

Part III.

Turfgrass

Authored by:

Michael Goatley Jr., Extension Turfgrass Specialist, Virginia Tech

Thomas Hardiman, Extension Seed Programs Leader, Virginia Tech

David R. Chalmers, Extension Turf Specialist (retired), Virginia Tech

David L. Whitt, Extension Seed Programs Leader (retired), Virginia Tech

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Turfgrass Establishment

Pre-Planting Steps Involved in Successful Establishment of Turfgrasses

1. Select the best grass for climate, specific site conditions, its intended use, and maintenance requirements. Consider cold, heat, and drought tolerances for cool- and warm-season species and cultivars. Keep in mind that not all grasses grown in Virginia are available from seed.
2. Submit a soil test sample to the Virginia Tech Soil Testing Laboratory to determine lime and fertilizer needs. Samples should be taken one to two months prior to establishment. Standard tests will provide recommendations for phosphorus, potassium, and lime. Exchangeable calcium and magnesium are also determined in the standard test. For preplant nitrogen applications plant, water-soluble nitrogen can be applied at levels up to 0.7-lb nitrogen per 1,000 sq ft. Slowly available nitrogen can be applied at levels up to 0.9 lb per 1,000 sq ft for cool season or 1.0 lb per 1,000 sq ft for warm season. Control any perennial grass or broadleaf weeds present.
3. Tillage will be necessary where soil compaction is severe, phosphorus or lime needs to be incorporated, or significant surface regrading is required. On other areas, light surface tillage will suffice.
4. Grade the area to establish surface drainage. Save the topsoil by moving it to the side if extensive grading or internal drainage is required.
5. Apply all of the recommended lime and two-thirds of the fertilizers and nitrogen source recommended by the soil test.
6. Till above materials into a depth of 4–6 inches.
7. Finish grade by fine raking.
8. Apply the remaining one-third of the establishment fertilizers and rake into the surface inch of the prepared soil.

Seeding

1. Apply seed at recommended seeding rates (**see table 1, page 67**) in terms of pure live seed (the percentage of pure living seed is calculated by multiplying percent germination by percent purity for each cultivar). Lightly rake the area to incorporate the seed in the surface 1/4–1/2 inch. Be careful not to bury very small-seeded grasses such as Kentucky bluegrass, bermudagrass, zoysiagrass, or centipedegrass. Recommended planting time by region of the state is listed in **table 2 (page 68)**.
2. Roll the area with a moderately heavy roller to firm the surface and assure good soil-to-seed contact.
3. Plan for weed control depending on the season of seeding. For fall seeding of cool-season grasses, Tenacity (active ingredient mesotrione) provides excellent control of many important winter annual and perennial weeds, and it can be applied at seeding (DO NOT use on warm-season grasses). For early postemergent control of most summer annual grassy weeds (except for goosegrass), Drive (active ingredient quinclorac) can be used on most cool- and warm-season grasses. **Read pesticide labels very carefully for specific species and/or variety concerns with some herbicides.**

4. Uniformly mulch the area (1-2 bales of weed-free straw per 1,000 sq ft) if frequent and uniform irrigation is unavailable. Don't attempt to remove the mulch as the grass establishes; simply mulch it back into the turf with the mower. Other mulching solutions could include granular-type products made from shredded newsprint or other recycled paper fiber. Some mulch products are suitable to be applied as a hydromulch using a hydroseeder.
5. Keep the seed zone moist but not saturated. New seedings may require several shallow waterings per day to ensure rapid germination. Only the top 1/4-1/2 inch needs to be kept moist. Without frequent daily irrigation, sprigs easily desiccate immediately after planting. Sod and plugs also require frequent, sometimes daily, irrigation in the first three to four weeks after planting.

Table 1. Recommended seeding rates for common turfgrass species, rate per 1,000 square feet.

Turfgrass species	Seeding rate (lbs/1,000 sq ft)
Kentucky bluegrass	2-3
Tall fescue	6-8
Fine fescue	3-5
Perennial ryegrass	3-5
Bermudagrass (hulled)	1-2
Bermudagrass (unhulled)	5-10
Zoysiagrass	1-2
Centipedegrass	0.25-0.50

Vegetative Plantings

Plugging and Sprigging

All of the warm-season grasses (bermudagrass, centipedegrass, zoysiagrass, and St. Augustinegrass) produce creeping stems and can be vegetatively established using either plugs or sprigs (stems often harvested from shredded sod). Soil preparation should be as previously described. The plugs should be fitted tightly into precut holes on 6-12 inch centers and tamped into place. Sprigs can be broadcast and lightly disked or pressed into shallow rows on 6-12 inch centers and covered with soil, with this being an important means of establishing bermudagrass and zoysiagrass in particular. Sprigging rates for bermudagrass and zoysiagrass range from 7 to 10 bushels per 1,000 sq ft and frequent irrigation is required for establishment. Note that zoysiagrass is very slow to establish from sprigs, and higher sprigging rates are recommended when possible. Standard preemergent herbicides can be used for plug and sprig establishments, but their modes of action do tend to reduce rooting of the creeping stems; for this reason they often are not applied.

Sodding

Soil preparation is similar to that described for seeding: a smooth, firm surface is needed. On hot days, moisten the soil to cool it before laying sod. Premium quality, certified sod is easier to transport and install than inferior grades. Good sod is light, does not tear easily, and quickly puts a root system into prepared, well-watered soil. Install sod as soon as it is received; sod is perishable and should not remain in a stack longer than 36 hours.

Table 2. When to plant cool- and warm-season grasses by region in Virginia.**When to plant cool-season grasses¹**

Area of Virginia	Seed	Sod
Northern Piedmont, areas in and west of the Blue Ridge	Aug 15–Sept 15 or March–early April	Any time soil is not frozen
Southern Piedmont and Eastern Virginia	Sept 1–Oct 15 or Feb and March	Any time soil is not frozen

When to plant warm-season grasses²

Area of Virginia	Seed	Sod	Sprigs	Plugs
Northern Piedmont, areas in and west of the Blue Ridge	May–July 15 (choose appropriate cultivars for climate)	June 1–July 15	June 1–July 1	June 1–July 15
Southern Piedmont and Eastern Virginia				
a. Hulled and eastern bermudagrass	May–July 15	Late May–Aug 15	Late May–July 15	Late May–July 15
b. Hulled bermudagrass	Late fall or winter prior to growing season	Not applicable (N/A)	N/A	N/A

¹ Cool-season grasses include Kentucky bluegrass, fine fescue, perennial ryegrass, tall fescue, and creeping bentgrass

² Warm-season grasses include bermudagrass, zoysiagrass, centipedegrass, and St. Augustinegrass.

Establish a straight line lengthwise through the lawn area and lay the sod on either side of the line with the ends staggered as when laying bricks. A sharp masonry trowel is very handy for cutting, forcing the sod tight, and leveling small depressions. Herbicides are generally not necessary for sod installations because the sod itself provides most of the weed control by its competitive nature for space. Roll and water the new lawn immediately; irrigate to moisten the soil below the sod until it is well rooted into the soil.

Sod Versus Other Establishment Methods

Successful, weed-free establishment is more difficult with seed, sprigs, or plugs than with sod. Also, the area is exposed to erosion because of the time required for germination and root growth of seed or the lateral growth of creeping stems. Sod use practically eliminates such problems, which is an especially important factor on steep slopes.

Post-Planting Steps To Ensure Successful Establishment

After seed germination, maintain moisture in the soil to a depth of 4–6 inches until plants are well established. Gradually adjust irrigation programs from “lightly and frequently” to a maintenance program that follows a “deeply and infrequently” irrigation strategy.

Initiate a mowing program with a sharp blade that follows the “one-third rule” (never remove more than one-third of the leaf blade at any time) of clipping. Ensure that soil moisture conditions are suitable for foot and equipment traffic to avoid rutting and footprints.

When the sod, sprigs, or plugs are fully rooted or the seed is established, fertilize in accordance with maintenance fertilization recommendations for the grasses (refer to [VCE publication CSES 135P, Lawn Fertilization in Virginia](http://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/CSES/CSES-135/CSES-135-pdf.pdf), available at www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/CSES/CSES-135/CSES-135-pdf.pdf). Begin mowing with a sharp mower as soon as the grass reaches a height one-third greater than the recommended mowing height.

Weed control programs typically are not initiated on recently established grass until the turf has been mowed three to four times. Follow label directions very carefully to safely treat new establishments and to optimize control.

Fertilization and Liming of Established Turfgrass

Phosphorus, potassium, and lime requirements should be determined by soil test. Turf grown on irrigated sandy soils or subjected to frequent and heavy traffic could require higher amounts of nutrients. Turf grown in the shade requires less nitrogen.

Do not apply readily available nitrogen sources in excess of 0.7 lb of actual nitrogen per 1,000 sq ft per active growing month in any single application. For sources that are greater than or equal to 15% slowly available nitrogen, apply no more than 0.9 lb (cool season) or 1.0 lb (warm season) nitrogen per 1,000 sq ft per active growing month, adjusting the fertility program respective to the grass and situation requirements. If possible, water in all fertilizers following application.

Timing and rate of fertilization are influenced by turf species, existing turf conditions, desired level of quality, type of fertilizer, time of year, etc. Established cool-season turfs are fertilized predominantly

in the fall and lightly in late spring, while established warm-season turfs are fertilized from late spring through August. Avoid summer fertilization on cool-season grasses if at all possible. Do not apply urea within two weeks of liming.

Phosphorus and potassium levels can be high enough in the soil that there is no need to apply additional amounts of these nutrients. This can be determined by soil test.

Nitrogen fertilizers will state from what source (or carrier) the nitrogen is derived. The nitrogen carrier has a great impact on how you fertilize because different nitrogen carriers make nitrogen available to the turf at different rates. Consequently, the carrier will affect how much nitrogen to apply as well as when to apply it.

Nitrogen fertilizers are generally broken down into two categories: those with water-soluble, readily available nitrogen and those with slowly available nitrogen. Nitrogen fertilizers that are readily available have all of their nitrogen immediately available for plant use. After three to six weeks, this type of nitrogen is used up by the turfgrasses and results in short periods of turfgrass response. Slowly available nitrogen, however, can last from eight to 12 weeks or more.

Some of the nitrogen in slow-release fertilizers can be water-insoluble nitrogen. The percent WIN is usually stated on the fertilizer container. The fraction of nitrogen not listed as WIN should be regarded as readily available nitrogen. To effectively gauge the type of plant response from using slow-release fertilizers, calculate the percent of the total nitrogen in the container that is WIN by the following example:

In this example, 35% of the nitrogen is WIN, while the other 65% of the nitrogen is considered readily available nitrogen. In using such a fertilizer, one could expect to get an immediate response due to the high amount of readily available nitrogen. As a general guideline, if the fertilizer being used has 15% or less WIN or other slowly available N sources, it should be used in the same manner as a readily available nitrogen source in fertilizer programs.

Fertilizer label 16-4-8:	Total nitrogen	16.00%
	5.6% water insoluble nitrogen or WIN-available phosphoric acid (P ₂ O ₅).	
	4.00%	
	Sulfate of potash (K ₂ O)	8.00%

To find % of N that is WIN, use the following calculation:

$$\frac{(5.6 \text{ WIN} \times 100)}{(16 \text{ total N} \times 100)} = 35\% \text{ WIN.}$$

If the fertilizer has greater than 15% WIN or other slowly available N sources, it should be used in fertilizer programs as a slowly available form of nitrogen.

Typical nitrogen carriers, along with their inherent characteristics, are listed in **table 3 (page 73)**.

Calculating How Much Fertilizer To Purchase

In deciding what type of fertilizer to purchase, it is usually helpful to first look at Virginia Tech's recommendations for fertilizer programs that best fit a particular situation (grass species and location). Recommendations are commonly made on the basis of the number of pounds of actual nitrogen per 1,000 sq ft of lawn area. To convert pounds per 1,000 sq ft to pounds per acre, multiply the pounds of nitrogen per 1,000 sq ft by 43.5 (which is the number of 1,000 sq ft units in 1.0 acre).

The amount of fertilizer to be purchased for any one application will depend on the percent of nitrogen contained in the fertilizer. For example, to apply 1.0 lb N/1,000 sq ft from sulfur-coated urea (32% N), divide the desired application rate by the analyses (1.0 lb N/0.32 N = 3.1 lbs of sulfur-coated urea fertilizer needed to apply 1.0 lb N/1,000 sq ft). The total quantity of fertilizer material needed for an area is calculated by multiplying 3.1 lbs of material by the number of 1,000 sq ft units of lawn area to be fertilized. For example, if a homeowner had 8,500 sq ft of lawn area and wanted to use a 46-0-0 (46% N) fertilizer to apply 0.7 lb of actual nitrogen per 1,000 sq ft of lawn, the homeowner would make the following calculations:

$$\frac{1.25}{0.07} = 1.8 \text{ per } 1,000 \text{ sq ft.}$$

1.8 lbs of fertilizer per 1,000 sq ft x 8.5 units of 1,000 sq ft = 15.3 lbs of fertilizer needed per 8,500 sq ft of lawn.

Applying the Right Amount of Fertilizer

Getting the most out of every fertilizer dollar involves knowing how to accurately apply fertilizer to your lawn. Most lawn fertilizers are applied by the homeowner as dry granules using either a drop-type or spinner-type fertilizer spreader. Each fertilizer spreader will have a dial to adjust the spreader openings that determine how much fertilizer is applied as the spreader travels across the lawn. Changing to a fertilizer of different granule size or weight and varying speed of spreader operation can alter application rates. Therefore, homeowners should be able to calibrate or adjust their fertilizer application.

Calibrating a Drop-Type Spreader

1. Attach a pan, bag, bucket, or other apparatus to the spreader to collect the fertilizer during operation.
2. Fill the spreader.
3. Determine the width of spreader application.
4. Operate the spreader to cover 435.6 sq ft. NOTE: For an 18-inch wide spreader, the distance should be

$$\frac{435.6 \text{ sq ft}}{1.5 \text{ ft}} = 290.4 \text{ ft}$$

5. Weigh the amount of fertilizer collected.
6. Multiply the weight collected by 2.3 to calculate fertilizer applied per 1,000 sq ft.
7. If a per-acre delivery rate is desired, multiply the weight collected by 100 to calculate fertilizer applied per acre.
8. Repeat this procedure and continue by trial and error, adjusting the applicator dial each time until the desired application rate is reached.

Calibrating a Spinner-Type Spreader

The procedure and calculations are the same as the drop-type spreader except the width of the fertilizer throw is used as the spreader width. For example, if a spinner spreader has an application width of 5 feet, the operating distance would be

$$\frac{435.6 \text{ sq ft}}{5 \text{ ft}} = 87 \text{ ft}$$

This type of applicator gives the best results when half of the desired fertilizer application rate is applied traveling in one direction, while the other half is applied in a direction at a 90-degree (right) angle to the first in a crisscrossing pattern. This ensures more uniform coverage by minimizing the effect of leaving too much space between swaths. However, when using this half plus half crisscrossing method, be sure to calibrate the spreader to apply half of the fertilizer to the 435.6 sq ft area because the lawn area will be covered twice.

Spreader Calibration Without a Collection Device

Method A: The procedure and calculations are the same except that the fertilizer material is repeatedly applied onto wrapping paper or a smooth concrete floor until an area of 435.6 sq ft is covered. The material is then swept up and weighed to determine the application rate per 435.6 sq ft.

Method B: A quantity of fertilizer is weighed and then put in the spreader. The spreader is operated over a 435.6 sq ft lawn area (this fertilizer material cannot be recovered), and the fertilizer remaining in the spreader is then weighed. Subtracting the weight of the remaining fertilizer from the starting weight will equal the fertilizer application rate per 435.6 sq ft.

Method C: This method actually does not involve calibration, but it works particularly well for smaller lawns (10,000 sq feet or less) and applications with spinner-type spreaders that have easy to adjust application levels. Determine the area of the lawn and calculate the amount of fertilizer to the area to be treated. Place that amount of fertilizer in the hopper, select a very low setting on the spreader, and start delivering the product in multiple passes over the lawn in different directions. This method is not the most efficient in terms of time, so it would not be desirable for a lawn care professional being paid by the job, but it is quite effective for treating smaller areas in lieu of the time spent calibrating the spreader.

Table 3. Characteristics of nitrogen fertilizer sources commonly used in turf.

Nitrogen source	% nitrogen	Lbs needed for 0.7 lb of nitrogen ¹	Lbs needed for 0.9 lb of nitrogen	Lbs needed for 1.0 lb of nitrogen	Nitrogen availability	Foliar burn potential
Ammonium sulfate	20.5	3.4	N/A	N/A	Fast	High
Calcium nitrate	15.5	4.5	N/A	N/A	Fast	Very high
Urea	45	1.5	N/A	N/A	Fast	High
Urea formaldehyde	38	1.8	2.4	2.6	Slow ²	Low
Isobutylidene diurea	31	2.3	2.9	3.2	Slow ³	Low
Sulfur- or polymer-coated urea	Varies (32 used as standard)	2.2	2.8	3.1	Moderate ⁴	Low
Methylene urea	Varies (40 used as standard)	1.8	2.3	2.5	Moderate ⁵	Low
Natural organic	Varies (6 used as standard)	11.7	15.0	16.7	Slow ²	Low

¹ Up to 0.7 lb of water-soluble nitrogen per 1,000 sq ft per active growing month can be applied to either cool-season or warm-season grasses. For products that are 15% or more slowly available nitrogen, up to 0.9 lb or 1.0 lb of nitrogen can be applied per 1,000 sq ft per active growing month to cool-season or warm-season grasses, respectively.

² Release is dependent on microbial activity and factors that affect it (e.g., temperature, soil, pH, aeration, moisture, etc.).

³ Release rate is dependent on moisture availability, particle size, and soil pH.

⁴ Release rate is dependent on particle size, soil temperature, soil moisture, mechanical breakage, and thickness of the coating.

⁵ Release rate of controlled release component of methylene urea is dependent on microbial activity; small amounts of soluble nitrogen in the product will provide almost immediate response.

Applying at the Proper Time

Proper timing of nitrogen applications is different for warm-season and cool-season turfgrasses because of their different growth cycles. The following four charts show the recommendations for pounds of actual nitrogen per 1,000 sq ft of established lawn area using both quick-release and slow-release nitrogen sources for both warm- and cool-season grasses. The charts can be used to determine the most effective times of application for different levels of turfgrass quality.

Fertilizer Programs for Cool-Season Grasses

The best time to fertilize cool-season grasses, including Kentucky bluegrass, tall fescue, perennial ryegrass, and fine fescue (creeping red fescue, hard fescue, sheep fescue, and chewings fescue), in Virginia is from Aug. 15 through November. Excessive spring application of nitrogen to cool-season grasses in Virginia leads to excessive leaf growth at the expense of stored food reserves and root growth, increasing injury to lawns from summer disease and drought.

Table 4. Recommended nitrogen fertilizer rate and timing for various management programs.

Program 1. Nitrogen application by month using predominately quickly available nitrogen fertilizers (less than 15 % slowly available nitrogen or water-insoluble nitrogen).

	Sept	Oct	Nov	May 15–June 15
Quality desired	(lb N/1,000 sq ft)			
Low	0.0	0.7	0.0	0.0–0.7
Medium	0.7	0.7	0.0	0.0–0.7
High	0.7	0.7	0.7	0.0–0.7

Program 2. Nitrogen application by month using predominately slowly available nitrogen fertilizers (15% or more slowly available nitrogen or water-insoluble nitrogen).

	Aug 15–Sept 15	Oct 1–Nov 1	May 15–June 15
Quality desired	(lb N/1,000 sq ft)		
Low	0.9	0.0	0.0
Medium	0.9	0.0	0.0–0.9
High	0.9	0.9	0.0–0.9

Important Notes About Programs 1 and 2

1. Fine fescue performs best at 1–2 lbs nitrogen per 1,000 sq ft per year.
2. Applications in successive months should be approximately four weeks apart.
3. Natural organic and activated sewage sludge products should be applied early in the application periods in Program 2 to maximize their effect.
4. If nitrogen was not applied the previous fall or to help a new lawn get better established, 0.7 lb nitrogen in Program 1 and up to 0.9 lb nitrogen in Program 2 may be applied per 1,000 sq ft in the May 1–June 15 period.

Fertilizer Programs for Warm-Season Grasses

Warm-season grasses, including bermudagrass, zoysiagrass, St. Augustinegrass, and centipedegrass, perform best when fertilized between April 1 and Aug. 15 in Virginia. Do not initiate spring nitrogen fertilization programs until frost potential has passed.

Table 4. Recommended nitrogen fertilizer rate and timing for various management programs. (cont.)

Program 3. Nitrogen application by month using predominately quickly available nitrogen fertilizers (less than 15% slowly available nitrogen or water-insoluble nitrogen).

	April*	May	June	July-Aug
Quality desired	(lb N/1,000 sq ft)			
Low	0.0	0.7	0.7	0.0
Medium	0.0	0.7	0.7	0.7
High	0.7	0.7	0.7	0.7

*Whenever possible, initiate spring fertilizer applications after turf greening is complete.

Program 4. Nitrogen application by month using predominately slowly available nitrogen fertilizers (15% or more slowly available nitrogen or water-insoluble nitrogen).

	April 15–May 31	June 1–July 15	July 16–Aug 15
Quality desired	(lb N/1,000 sq ft)		
Low	0.0	1.0	0.0
Medium	0.0	1.0	1.0
High	0.9	0.9	0.0–0.9

Important Notes About Programs 3 and 4

1. If overseeded for winter color, add 0.5–1.0 lb of readily available nitrogen per 1,000 sq ft in October and November.
2. Applications in successive months should be approximately four weeks apart.
3. Centipedegrass and mature zoysiagrass perform best at 1–2 lbs nitrogen per 1,000 sq ft per year.
4. Improved winter hardiness on bermudagrass will result from the application of potassium in late August or September.

Turfgrass Management Table Based Upon Use and Location in Virginia

Grass Species & Recommended Use	Adaptation ¹		Fertilization Requirements ² lbs Nitrogen / 1000 sq ft/yr			Mowing Height ³	Overseeding Rate ⁴ lbs/1000 sq ft
	Northern Piedmont & Areas West of The Blue Ridge	Southern Piedmont & Eastern Virginia Areas	Nitrogen (N)	Phosphate (P ₂ O ₅)	Potash (K ₂ O)		
Bermudagrass ^{5, 6}							
Lawns	NA	A	2-4	0-3	1-3	1 – 2”	2-10
Athletic Fields	A*	A	3-4	0-3	0-3	1/2-1 1/2”	5-10
Fairways	A*	A	3-4	0-3	0-4	1/2-3/4”	5-10
Tees	A*	A	3-4	0-3	0-4	1/2”	5-10
Greens	NA	SA*	1-3	0-3	0-4	3/16” or less	NR
Zoysiagrass ^{5, 6}							
Lawns	A*	A	1-2	0-3	1-3	3/4-1”	NR
Tees	A*	A	1-2	0-3	1-3	1/2-3/4”	NR
Fairways	A*	A	1-2			½-3/4”	NR
Kentucky Bluegrass							
Lawns	A	SA*	2-3.5	0-3	0-3	1 1/2-2 1/2”	+
Athletic Fields	A	SA*	2-3.5	0-3	0-3	1 1/2-2 1/2”	+
Fairways	A	NA	2-3.5	0-3	0-3	3/4-1 1/4”	+
Tees	A	NA	2-3.5	0-3	0-3	3/4-1 1/4”	+
Tall Fescue							
Lawns	A	A	2-3.5	0-3	0-3	2-3”	+
Athletic Fields	A	A	2-3.5	0-3	0-3	1 3/4-2 1/2”	+
Fine-leaf fescues (Red, chewings, hard and sheep fescue)							
Shaded lawns and low maintenance areas	A	SA	1-2	0-3	0-3	1 1/2-3”	
Creeping bentgrass							
Tees	A*	A*	2-3.5	0-3	0-4	1/4”	

Turfgrass Management Table Based Upon Use and Location in Virginia (cont.)

Greens	A*	A*	2-3.5	0-3	0-4	3/16" or less	
Fairways	A*	SA*	2-3.5			1/2"	
Perennial ryegrass⁷							
Lawns	SA	NA	2-3.5	0-3	0-3	1 1/2-2"	+
Athletic Fields	SA	NA	2-3.5	0-3	0-3	3/4"- 2"	+
Fairways	SA	NA	2-3.5	0-3	0-3	3/4-1"	+
Tees	SA	NA	2-3.5	0-3	0-3	3/4"	+
St. Augustinegrass⁵							
Lawns	NA	SA*	2-4	0-3	0-3	2-3	
Centipedegrass⁵							
Lawns	NA	SA	1-2	0-3	0-3	1-2"	
Buffalograss⁵							
Lawns	NA	NA	2-3	0-3	0-3	1.5-2.5"	

A = Adapted.

SA = Semi-adapted (may not persist under normal management). NA = Not adapted (better grass species are available for that use).

NR= Not recommended.

¹ = Turfgrass species may become more adaptive to a climate through increased management (i.e., irrigation, variety selection, fungicide applications, traffic control, proper fertilization, proper mowing, and supplemental cultural practices).

² = Fertilization requirement will depend upon geographical locations and management level/use of the turf; use soil test results to guide all other nutrient applications other than nitrogen.

³ = The ability of a specific turf species to tolerate a particular mowing height is dependent upon the variety and time of the year. Raising the mowing height toward the high end of the range before an anticipated stress period (raise before summer for cool-season grasses, raise before winter for warm-season grasses) will improve stress tolerance. Never remove more than 1/3 of the leaf tissue in any one mowing.

⁴ = Single variety or blends of perennial ryegrass varieties are typically most satisfactory for winter overseeding of lawns, athletic fields, fairways, and tees at those rates listed. Annual ryegrass and/or intermediate ryegrass have similar uses but often require more frequent mowing. It is not recommended to overseed Zoysiagrass, St. Augustinegrass and centipedegrass for winter color.

⁵ = All varieties of these species go off-color, turning brown at the first frost and remaining dormant until spring.

⁶ = The yearly nitrogen requirement will depend upon whether the turf is overseeded in the fall for winter turf. An additional 1 lb of N/1000 sq ft can be applied to overseeded bermudagrass fairways or athletic fields during the active growing periods of the overseeded cool-season turfgrass.

⁷ = When used as a mono-stand, it is very often beneficial to use blends of 2 or more varieties.

* = Requires high levels of management and appropriate variety selection.

+ = May need to be periodically overseeded to maintain adequate density, to repair damaged areas, or to make up for the lack of persistence from year to year.

Description of Cool-Season Grasses Used in Virginia

Kentucky bluegrass is a medium-textured turfgrass best suited to well-drained soils and moderate to high levels of sunlight and management. It can be established from seed or sod. Mixtures or blends of three or four Kentucky bluegrass varieties are recommended in Virginia because they are more likely to provide good quality turf over the wide range of management conditions. Kentucky bluegrass is best suited for full sun or moderate sunlight conditions under high levels of maintenance in the Central and Northern Piedmont and areas in and west of the Blue Ridge Mountains in Virginia.

Tall fescue is well adapted throughout Virginia and has the deepest root system of the cool-season grasses. Improved cultivars called “turf-type” tall fescues have much finer leaf texture and can be mixed with Kentucky bluegrass – a common practice in sod production that expands the genetic diversity of the grasses. The main management problem with tall fescue is the summer occurrence of *Rhizoctonia* brown patch disease.

The **fine fescue** group of very closely related species (hard, chewings, creeping red, and sheep fescues) is best suited for low-maintenance areas or in partial to full shade. They require very little fertility and less mowing, but perform poorly under heavy traffic or poorly drained soil conditions. Hard fescues are best adapted to open sun situations of the group, and overall, fine fescues are best adapted in the Northern Piedmont and areas in and west of the Blue Ridge Mountains in Virginia. Fine fescues sometimes are mixed with Kentucky bluegrass to provide a seed mixture that will perform well in shade and open sun.

Ryegrass is available in two types: annual and perennial. Annual (Italian) ryegrass will provide rapid germination and fast growth but will live only one year. This, along with poor persistence under adverse conditions, makes annual ryegrass only suitable where a temporary turf is desired. However, there are a number of good perennial ryegrasses available for lawn use. Perennial ryegrass lawns perform best at the higher elevations (>1,000 feet) in Virginia. The best use for perennial ryegrasses for Virginia is in a mixture with Kentucky bluegrass where the perennial ryegrass component is less than 15% by weight. A pure ryegrass lawn is generally not recommended since summer quality often declines in July and August due to its lack of drought tolerance and susceptibility to heat stress and fungal diseases.

Description of Warm-Season Grasses Used in Virginia

Bermudagrass is a warm-season turfgrass that is best adapted in Eastern Virginia, but the introduction of cold-tolerant cultivars has expanded the use of this grass pretty much statewide. It does best in open sun and is not shade tolerant. Some varieties do not produce viable seed and are therefore only vegetatively established using sprigs, plugs, or sod. Commonly used varieties that are vegetatively propagated include Tifway, Patriot, Latitude 36, Northbridge, TifTuf, Iron Cutter, and Tahoma 31. Seeded varieties also vary in their cold tolerance, and this is an important consideration in their selection outside the warmest climates of Virginia. Consult the annual VCE publication “Virginia Recommended Turfgrass Varieties” for the latest recommendations on best performing cultivars. Bermudagrass is sometimes overseeded with perennial ryegrass in early autumn to provide winter color while dormant. However, spring transition back to bermudagrass can be hindered by spring-summer conditions that favor perennial ryegrass growth and delay bermudagrass spring regrowth.

Zoysiagrass is a warm-season grass that can be used on lawns, golf course fairways, and areas that do not receive concentrated traffic. There are two major species of zoysiagrass that are used in Virginia, with the wider-bladed *Zoysia japonica* having such cold tolerance that it is adapted statewide, and the finer-bladed *Zoysia matrella* cultivars having somewhat less cold tolerance and being better adapted to the Southern Piedmont and Eastern Virginia. Zoysiagrass is very suited as a low-maintenance turf; it grows slowly and does not recover quickly from severe damage. There are varieties that can only be vegetatively propagated by using sod or plugs. Sprigging zoysiagrass is difficult due to its slow rate of establishment.

St. Augustinegrass and centipedegrass are both lawn grasses that grow best in the Hampton Roads area of Virginia, where they benefit from the coastal climate. Both are vegetatively propagated (stolons, plugs, or sod), while centipedegrass can also be established from seed. St. Augustinegrass requires more management and higher nitrogen levels than does centipedegrass. However, these grasses are not as common to coastal Virginia as they would be in more southern states.

Mixtures Versus Single Species or Variety

The individual species and the conditions under which they are grown determine whether a pure species, variety, or mixture of species or varieties is preferred. Under Virginia conditions, these general rules have given best results.

1. Mixtures or blends of adapted Kentucky bluegrass varieties have been superior to single varieties grown alone.
2. In shady areas, adding an adapted variety of creeping red fescue improves the turf.
3. Tall fescue can be grown alone or in mixtures with Kentucky bluegrass, but in mixtures, 90% or more of the mixture should be tall fescue.
4. Single varieties grown alone are preferred for all warm-season grasses.

When purchasing turfgrass seed, it is extremely important to buy quality seed. Consumer protection programs have been devised to identify quality seed of the varieties recommended by Virginia Cooperative Extension.

Certified Seed

The best guarantee of varietal purity is to purchase CERTIFIED SEED. Such seed will contain fewer weed and other crop seed contaminants and will be free of unneeded inert filler. Certified seed of single grass varieties and certain grass mixtures and blends are available in Virginia. Even with uncertified seed, it is still very important to buy seed by variety name. Varietal purity would not be certain, but there would be an indication that a percentage of the seed is of the variety claimed. When seed is purchased by kind (species) only (e.g., Kentucky bluegrass, red fescue, tall fescue, etc.), the buyer has no indication as to variety adaptation or expected performance. This seed may be sold as Variety Not Stated or VNS. Purchasing turfgrass seed without some assurance that it contains adapted varieties should be avoided except where the quality or persistence of the turfgrass stand is unimportant.

Grass Seed Mixture			
Lot # 1234-56			
Pure Seed	Variety	Germ	Origin
49.11%	ABC Tall Fescue	90%	OR
34.63%	LMP Tall Fescue	85%	OR
9.95%	TUV Tall Fescue	90%	OR
4.94%	XYZ Kentucky Bluegrass	85%	ID
0.00% Other Crop Seed			0.00% Weed Seed
1.37% Inert Matter			Test Date 11/19
Noxious Weed Seed Per lb. None Found NT WT 50 lbs.			
Seed Company			
Any Street			
Anywhere, USA 00000			

- Pure Seed:** the percentage of that variety or kind of seed.
- Variety/Kind:** Indicates the variety or kind in the container.
- Germ:** the germination percentage for that variety or crop kind 90 out of 100 seed will germinate for a 90%
- Origin:** the state of country the seed was grown.
- Other Crop Seed:** the percentage of other crop seeds in the container.
- Weed Seed** the percentage of weed seed in the container.
- Inert Matter:** the percentage of stem, leaves, chaff, and matter that will not germinate.
- Test Date:** the date seed lab report was issued for this lot of seed
- Noxious Weed:** if present must be listed as the kind and the amount present is seed per pound.

Purchasing Quality Turfgrass Seed

When purchasing turfgrass seed, there are several questions you need to consider. The following list is offered to assist you in making the best choice of grass for the particular location.

1. Most types of turfgrass are perennials and are expected to grow back year after year. When selecting and purchasing grass seeds, consider it a long-term investment. You usually get what you pay for, so consider purchasing a recommended variety that has been tested in Virginia.
2. Deal with a reliable retail store that can answer your questions and provide good information and advice.
3. Factors such as temperature, moisture, and light determine the kinds of grasses that are adapted to a location.

In order to make the best selection, take the time to consider a few basic questions, such as:

1. In what temperature zone or region of the state will the grass be grown? Examples: Eastern, Northern Piedmont, Southern Piedmont, or Western Virginia.
2. Under what moisture conditions will the grass be grown? Examples: irrigated or nonirrigated with light sandy well-drained soil, loamy deep medium-texture soil, or heavy clay soil.
3. Is the area to be planted an open area with full sun, partially shaded, or heavily shaded?
4. What type of use will the area have, and how much traffic and maintenance will it receive? Examples: home lawn with low or high maintenance, commercial business with high visibility, athletic field, or other use.

After gathering this information, consult with a knowledgeable garden center or Extension professional and review the turfgrass options.

Over the past several years, many new turfgrass varieties have been introduced in the Virginia market. The University of Maryland, USDA, and Virginia Tech conduct extensive turfgrass variety trials to identify which varieties perform well in the different regions of the state. Performance data from these trials, along with seed quality, are reviewed and published annually, and the varieties that have the best performance are recommended. The **Virginia Turfgrass Variety Recommendations** list is available through your local Extension office.

The best way to ensure that you are purchasing quality turfgrass seed is to ask for seed that is **blue tag certified**. This ensures that the seed has been inspected by an independent third party and has met established standards of quality.

The Virginia Crop Improvement Association standards for sod quality grass seed of these species are specified in **table 5 (page 82)**.

Table 5. Virginia Crop Improvement Association standards for sod-quality grass seed for common turfgrass species in Virginia.

	Minimum purity	Minimum germination	Maximum other crop seed ¹	Maximum weed seed	Lawn & turf noxious weed seed
Kind of seed	(%)				
Kentucky bluegrass	98	85	0.10 ²	0.10	None
Fine fescue	98	85	0.01	0.10	None
Tall fescue	98	85	0.10 ³	0.10	None

¹ Must be free of Canada bluegrass (*Poa compressa*), cheat and chess (*Bromus* spp.), chickweed (*Cerastium* spp. and *stellaria media*), crabgrass (*Digitaria* spp.), foxtail (*Setaria* spp.), goosegrass (*Eleusine indica*), nimblewill (*Muhlenbergia schreberi*), nutsedge (*Cyperus* spp.), panicum (*Panicum* spp.), ryegrass (*Lolium* spp.), smooth brome (*Bromus inermis*)

² Off-types of Kentucky bluegrass shall not exceed 2% for any one component. Up to 90 Canada bluegrass per pound shall be permitted in Kentucky bluegrass.

³ Up to 30 ryegrass seed per pound shall be permitted in tall fescue.

Purchasing Quality Sod in Virginia

There are several types of sod being grown in Virginia. The basic types are Kentucky bluegrass blends, tall fescue Kentucky bluegrass mixtures, bermudagrass, and zoysiagrass. Each of these types of sod is best suited to particular uses and geographic areas of Virginia. Some producers grow sod in the Virginia Crop Improvement Association-certified sod program, which means that the sod produced must meet established standards of quality. To view these standards, go to www.virginiacrop.org. VCIA-certified sod is of high quality, meeting rigid standards requiring pre-planting field inspections, prescribed varieties and mixtures, periodic production inspections, and a final preharvest inspection. This program serves as a marketing tool and provides the consumer with guaranteed standards of quality. Consumers purchasing VCIA-certified turf will receive a blue certified turf label as proof of purchase.

VCIA-Certified Turf Label (Blue)

High-quality sod is also available outside of the VCIA-certified sod program. When purchasing this sod, the consumer is encouraged to be aware of factors that are important in determining sod quality. High-quality sod will contain the best varieties and be free of serious disease, insect, or weed problems. It will be dense, have good color, and hold together well.