.

Seed Mixtures and Seeding

Several cool-season turfgrass species and many cultivars are available for use in lawns in the Chesapeake Bay watershed. Although no established rules exist for which species should be used for a new lawn, recent research has shown that a mixture of turf-type tall fescue and microclover can be used in some areas of the Chesapeake Bay watershed for new home lawns.

Microclover is a legume, and can convert atmospheric nitrogen into organic nitrogen that can be eventually be used by turfgrass. Thus, reductions of nitrogen fertilizer can be achieved when microclover in mixed with tall fescue. Estimates for fertilizer reduction range from 1 to 2 lbs. of nitrogen per 1000 sq. ft. annually.

Microclover produces a dark green color that many homeowners enjoy. Turfgrass stands that include microclover often appear darker green due to the inherent color of microclover, and maintain this darker green appearance more uniformly over the entire growing season, being particularly evident in summer months. Although clover in lawns is considered objectionable to many homeowners, this is often because it occurs in patches. When microclover is properly mixed with grass seed, the result is a more uniform appearance with few patches (Figure 5).

Figure 5. Plots of tall fescue/microclover mixtures showing darker green color compared to tall fescue alone.

Research in Pennsylvania and Maryland has demonstrated that mixing 'Pirouette' microclover (5% by weight) with a good turf-type tall fescue (95% by weight) and seeded at 6 to 8 lbs./1000 sq. ft. can produce a uniform mixture of both species. Because clover foliage tends to die back in the winter, the lawn is dominated by tall fescue (with very little microclover visible) in early spring. As temperatures begin to warm later in the spring, the clover gradually becomes more prevalent in the stand, and populations increase throughout the summer and into the fall.

Seeding of tall fescue/microclover mixtures can take place from mid spring to early fall. Soils that are slightly moist are easier to prepare for seeding than wet soils and warm soils allow faster germination and establishment than cold soils. When planted in late summer, seedlings will have two cool growing seasons (fall and spring) to become established, whereas seedlings developing from spring establishments will be subjected to the heat and drought of summer, making survival more difficult. Weeds are usually more of a problem in spring establishments than in late summer or early fall establishments as 1) the cool temperatures and frosts in late summer/early fall will slow weed development, and 2) summer annual broadleaf weeds and grasses germinating in early to mid-spring can cause severe competition.

Seeding methods: To obtain a uniform lawn, seed should be evenly distributed over the prepared soil. A drop-type spreader is ideal for distributing seed on small areas (Figure 6). Seeding in two directions results in fewer skips and a more uniform application. Thus, you should calibrate your spreader to deliver half of the desired amount of seed and cover the entire lawn area twice in opposite directions (Figure 7).

Figure 6. Drop spreader used for applying seed to small or medium sized areas.

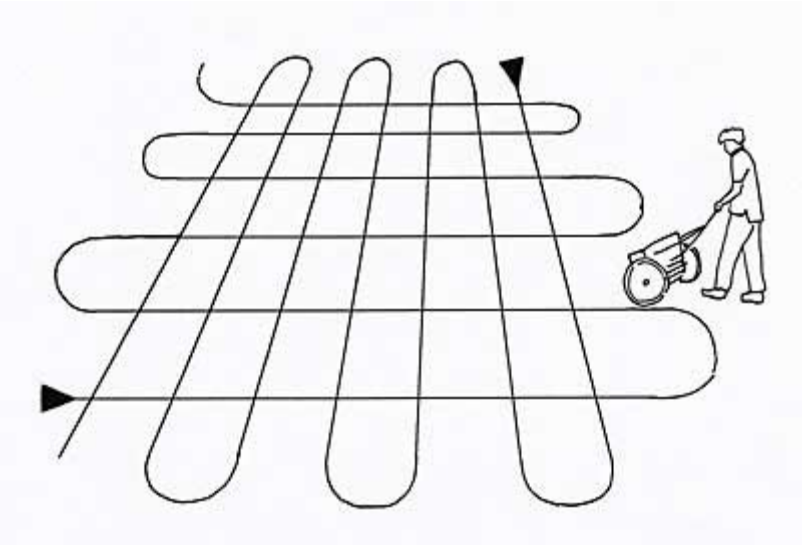

Figure 7. Diagram showing seeding with a drop spreader in opposite directions.

Starter fertilizer should be applied just before or just after seeding. Starter fertilizer will provide the new seedlings with sufficient nutrients to ensure rapid establishment. Many starter fertilizers have equal amounts of nitrogen, phosphate, and potash. Others have two parts nitrogen to one part phosphate to one part potash. Examples of starter fertilizer analyses are 10-10-10, 16-8-8, and 20-10-10. Similar products such as 10-6-4 or 15-10-10 are acceptable. Most starter fertilizers contain quick-release nitrogen.

Starter fertilizers should be applied at 0.5 to 1 lb. nitrogen/1000 sq. ft. Amounts in excess of 1.5 lb. nitrogen/1000 sq. ft. can burn the young turf and result in poor establishment.

In Maryland, as noted earlier, nitrogen and phosphorus can only be applied as recommended by soil tests and in accordance with nutrient management recommendations as administered by the Maryland Department of Agriculture. Also, the amount of nitrogen and phosphorus contained in compost must be analyzed, and taken into account so that Maryland nitrogen and phosphorus limits are not exceeded.

After you have applied the seed and starter fertilizer, it is beneficial to drag small-scale establishments with a leaf rake. Drag in straight lines taking care not to apply pressure to the rake since you don't want to move the seeds, only cover them with a small amount of soil. If done correctly, dragging should cover most the seeds with about 1/4 inch of soil. Some of the seeds will be visible on the soil surface (Figure 8).

Figure 8. Dragging the seeded area in straight lines with a leaf rake

Next, use a lightweight roller to roll the entire area. Rolling presses the seed into the soil. Make sure that the roller surface and the soil are dry before rolling the seedbed to avoid collecting seed and soil.

For larger seeding jobs, you can use a tractor-drawn cultipacker seeder (Figure 9). Cultipackers firm the surface and deposit seed in the soil. Most units have a box for seed mounted above a grooved roller. The box has small openings in the bottom through which seed falls onto the soil surface. The seed is dropped into shallow grooves created by the roller and the soil is firmed around the seed.

Figure 9. Cultipacker seeder.

Hydroseeding is a method of seeding large lawns. It involves preparing a mixture of seed, water, fertilizer, and mulch in a large tank and pumping the mixture through a hose or gun onto a prepared seedbed. Although lawns of any size can be established through hydroseeding, this method is most efficient for large sites or steep slopes.

Most hydroseeding equipment consists of a large tank (500 to 1500 gallon capacity for use in lawn establishment) equipped with an agitation system to keep the mix of seed, water, fertilizer, and mulch in suspension. An engine powers the pump which agitates the mix and forces it through a hose and nozzle. Some hydroseeders are equipped with a gun that shoots the mix out of the tank in a stream that can extend over 100 feet. The hydroseeder operator moves the hose or gun back and forth until the entire area is covered with the prepared mix (Figure 10).

Figure 10. Hydroseeder operator covers area with prepared mix

Advantages of hydroseeding over other methods of lawn establishment from seed are that large areas can be seeded quickly and sloped areas are easier to seed. Disadvantages include the high cost of hydroseeding equipment, the fact that seed is placed on the soil surface and may not be in close contact with the soil (sometimes resulting in seedlings drying out), and a hydroseeder takes some experience to operate.

Mulching: Application of mulch to a new establishment helps to retain soil moisture, prevents movement of seed and soil erosion, reduces surface crusting, and helps to moderate soil temperatures. Mulching usually helps tall fescue/microclover mixtures establish faster and results in a more uniform stand. It is particularly important on sloped areas where there is a higher chance of erosion. Use of poor quality mulch or poor mulching practices may result in seed movement and soil erosion, smothering of new seedlings, introduction of weed seeds, and disease problems. Poor mulching practices may also result in extra clean-up work.

Straw (not to be confused with hay) is the most widely used and least expensive mulch for lawn establishment from seed (Figure 11). It comes in bales from areas where small grains (wheat, barley, rye, or oats) are produced. The straw used for mulching lawns should contain few grain and weed seeds. Although straw usually has fewer weed seeds than hay, expect some weed introduction with straw mulch. Any small grains that germinate will usually gradually die out with mowing.

Figure 11. Straw mulch on newly-seeded lawn

Be sure to apply the proper amount of straw mulch to the newly-seeded lawn. Too much straw can smother new seedlings and lead to disease problems. Insufficient amounts will not retain soil moisture or prevent seed movement and soil erosion. Rates of 80 to 100 lb. of straw/1000 sq. ft. are generally sufficient on level or gently sloping areas (a typical bale of straw weighs between 30 and 40 lb.). Higher rates may be required on steeper slopes. Excess straw should be removed following establishment.

Hydroseeding units can be used for mulching areas where seed has already been applied. In these cases, the practice is called hydromulching. The most common mulches used for hydromulching are virgin wood fiber and chopped recycled paper (usually newspaper). These mulches are mixed with water and a tackifier (an organic-based glue) and sprayed over the seed and soil in a thin layer. Rates of 30 to 40 lb./1000 sq. ft. (900 to 1600 lb./acre) can be used on level and gently sloping areas and up to 3000 lb./acre are sometimes used on steep slopes. Increasing rates of mulch may cause smothering of seedlings, disease problems, and may also deplete soil nitrogen.

Occasionally, mats or covers are used as mulches for new establishments. These can be geotextile fabrics, wood fiber mats, burlap, or other types of loose-woven fabrics or mats. Mats or covers may be used in high value establishments when soil temperatures are cold or on steep banks. They provide weed free, uniform coverage, but are a labor intensive means of mulching because they are bulky and must be anchored with pins or staples. It is important to remove covers or mats soon after germination to prevent disease and to allow light to reach seedlings. Pins and staples should also be removed for safety purposes.

Different types of plant fiber mulches are sometimes used in lawn establishments. Although they may not be as effective as the types discussed previously, they may be priced lower and readily available. Each of these products must be evaluated for its merits as mulch and used at specific rates.

Care of Newly-Established Tall Fescue/Microclover Lawns

The 4 to 8 week period following seeding is critical to the survival of new tall fescue/microclover lawns. More new seedings fail due to improper follow-up care than all other facets of lawn establishment. As the newly-established lawn matures, it must be watered and mowed on a regular basis. Traffic must be limited since tall fescue/microclover wear tolerance during the establishment phase is poor.

Watering: In the weeks following establishment, grass and clover root systems are delicate and shallow and seedlings cannot withstand severe moisture stress. The soil should be moist at all times, but not excessively wet. This can usually be accomplished by light, frequent irrigation. Irrigation can be reduced during rainy periods, in cool-overcast conditions, and if the seedbed is properly mulched. Irrigation may be needed on a more frequent basis during windy, hot, and/or low humidity conditions.

Mowing: Newly-established tall fescue/microclover lawns need to be mowed on a regular basis. Regular removal of small amounts of leaf tissue is much less stressful to your turf than infrequent removal of large amounts of tissue. Begin mowing newly-

established turfgrass with a light-weight mower when grass plants are no more than 1/3 higher than the desired cutting height. In most cases, a mowing height of 3 to 3.5 inches is suggested.

Fertilization: One of the advantages of using microclover in the seed mix is that you don't have to use as much nitrogen fertilizer on the new lawn. In some cases, no nitrogen fertilizer is needed, especially if compost was used to modify the soil. However, if the starter fertilizer applications are not enough to sustain rapid growth of the new lawn an application of ½ lb. nitrogen/1000 sq. ft. about 4 to 8 weeks after applying the starter fertilizer helps to thicken the new stand.

Weed control: Many of the herbicides that will control the most common objectionable broadleaf weeds in lawns will also injure or kill microclover. More research is needed on screening individual broadleaf weed herbicides to determine if programs can be developed to kill weeds such as dandelion and plantains, while allowing microclover to persist. It is possible that adjustments to normal rates and timing of application of these herbicides will minimize damage to microclover while controlling other broadleaf weeds. For example, 2,4-D is known to damage clover leaves, but the amount of clover actually killed can vary greatly depending on many factors, including application rate. Research at Penn State has shown that the broadleaf weed herbicide MCPA generally has a minimal long-term impact on microclover when used at label-directed rates.

Cultural practices can have a major impact on reducing potential broadleaf weed problems, thus reducing or eliminating the need for broadleaf weed herbicide applications that may injure microclover. Proper soil preparation prior to seeding, including adjusting soil pH and phosphorus as recommended by soil tests, will help ensure rapid establishment and maximize lawn density, thus minimizing weed encroachment. Also critical to reducing the potential for weed encroachment is avoiding mowing the lawn too short. Mowing at a height of 3 to 3.5 inches has consistently been shown to greatly minimize weed populations.

Traffic control: Keep all foot and vehicular traffic off the newly established lawn until it is well rooted and has been mowed several times. Seedlings of tall fescue and microclover can be bruised or uprooted if trampled in the early stages of development.

Figure 12. Well-established tall fescue/microclover lawn in Maryland.

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