

# Lawn Establishment

**Establishing a new lawn begins with careful planning, knowledge of soil conditions, and an understanding of the environmental and cultural requirements of turfgrasses.**



## Introduction

The quality of a new lawn is directly related to the success of establishment. Turf establishment begins with careful planning, knowledge of soil conditions, and an understanding of the environmental and cultural requirements of turfgrasses. This publication provides a stepwise approach to turf establishment and renovation and includes information on preparing the site for establishment, seeding, sodding, renovation, and care of newly-established turf.

## Preparing the site

### Planning the new lawn

Planning is an often overlooked, but important part of establishing turfgrasses. It begins by visiting the site and determining how much area is to be prepared and planted, locating obstacles that may interfere with soil preparation, assessing the condition of the soil, and noting site conditions that may influence the type of grass you will use. Visiting the site will also give you some idea of the materials and equipment needed to complete the job. Perhaps the most important phase of planning involves scheduling a time to prepare the soil and begin planting.



Figure 1. Using a measuring wheel to determine the area of a lawn.

The size of the site you intend to establish will dictate the type of equipment you will use, how much labor is needed, as well as how much organic matter, fertilizer, lime, and seed or sod is required. Tools used to measure the area of a site usually include a tape measure or measuring wheel (Fig. 1). Most sites are rectangular, thus, the total area can be determined by multiplying the length of the site by the width. Refer to Fig. 2 to calculate areas of irregular shapes. In many cases, a house, driveway, and other structures will occupy area on the site. Since no turf will be established in these areas, be sure to calculate the total area that is occupied by these structures and subtract this number from the total area of the site. Fig. 3 shows a sample property and how to calculate the area of the lawn.



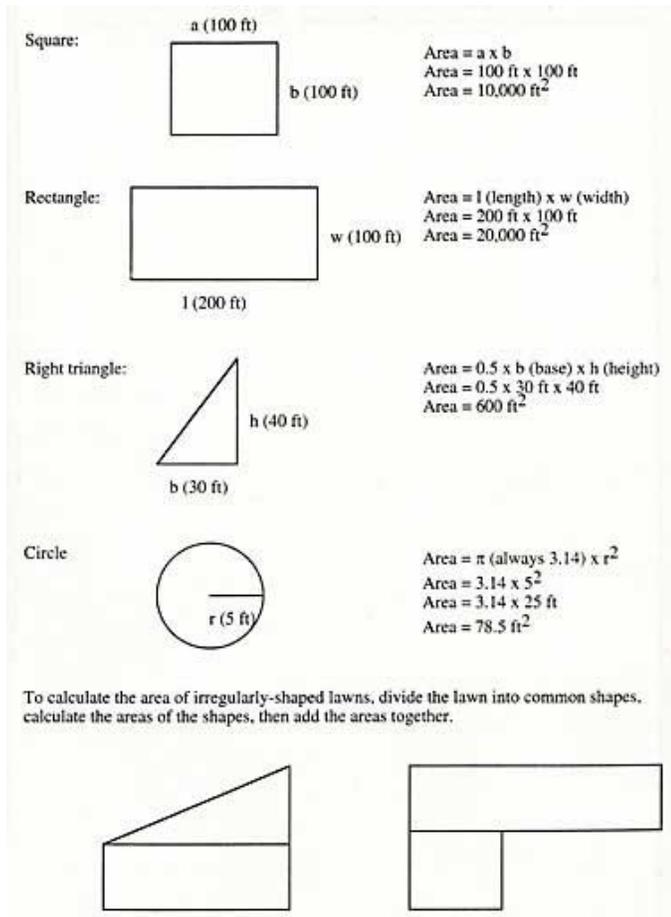


Figure 2. Calculations used to determine areas of different shapes

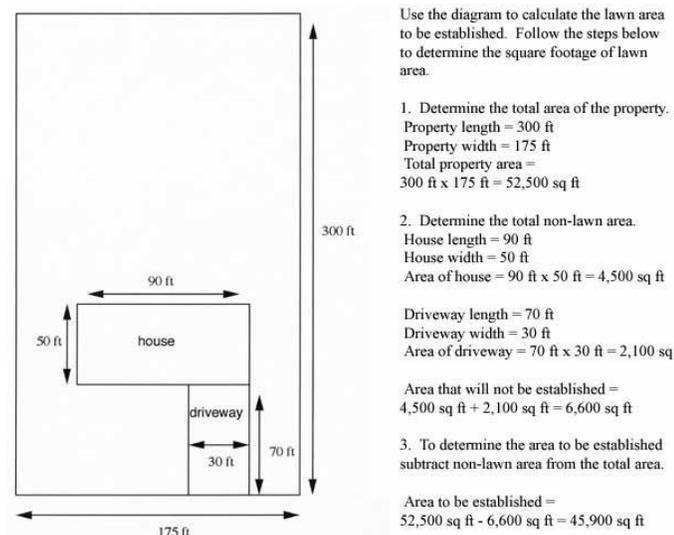


Figure 3. Sample property and how to calculate the area of a lawn.

After determining the area of the site, mark the location of any obstacles that interfere with soil preparation or that may be damaged. Rocks, stumps, lumber, and large roots will interfere with grading and tilling and create establishment problems if buried in soil. Assess the amount and size of debris at the site to determine if you need to bring a backhoe and/or front end loader to facilitate removal. Marking the location of utility

lines and irrigation heads with brightly-colored flags will help to avoid damaging these objects with excavating equipment. Place fences around trees to avoid damaging roots, bark, and branches.

Certain types of weeds growing on the site may interfere with establishment if not controlled prior to planting. Tilling these weeds into the soil prior to establishment may not eliminate them and new growth from roots, crowns, and seeds may occur. If grass weeds are present in large quantities on the site, make provisions to control them with herbicides. Broadleaf weeds, such as dandelion and clover, are usually controlled after the lawn is established.

An assessment of soil conditions is another important, but often overlooked, phase of planning a lawn. Check the degree of compaction and the amount of topsoil present. Determine if the soil is well drained or poorly drained and if drainage problems need to be corrected. Note the grade of the site and determine the extent of grading that is required.

Since you cannot determine which nutrients and how much organic matter are needed for establishment simply by looking at the soil, purchase a soil test kit from a university or private test lab and test the soil. A soil test report should tell you how much organic matter, fertilizer, and lime you will need to incorporate into the soil prior to establishment. Collect the soil samples three to four weeks before you begin preparing the soil to allow the lab to process the sample and mail the report to you (Fig. 4).



Figure 4. Take a soil test prior to establishment

During the site visit, be sure to note conditions which may influence the grass species you will use to seed the lawn. These may include the amount of shade present, drainage characteristics of the soil, and quality of the topsoil. If possible, determine the level of turf quality expected by the owner or developer and if they are willing to pay costs associated with a high-quality lawn. Ask the customer if the lawn will receive a lot of traffic and how often he/she intends to fertilize, water, and mow.

Obtain all materials needed for establishment prior to starting the job. Allow enough time for delivery if you are ordering materials. Make a list of all items needed at the site for each step of the establishment. Also, make sure you have enough

help and a truck and trailer for transporting materials and equipment to the site.

Choosing a time of year to establish a lawn is critical, especially if establishment is by seeding. In the Pennsylvania, optimum times for turf seeding are mid/late spring and late summer/early fall. Seed will not germinate when soil temperatures become too cold in late fall and summer seedings are subject to heat, drought, and disease problems.

## Preparing the Soil and Grading

Site preparation for lawn establishment begins after construction activities have ceased and before topsoil has been replaced (if it was removed and stockpiled prior to construction). If you have not already done so, place brightly colored flags or fences around vulnerable objects such as utility lines and trees. Remove all large rocks and wood that may interfere with establishment. A front end loader and backhoe are useful for removal of large debris. If grass weeds are present on the site, consider controlling them with a herbicide.

**Rough Grading:** Rough grading involves leveling or contouring the soil to provide the grade and slope of the lawn. The final grade should slope enough to allow surface water to drain away from buildings yet be gradual enough to allow easy maintenance and outdoor activities. Typically, grading begins on the subsoil (the soil layer beneath topsoil), before the topsoil is replaced. Rough grading may also be performed on topsoil if it has not been removed and stockpiled prior to construction activities.

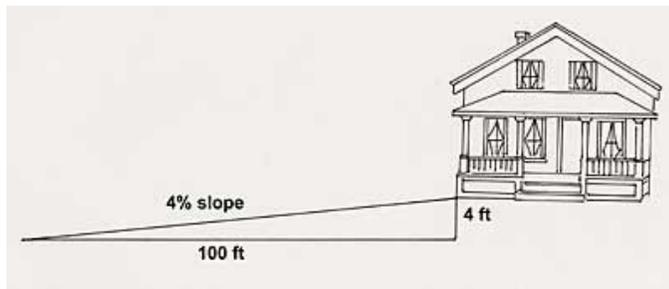


Figure 5. If possible, the grade should slope away from building foundations at a 1 to 4 percent slope

The subsoil grade (subgrade) should conform to the desired surface contour. However, it should be lowered to account for the addition of several inches of topsoil. The subgrade should be free of depressions where water can accumulate. If possible, the grade should slope gently away from any building foundation at a 1 to 4 percent slope (1 to 4 foot drop for every 100 feet) (Fig. 5). On sites where homes have been built into hillsides, drainage swales are needed around buildings. Where steep slopes exist and/or grades change drastically, consider installing retaining walls or ground covers.

Before you begin grading, consider installing stakes marked with colored ribbons to indicate the desired grade and depth of topsoil. The stakes should be placed at fixed intervals and wherever a grade change is needed. Often, the subsoil at the

site is severely compacted due to construction activities. A bulldozer equipped with a large hook called a ripper can break these soils apart and facilitate tillage and grading. If the soil is only slightly compacted, it can be loosened with a chisel plow.

Various types of grading equipment can be used to establish a rough grade. Although bulldozers are sometimes used, they can compact the soil. If possible, use a skid steer or tractor equipped with a grading blade or box scraper (Fig. 6).



Figure 6. Skid steer establishing a rough grade

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 a good quality topsoil is needed to establish good quality turf. 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.

## Modification of Topsoil

Modification of topsoil with amendments may be necessary to improve soil quality. Most soil test labs can provide a complete analysis of the soil along with recommendations for how much organic matter, fertilizer, and lime should be added.

Organic matter may be a beneficial amendment when soils have high sand or clay contents. Sandy soils lose water and nutrients quickly, thus, a good source of organic matter amended into these soils improves water and nutrient retention, reducing the need for irrigation and fertilizer. Clay soils typically are poorly drained and lack sufficient aeration for good root growth. Organic matter additions to clay soils will provide better water and air movement through the soil, thereby improving turf root growth.

Although sphagnum peat products are ideal organic amendments for sand and clay soils, they can be expensive for use in lawn establishment. Good quality composts are usually less expensive than sphagnum peat and can be good organic matter amendments; although they contain less organic matter than high quality peats. If you decide to use compost instead of peat, be aware that all composts are not alike and some are

better for use in turf establishment than others. Make sure that the compost you choose has been successfully used by other professionals for lawn establishment or has been successfully tested on turf at a university. Poor quality composts should not be used.

Sand is occasionally used to improve clay soils; however, large amounts are needed to achieve noticeable soil improvement. Clay soils must contain about 60 percent by volume of a coarse, uniform sand to achieve significant improvement in drainage. This would involve incorporating a 3 to 4-inch layer of sand into a 6-inch layer of clay soil. Although possible, this method is too expensive for most lawn establishments.

A soil test report for turf establishment should specify the amount of organic matter needed in a soil. Once you know the recommended amount, spread the material evenly over the entire site. The soil should be tilled before spreading the amendment as this will make mixing the amendment with the soil easier. Spreading can be done with a loader bucket, grading blade, or York rake for large sites or with shovels and grading rakes for small lawns. Typically, a 1 to 2-inch layer of sphagnum peat or compost can be worked 4 to 6 inches into the soil with conventional rototilling equipment. If more than 2 inches of organic matter is required, till the 2-inch layer into the soil, then spread more of the amendment and till again. Organic layers greater than 2 inches are difficult to till evenly into soils.

The only way to determine how much fertilizer and lime are required for turf establishment is with a soil test. The nutrients most often needed by turfgrasses in the form of fertilizer supplements are nitrogen, phosphorus, and potassium. Because phosphorus and potassium do not move into the soil fast enough when surface applied, they usually are tilled into the soil to a depth of 4 to 6 inches before establishment. This is accomplished by spreading the amount recommended in the soil test report on the soil surface with a fertilizer spreader, then tilling. Lime can be applied in a similar manner if the soil is too acidic. The amount needed should be specified on the soil test report. Nitrogen should not be tilled into the soil since it can be leached out of the topsoil before the turf can use it. Nitrogen, as well as additional phosphorus and potassium, should be applied to the surface as starter fertilizer just before or just after seeding.



Figure 7. Tilling topsoil with a rototiller

### Tillage

Tilling is typically done with a rototiller and serves to mix amendments into topsoil while loosening soil for better root growth (Fig. 7). Tilling should be done on moist, but not wet, soils. The depth of tilling for most turf establishments should be at least 4 inches. One or two passes with a rototiller is usually sufficient to mix 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.

### Fine Grading

Following rough grading, incorporation of amendments, 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-up 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. An alternative to mechanical firming is to allow rainfall or irrigation water to settle the soil. Be aware that if you use water to firm the surface you may have to wait several days until the soil is dry enough to begin fine grading. Stones larger than two inches in diameter should be removed by hand with a stone rake and shovel or mechanically with a landscape rake (Fig. 8).



Figure 8. Landscape rake

After you firm the soil and remove stones, begin smoothing the remaining high areas and depressions. 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 large area, soil blades, harrows, cultipackers, landscape rakes, brushes, or steel mats can be used to smooth the soil surface.

## Seeding

### Seed Mixtures and Blends

Several cool-season turfgrass species and many cultivars are available for use in lawns. This is fortunate because no one grass is ideal for all environments and cultural conditions. Many lawns are established on sites having both sunny and shaded areas, different drainage properties, and varying amounts of traffic. Also, cultural practices such as mowing, fertilization, and irrigation vary from season to season. Because conditions differ, mixtures of different species and/or blends of different cultivars can be used to create a diverse stand that will adapt to a range of environments and cultural practices.

Although there are no established rules for which species should or should not be mixed, homeowners usually want grass mixtures that result in a uniform lawn free of different-colored patches and clumps of coarse-textured grass. Select species with similar colors, textures, and growth habits to avoid patches and clumps. Suggested mixtures of cool-season turfgrass species for specific site conditions in Pennsylvania are listed in Table 1.

Blending turfgrass cultivars is a good way to introduce diversity into a turf stand, especially if only one species is used for the establishment. Blending is especially important with Kentucky bluegrass because there is little genetic variation within cultivars of this species. By blending three or four cultivars of Kentucky bluegrass you can significantly increase diversity, thereby improving disease resistance and adaptability to different site conditions.

Species	Seed Rate (lb./1000 sq ft)	% by weight in Seed Mixture
<b>Sunny areas and well-drained soils</b>		
Turf-type tall fescue	6-8	100
Kentucky bluegrass	2-3	100
Perennial ryegrass	4-5	100
Kentucky bluegrass & perennial ryegrass	2-3	80-90 10-20
Kentucky bluegrass & fine fescues & perennial ryegrass	3-4	40-60 20-40 10
<b>Partially-shaded areas</b>		
Fines fescues & Kentucky bluegrass & perennial ryegrass	4	40-50 40-50 10
Turf type tall fescue	6-8	100
Fine fescues	4-5	100
<b>Fully-shaded areas</b>		
Fine fescues	4-5	100
Rough bluegrass	2-3	100
<b>Overseeding or renovation of lawns</b>		
Perennial ryegrass	4-6	100

Table 1. Some suggested seed mixtures for home lawns, parks, grounds, and commercial properties.

### Seed Labels and Quality

Selection of high-quality seed is an important step in establishing a lawn. Low-quality seed (seed that is low in viability, high in weed seed, or of low purity) will result in a thin, weedy lawn that is more susceptible to damage from pests and adverse environmental conditions.

By law, the turfgrass seed label must contain certain information concerning the origin and quality of the seed. A sample of a typical turfgrass seed label is shown in Fig. 9.

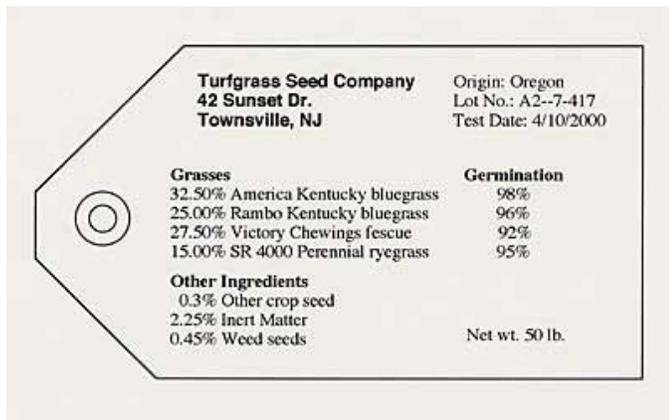


Figure 9. Example of a turfgrass seed label

Information provided on the label includes:

- The name and address of the company responsible for the contents of the container.
- A lot number for tracing the seed back to the original production site.
- Kind and variety of turfgrass seed listed in order of predominance
- The percentages by weight of the individual cultivars.
- Percent by weight of other crop seed and weed seed.
- Percentage by weight of inert matter.
- The date of the most recent germination test.

### Indicators of Seed Quality - Purity, Viability, and Pure Live Seed

All species and cultivars of turfgrasses in the container must be listed on the seed label. The percent by weight of seed for each species and cultivar is also provided and is referred to as seed purity. Sometimes, seed is sold for which no cultivar name(s) exist. In this case, 'variety not stated' (VNS) or 'common' is listed next to the species name. Variety not stated or common generally indicates low quality seed. However, just because a variety is named does not necessarily mean it is superior in quality to seed listed as VNS or common.

Official seed regulatory agencies responsible for inspecting seed will certify seed that meets the specifications set by the agency. This seed is referred to as 'certified seed' and is the only real guarantee of cultivar purity. Whenever possible, buy certified seed for use in lawn establishment.

The seed label also lists the percent germination for each turfgrass species and variety in the container. Percent germination indicates seed viability and must be determined by special test procedures within a specified time period, usually within nine months of sale.

Together, seed purity and germination provide a good indicator of seed quality. Occasionally, seed is sold that is low in purity and germination for what may appear to be a bargain price. However, be aware that in order to achieve the same quality of turf as with 'good seed' of high germination and purity, more seed is required.

The amount of seed required to compensate for poor purity and germination can be determined by calculating percent pure live seed (PLS). Pure live seed indicates the amount of seed in the container that is capable of developing into seedlings. To calculate PLS, the percentage of pure seed of a cultivar is multiplied by the percent germination, and the product is divided by 100. For example, 92 percent pure seed of the cultivar x 80 percent germination / 100 = 74 percent PLS. To determine how much seed to plant, divide 100 by the percentage PLS (74 percent in this case). Thus, in this example,  $100/74 = 1.4$ . Thus, 1.4 pounds of seed with a purity of 92 percent and a germination of 80 percent would be needed for each pound specified in the desired seed mixture.

Often, seed that is low in purity and germination is sold at a reduced price. One way of determining if the reduced price is really a good bargain is to divide the PLS into 100 then multiply by the cost of the seed. A comparison of two seed lots is provided as an example.

**Seedlot A** (sold at 'reduced' price of \$0.95 per lb):

$$\text{PLS} = (85\% \text{ purity}) \times (60\% \text{ germination}) / 100 = 51\% \quad 100 / 51 = 2 \text{ lb of seed needed per lb of seed specified} \quad \text{Cost} = \$0.95 \times 2 = \$1.90 \text{ per lb of PLS}$$

**Seedlot B** (sold at regular price of \$1.50 per lb):

$$\text{PLS} = (99\% \text{ purity}) \times (90\% \text{ germination}) / 100 = 89\% \quad 100 / 89 = 1.1 \text{ lb of seed needed per lb seed specified} \quad \text{Cost} = \$1.50 \times 1.1 = \$1.65 \text{ per lb of PLS}$$

A comparison of actual cost per pound of pure, viable seed reveals that the seed that appeared to be a bargain was actually more expensive.

### Seeding Rates

Rate suggestions for seeding the different turfgrass species are usually given in pounds per 1000 sq ft and are designed to provide about 1000 to 2000 seedlings per 1000 sq ft. Typical seeding rates for individual species are provided in Table 1.

Occasionally, seeding rates that are higher or lower than normal are used for lawn establishment. High seeding rates are sometimes used if seeding takes place past the optimum period of late summer/early fall as cold temperatures decrease seed germination. High rates can also be used if a quick and dense establishment is desired or if the turf will be subjected to heavy wear, such as on a football field. Simply increasing the seeding rate, however, does not always ensure a healthy turf. An excessively dense stand resulting from high seeding rates can result in increased disease problems and mower scalping.

Low seeding rates may be justified where high turf density is not required, such as a low maintenance planting that will not be mowed or mowed infrequently at a high cutting height. Sometimes low seeding rates are used when budgets prohibit seeding at optimum rates. Realize that by using lower than optimum seeding rates the resulting turf stand will be thin and weeds may be more of a problem.

## Timing of Seeding

Seeding of cool-season turfgrass species can be done from mid spring to early fall, but late summer is the optimum time to seed in most areas of Pennsylvania. Soils tend to be dryer and warmer during late August and early September than in spring. 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 establishments as the cool temperatures and frosts in late summer/early fall will slow weed development.

## Seeding Methods

To obtain a uniform turf, seed should be evenly distributed over the prepared soil. A drop-type spreader is ideal for distributing seed on small areas. 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 (Fig. 10).

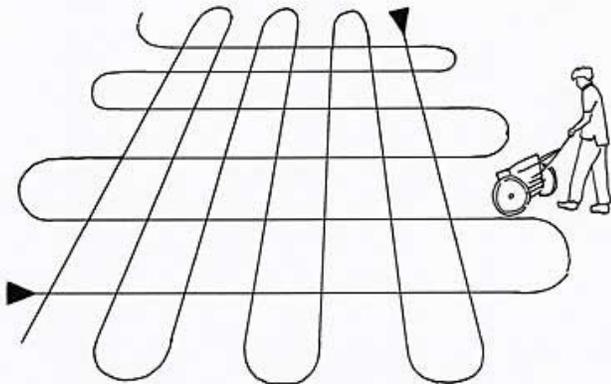


Figure 10. Diagram showing seeding in opposite directions

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. Application of a starter fertilizer is not a substitute for the phosphate and potash recommended on your soil test report.



Figure 11. Dragging the seeded area in straight lines with a leaf rake

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 ¼ inch of soil. Some of the seeds will be visible on the soil surface (Fig. 11).

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 (Fig. 12). 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 12. Cultipacker seeder

Hydroseeding is a method of lawn seeding that has become popular in recent years. 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 (Fig. 13).



Figure 13. 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 suitable mulch to new establishments helps retain soil moisture, prevents movement of seed and soil erosion, reduces surface crusting, and helps to moderate soil temperatures. Mulching usually helps turf 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 (Fig. 14). 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.



Figure 14. 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.

Pelletized mulches made from newspaper compressed into pellets are now available for use in newly-seeded turf (Fig. 15). Some of these mulches have starter fertilizer incorporated into the pellets. Pelletized mulches are designed to expand when wetted, thereby covering most of the soil surface. These products have the advantages of being free of weed seed and easy to apply. The pellets are applied with certain models of drop-type spreaders. Pelletized mulches are more expensive than straw mulch and do not control erosion on sloped areas as well as straw when applied at normal rates.



Figure 15. Pelletized mulch

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.

Different types of plant fiber mulches are sometimes used in turf 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.

## Sodding

Sodding is usually the most expensive method of establishing cool-season turfgrasses. However, it is the quickest way to achieve a mature lawn. It can be done at almost anytime of the year except when soils are frozen. The optimum times for sodding cool-season turfgrasses are in late summer, spring, or fall.

Sod can deteriorate if proper site preparation and follow-up maintenance practices are not followed. Soil preparation methods for sodding are identical to those for establishing turf from seed. The soil surface should be smooth and firm but not compacted. The soil should be dry to slightly moist when sodding. Never lay sod on wet soil.

Turfgrasses used for sod production typically produce rhizomes or stolons which knit turf together and provide lateral strength. Kentucky bluegrass is the most common cool-season turfgrass species used for sod in Pennsylvania. Occasionally, tall fescue and fine fescues are used, but some Kentucky bluegrass is usually included with these species to give the sod more lateral strength.

Sod is usually cut into rectangular strips that can be lifted by hand and delivered folded or rolled on pallets. Sod should be used immediately upon delivery because it deteriorates rapidly (within 24 to 48 hours) in warm weather. If you are unable to

lay the sod immediately, unroll it and place it turf side up in a shady, cool place. Water it thoroughly and frequently to keep it from drying.



Figure 16. Lay sod in staggered pattern

After preparing the seedbed, begin placing strips of sod on the soil in a staggered pattern, similar to laying bricks (Fig. 16). This pattern gives strength and support to the sod strips and keeps them in place. To ensure the sod strips are in a straight line, begin the first row flush against a straight driveway or sidewalk. If no straight pavement is available, stretch a string across the site and use this as a guide. When laying sod on sloped areas, put stakes into each strip of sod as it is laid. Staking of sod prevents slipping or movement down slope. Be sure to remove the stakes when the sod is well rooted.

As you unroll or unfold each strip, make sure that the ends and sides line up as close as possible with the adjacent strips. The sod will dry-out quickly if any spaces are left between strips, and knitting of adjacent strips will be slower. If a space does occur between two strips, do not try to stretch the sod into place. Instead, move the entire piece with a steel rake so that it abuts tightly against the adjacent strip. Because the strips are staggered, you need to cut pieces that overlap the establishment area boundaries with a sod knife to make a straight edge.

Occasionally, a strip of sod may not be cut evenly and a space may be left between strips. In this case, cut a piece from a leftover scrap that conforms to the open space and place it so that it fits tightly into the space.

After you lay the sod and before watering, smooth the lawn surface with a light-weight roller. You can also lightly tamp raised areas so that mowers will not scalp the turf. Next, walk over the lawn with a bucket of soil and fill any small openings between the strips.



Figure 17. Sod deterioration due to lack of water

After you have finished laying the sod, trimming edges, rolling, and filling openings with soil, thoroughly water the sod. Lack of water is the most common cause of sod deterioration so make sure that the water moves through the sod and wets the soil underneath (Fig. 17). Continue to water daily (if needed) until the sod is well rooted into the soil. This may take up to 4 weeks depending on the site and weather conditions.

Do not walk on the sod after you have begun to irrigate as this will create depressions in the surface. Keep traffic off the area until the sod is well rooted. Do not apply herbicides to newly-laid sod or to the soil prior to sodding. Herbicides interfere with root development and often result in establishment failure.

## Lawn establishment without tilling (renovation)

Lawn renovation involves reestablishing an existing, poor quality lawn without tilling and grading. Renovation can be done when drastic soil improvement is not needed and the lawn has an acceptable grade. It is usually faster and less expensive than traditional methods of establishment, but still requires careful planning as well as knowledge of soils and the environmental/cultural needs of turfgrasses.

Before you begin to renovate, correct the primary causes of lawn deterioration. Some common causes include drought, heavy shade, extreme soil acidity, weed or insect infestation,

disease, thatch, improper mowing, and grass species and cultivars that are poorly-adapted to the site. Most of these problems can be corrected by renovation, proper turfgrass selection, and improved cultural practices. Once the cause(s) of deterioration are recognized, and plans are made to correct the problems, renovation can begin.

As with other establishment methods, renovation involves careful planning. Visit the site and assess the area to be planted. Note conditions that may influence the type of grass you will use. Take a soil test and examine the grade and smoothness of the surface. Also, note the presence of utility lines and irrigation heads that may be damaged by renovation equipment (aeration and slicing machines), the presence of tree roots and rocks at the soil surface, and how much thatch is present.

After you have completed the site assessment, treat the entire lawn with a total vegetation control herbicide that does not leave a soil residual. The most effective herbicide used for lawn renovation is glyphosate (a frequently used formulation of glyphosate is Round-up Pro™). Glyphosate will kill all vegetation it contacts and since it is inactivated when it contacts soil, there is no residual that will interfere with turfgrass seed germination (Fig. 18). Glyphosate does not kill weed seeds.



Figure 18. Lawn sprayed with glyphosate

Many types of sprayers are available for applying glyphosate and you should choose one that fits the scope of your renovation program. Other important aspects of spraying are making sure that you cover the area uniformly, that the herbicide is applied at the correct rate, and that there is little to no spray drift. To avoid skips, spray in two directions, perpendicular to one another, using ½ rates for each direction. Never spray on a windy day as glyphosate spray can drift into a neighbor's lawn or onto valuable ornamental plantings. Keep traffic off the site for several hours following spray applications to avoid tracking the herbicide onto untreated turf. Never spray when rain is expected since the herbicide will be washed off the grass and be ineffective.

Wait until the lawn is killed by the herbicide before continuing the renovation operation. Depending on the weather conditions and the plants you are attempting to kill, this can

take a few days or up to three weeks.

After the turf and weeds have died, remove excess thatch (if necessary). This can be accomplished by running a slicing or dethatching machine over the lawn in several directions or until most of the thatch has been removed. Then rake up the thatch and remove it from the site.



Figure 19. Aerating a site with a core aerator

Following thatch removal, apply amendments recommended on the soil test report. After you have applied recommended amounts of organic matter, fertilizer, and lime to the surface, make several passes with a core aerator (Fig. 19). Typically, no more than a ¼ to ½ inch layer of compost or peat can be effectively incorporated with an aerator in the renovation process. Aerator tines will punch some of the amendments into the soil while bringing cores to the surface.

Next, run a slicing or dethatching machine over the surface to break up soil cores and mix the soil with organic matter, fertilizer, and lime (Fig. 20). The slicer blades should penetrate only about ¼ to ½ inch into the soil. Afterwards, rake the area with a leaf rake or drag with a mat to smooth the surface and work some of the amendment/soil mix into the holes made by the core aerator.



Figure 20. Slicing the surface with a dethatching or slicing machine

If these operations are done correctly, the area should now be ready to seed. If the area was aerated and sliced vigorously, there should be enough soil exposed to seed with a drop

spreader. If the area was simply killed with glyphosate but not aerated and sliced, seed with a seeder/slicer machine that cuts small grooves (¼ inch deep into the soil) with rotating vertical blades then deposits seed in the grooves.

Perennial ryegrass is the best species for renovation of lawns because it germinates and establishes quickly, and its roots can penetrate slightly-compacted soils. Kentucky bluegrass, the fine fescues, and tall fescue can also be established in a renovation program, but make sure the lawn area has been vigorously aerated to loosen the soil surface. Seeding rates are listed in Table 1.

As with other methods of establishing cool-season turfgrasses, apply starter fertilizer just before or immediately after seeding, then irrigate just enough to keep the surface moist. If you allow enough of the dead vegetation to remain on the surface, there is no need to mulch.

### Care of Newly Established Turf

The 4 to 8 week period following seeding or sodding is critical to the survival of the new lawn. More establishments fail due to improper follow-up care than all other facets of lawn establishment. As the newly-established turf matures, it must be irrigated and mowed on a regular basis. Many new stands also need additional fertilizer and herbicide applications. Traffic must be limited since turfgrass wear tolerance during the establishment phase is extremely poor.



Figure 21. Irrigation of newly-established turf

### Watering

In the weeks following establishment, grass root systems are delicate and shallow and seedlings cannot withstand severe moisture stress. Whether the lawn is established from seed or from sod, it will probably need regular, sometimes daily, irrigation (Fig. 21). 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.

## Mowing

Newly-established turf needs to be mowed on a regular basis (Fig. 22). 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 turf with a light-weight mower when grass plants are no more than one-third higher than the desired cutting height. Thus, if you want to mow the turf at two inches, begin mowing just before it reaches three inches.



Figure 22. Mowing newly-established turf

An important consideration in mowing new establishments is how soon the turf is able to withstand the weight of the mower and the person doing the mowing. You can test this by walking onto the new turf and looking to see if the grass plants move back into an upright position where you have stepped. If they do, you can probably begin mowing. If not, you risk trampling the new seedlings into the soil.

## Fertilization

Sometimes starter fertilizer applications are not enough to sustain rapid growth of new establishments and additional fertilizer is required. An application of ½ lb nitrogen/1000 sq ft 4 to 8 weeks after applying the starter fertilizer helps to thicken the new turf.

## Weed Control

Newly-established turf is very sensitive to most herbicides, and applications should be avoided unless a severe weed infestation occurs and you are absolutely sure the herbicide will not interfere with the growth of the turf. Herbicide labels usually have precautionary statements concerning the rate and length of time after seeding the product can be safely applied. Many broadleaf herbicides, for example, should not be applied until 4 to 6 weeks following establishment.

## Traffic Control

Keep all foot and vehicular traffic off the newly-established turf until it is well rooted and has been mowed several times. Seedlings can be bruised or uprooted if trampled in the early stages of development. Traffic on sod restricts root development and leads to thinning. If necessary, place signs and/or barriers around the lawn to discourage traffic.

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