Final Draft of Standard

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6.12 SODDING

Definition

Stabilizing areas by laying a continuous cover of grass sod.

Purpose

To prevent erosion and damage from sediment and runoff by stabilizing the soil surface with permanent vegetation where specific goals might be:

- to provide immediate ground cover,
- to stabilize disturbed areas with a suitable plant material that cannot be established by seed, or
- to stabilize drainageways, channels, and other areas of concentrated flow where flow velocities will not exceed that specified for a grass lining (*Appendix 8.05*).

Conditions Where Practice Applies

Disturbed areas which require immediate and permanent vegetative cover, or where sodding is preferred to other means of grass establishment. Locations particularly suited to stabilization with sod are:

- waterways and channels carrying intermittent flow at acceptable velocities (*Appendix 6.05*),
- areas around drop inlets, when the drainage area has been stabilized (Practice 6.53, *Sod Drop Inlet Protection*),
- areas where prompt use and/or aesthetics are important, and
- highly erodible or steep critical areas.

Planning Considerations

Quality turf can be established with either seed or sod; site preparation for the two methods is similar. The practice of sodding for soil stabilization eliminates both the seeding and mulching operations and is a much more reliable method of producing adequate cover and sediment control. However, compared to seed, sod is more difficult to obtain, transport, and store.

Advantages of properly installed sod include:

- immediate erosion and dust control,
- nearly year-round establishment capability,
- less chance of failure than with seedings,
- freedom from weeds, and
- rapid stabilization of surfaces for traffic areas, channel linings, or critical areas.

Sod can be laid during times of the year when seeded grasses may fail, provided there is adequate water available for irrigation in the early weeks. Irrigation is essential, at all times of the year, to install sod. It is initially more costly to install sod than to plant seed. However, the higher cost may be justified for specific applications where sod performs better than seed.

In waterways and channels that carry concentrated flow, properly stapled sod is preferable to seed because it provides immediate protection. Drop inlets placed in areas to be grassed can be protected from sediment by placing permanent sod strips around the inlet (Practice 6.53, *Sod Drop Inlet Protection*). Sod also maintains the necessary grade around the inlet.

Because sod is composed of living plants that must receive adequate care, final grading and soil preparation should be completed before sod is delivered. If left rolled or stacked, heat can build up inside the sod, causing severe damage and loss of costly plant material.

Specifications

Choosing appropriate types of sod—The type of sod selected should be composed of plants adapted to both the site and the intended purpose. In North Carolina these are limited to Kentucky bluegrass, tall fescue, bluegrass tall fescue blends, fine-turf (hybrid) Bermudagrass, St. Augustinegrass, centipedegrass, and zoysiagrass. Species selection is primarily determined by region, availability, and intended use (*Table 6.12*). Availability varies across the state and from year to year. New varieties are continually being developed and tested. A complete and current listing of sod recommendations can be obtained from suppliers or the North Carolina State Cooperative Extension office. Sod composed of a mixture of varieties may be preferred because of its broader range of adaptability.

Washed Sod - Washed sod is sod that has been specially pressure washed to remove the soil, leaving only plants and roots. This process eliminates the possibility of soil incompatibility, and it forces the grass to establish its root system more quickly than soil-based sod.

It is commonly used in areas that need to be well drained with underlying sandy media such as sports pitches, golf greens and tees, or stormwater control infiltration devices containing sensitive media. Washed sod weighs half as much as conventional sod and is therefore, easy to transport and install in areas where large equipment access is limited.

Site preparation for washed sod is like that of conventional sod. However, due to lack of soil base, washed sod lacks side-to-side stability and moisture retention. Therefore, it is important to conform with vendor guidelines.

Quality of sod—Use only high-quality sod of known genetic origin, free of noxious weeds, disease, and insect problems. It should appear healthy and vigorous, and conform to the following specifications:

- Sod should be machine cut at a uniform depth of 1/2 - 2 inches (excluding shoot growth and thatch).
- Sod should not have been cut in excessively wet or dry weather.
- Sections of sod should be a standard size as determined by the supplier, uniform, and untorn.
- Sections of sod should be strong enough to support their own weight and retain their size and shape when lifted by one end.
- Harvest, delivery, and installation of sod should take place within a period of 36 hours.

Soil preparation—Test soil to determine the exact requirements for lime and fertilizer. Soil tests may be conducted by the State soil testing lab or a reputable commercial laboratory. Information on free soil testing is available from the Agronomic Division of the North Carolina Department of Agriculture or the Agricultural Extension Service. Where sodding must be planned without soil tests the following soil amendments may be sufficient:

- **Pulverized agricultural limestone** at a rate of 2 tons/acre (100 lb/1,000 ft^2)
- **Fertilizer** at a rate of 1,000 lb/acre (25 lb/1,000 ft^2) of 10-20-20 or similar ratio providing same nutrient content. These amendments should be spread evenly over the area and incorporated into the top 4-8 inches of soil by disking, harrowing, or other effective means. If topsoil is applied, follow specifications given in Practice 6.04, *Topsoiling*.

Prior to laying sod, clear the soil surface of trash, debris, roots, branches, stones, and clods larger than 2 inches in diameter. Fill or level low spots in order to avoid standing water. Rake or harrow the site to achieve a smooth and level final grade.

Complete soil preparation by rolling or cultipacking to firm the soil. Avoid using heavy equipment on the area, particularly when the soil is wet, as this may cause excessive compaction, and make it difficult for the sod to take root.

Sod installation—A procedure for installing sod is illustrated in Figure 6.12a and described below.

1. Moistening the sod after it is unrolled helps maintain its viability. Store it in the shade during installation.
2. Rake the soil surface to break the crust just before laying sod. During the summer, lightly irrigate the soil immediately before laying the sod to cool the soil and to reduce root burning and dieback.
3. Do not sod on gravel, frozen soils, or soils that have been treated recently with sterilts or herbicides.
4. Lay the first row of sod in a straight line with subsequent rows placed parallel to and butting tightly against each other. Stagger strips in a brick-like pattern. Be sure that the sod is not stretched or overlapped and that all joints are butted tightly to prevent voids. Use a knife or sharp spade to trim and fit irregularly shaped areas.
5. Install strips of sod with their longest dimension perpendicular to the slope. On slopes 3:1 or greater, or wherever erosion may be a problem, secure sod with staples or other approved method.
6. When staples are utilized, staples shall be at least 6 inches in height. At a minimum, staples shall be applied at each corner of the sod, in the middle of the sod and once every foot on the uphill leading edge.
7. As sodding of clearly defined areas is completed, roll sod to provide firm contact between roots and soil.
8. After rolling, irrigate until the soil is wet 4 inches below the sod.
9. Keep sodded areas moist to a depth of 4 inches until the grass takes root. This can be determined by gently tugging on the sod; resistance indicates that rooting has occurred.
10. Mowing should not be attempted until the sod is firmly rooted, usually 2-3 weeks.

Sodded waterways—Sod can provide a resilient channel lining, providing immediate protection from concentrated runoff and eliminating the need for installing mats or mulch. The following points apply to the use of sod in waterways:

1. Prepare the soil as described in Practice 6.30, *Grass-lined Channels*. The sod type must be able to withstand the velocity of flow specified in the channel design (*Appendix 8.05*).
2. Lay sod strips perpendicular to the direction of flow, with the lateral joints staggered in a brick-like pattern. Edges should butt tightly together (Figure 6.12b).
3. After rolling or tamping to create a firm contact, staple individual sod strips to resist washout during establishment.

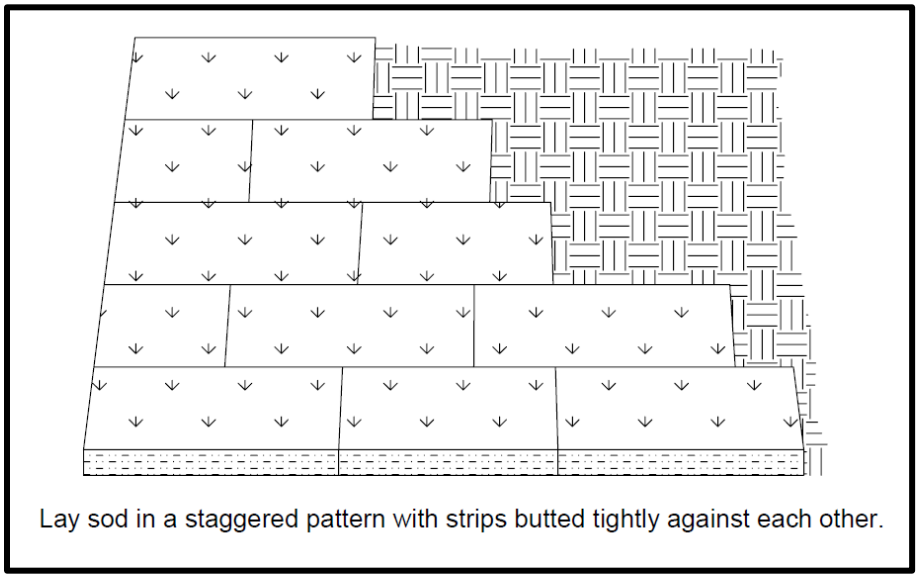

Figure 6.12a *Typical installation of Grass Sod.*

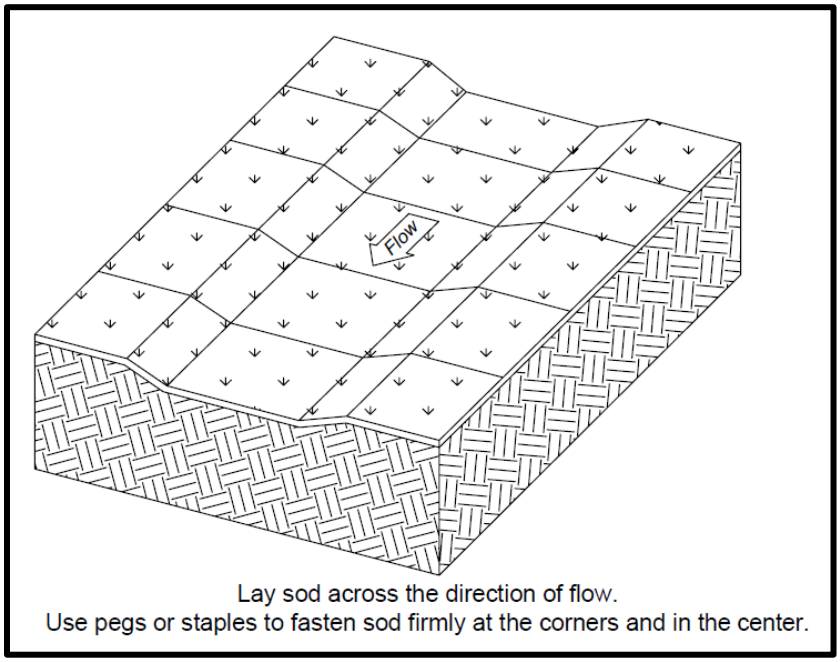

Figure 6.12b *Installation of Sod in Areas with Channel Flows.*

Table 6.12
Characteristics of the Principal Lawn Grasses grown as sod in North Carolina

Type of Sod	Region of Adaptation[1]	Tolerance Ratings					Maintenance		
Cool season grasses:		**Shade**	**Heat**	**Cold**	**Drought**	**Wear**	**Annual Fertilizer (lb N/1000 ft^2)**	**Mowing Height (in.)**	**Mowing Frequency[2]**
Kentucky bluegrass blend	F/M	good	Fair	Very good	Good	good	2-3	1.5-2.5	Medium
Tall fescue blend	C/F/M/P/S	Good	Good	Very good	Very good	Very good	2.5-3.5	2.5-3.5	High
Tall fescue/Kentucky bluegrass	F/M/P	Good	Good	Very good	Very good	Very good	2-3	2.5-3.5	High
Warm season grasses:									
Hybrid Bermudagrass	C/P/S	Very poor	Very good	Poor	Excellent	Excellent	3-6	0.75-2	Medium-high
Zoysiagrass	C/F/M/P/S	Good	Very good	Good	Excellent	Good	1-3	0.75-2	Low-high
Centipedegrass	C/P/S	Good	Good	Poor	Good	Poor	1-2	1-1.5	Low
St. Augustinegrass	C/P/S	Very good	Very good	Poor	Good	Poor	2-3	2.5-4	Med-high

[1] Region of Adaptation: C-Coastal Plain, F-Foothills, M-Mountains, P-Piedmont, S-Sandhills
[2] Mowing Frequency is dictated by season, intensity of management, and use

Adapted from *Carolina Lawns*, NCAES Bulletin no. AG-69, Revised and Miller, G. 2022. Lawns, Chapter 9. In: K.A. Moore, and. L.K. Bradley (eds). *North Carolina Extension Gardener Handbook*, 2nd ed. NC State Extension, Raleigh, NC.

Maintenance

After the first week, water as necessary to maintain adequate moisture in the root zone and prevent dormancy of the sod.

Permanent stabilization is achieved when sod roots completely bind into the underlying soil with no slumping of the sod or die-off.

Do not remove more than one-third of the shoot in any mowing. Grass height should be maintained between 2 and 3 inches unless otherwise specified.

After the first growing season, established sod requires fertilization, and may also require lime. Follow soil test recommendations when possible or use the rates in Table 6.12.

References

Site Preparation
6.04, Topsoiling

Surface Stabilization
6.11, Permanent Seeding

Runoff Conveyance Measures
6.30, Grass-lined Channels

Inlet Protection
6.53, Sod Drop Inlet Protection

Appendices
8.02, Vegetation Tables
8.05, Design of Stable Channels and Diversions

CTC Edits to Original Standard

6.12

SODDING

S

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Purpose

To prevent erosion and damage from sediment and runoff by stabilizing the soil surface with permanent vegetation where specific goals might be:

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- to stabilize disturbed areas with a suitable plant material that cannot be established by seed, or
- to stabilize drainageways, channels, and other areas of concentrated flow where flow velocities will not exceed that specified for a grass lining (*Appendix 8.05*).

Disturbed areas which require immediate and permanent vegetative cover, or where sodding is preferred to other means of grass establishment. Locations particularly suited to stabilization with sod are:

- waterways and channels carrying intermittent flow at acceptable velocities (*Appendix 6.05*),
- areas around drop inlets, when the drainage area has been stabilized (Practice 6.53, *Sod Drop Inlet Protection*),
- ~~residential or commercial lawns and golf courses~~areas where prompt use and/or aesthetics are important, and
- highly erodible or steep critical areas.

Quality turf can be established with either seed or sod; site preparation for the two methods is similar. The practice of sodding for soil stabilization eliminates both the seeding and mulching ~~operations, and~~operations and is a much more reliable method of producing adequate cover and sediment control. However, compared to seed, sod is more difficult to obtain, transport, and store.

Advantages of properly installed sod include:

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- nearly year-round establishment capability,
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- rapid stabilization of surfaces for traffic areas, channel linings, or critical areas.

Sod can be laid during times of the year when seeded grasses may fail, provided there is adequate water available for irrigation in the early weeks. Irrigation is essential, at all times of the year, to install sod. It is initially more costly to install sod than to plant seed. However, the higher cost may be justified for specific applications where sod performs better than seed.

Commented [WL1]: Group Comment: Remove peg and replace with staples

Commented [WL2]: Not permanently stabilized until roots have established. Removing reference to permanent stabilization and adding section at end to indicate when sod is considered permanently stabilized.

Commented [WL3]: Georgia mentioned highly erodible areas which had not been captured here.

In waterways and channels that carry concentrated flow, properly ~~pegged~~ stapled sod is preferable to seed because it provides immediate protection. Drop inlets placed in areas to be grassed can be protected from sediment by placing permanent sod strips around the inlet (Practice 6.53, *Sod Drop Inlet Protection*). Sod also maintains the necessary grade around the inlet.

Because sod is composed of living plants that must receive adequate care, final grading and soil preparation should be completed before sod is delivered. If left rolled or stacked, heat can build up inside the sod, causing severe damage and loss of costly plant material.

Specifications

Choosing appropriate types of sod—The type of sod selected should be composed of plants adapted to both the site and the intended purpose. In North Carolina these are limited to Kentucky bluegrass, tall fescue, bluegrass tall fescue blends, fine-turf (hybrid) Bermudagrass, St. Augustinegrass, centipedegrass, and zoysiagrass. Species selection is primarily determined by region, availability, and intended use (Table 6.12~~a~~). Availability varies across the state and from year to year. New varieties are continually being developed and tested. A complete and current listing of sod recommendations can be obtained from suppliers or the North Carolina State Cooperative ~~Agricultural~~ Extension office. Sod composed of a mixture of varieties may be preferred ~~becuase~~ because of its broader range of adaptability.

Table 6.12~~a~~ Types of sod Available in North Carolina

	Varieties	Region of Adaptation
Cool season grasses:		
Kentucky bluegrass blend[1]		Mountains
Tall fescue blend	~~Adventure, Brookston, Falcon, Finelawn, Galway, Houndog, Jaguar, Olympic, Rebel~~	Mountains and Piedmont
Tall fescue/Kentucky bluegrass		Mountains and Piedmont
Warm season grasses:		
Hybrid Bermudagrass	~~Vamont, Tifway, Tifway II & Tifgreen~~	Piedmont and Coastal Plain
Zoysiagrass	~~Emerald, Meyer~~	Piedmont and Coastal Plain
Centipedegrass	~~No improved varieties~~	Piedmont and Coastal Plain
St. Augustinegrass	~~Raleigh~~	Piedmont and Coastal Plain

[1]A large number of varieties exist—consult suppliers and your local N.C. State~~Agricultural~~ Cooperative Extension office for recommendations.

Commented [WL4]: Remove Varieties https://content.ces.ncsu.edu/extension-gardener-handbook/9-lawns#section_heading_6602 has many more cultivars

Commented [WL5R4]: Combine 6.12a and b

Commented [WL6R4]: Add in sandhills/foothills to region

Washed Sod - Washed sod is sod that has been specially pressure washed to remove the soil, leaving only plants and roots. This process eliminates the possibility of soil incompatibility and it forces the grass to establish its root system more quickly than soil-based sod.

It is commonly used in areas that need to be well drained with underlying sandy media such as sports pitches, golf greens and tees, or stormwater control infiltration devices containing sensitive media. Washed sod weighs half as much conventional sod and is, therefore, easy to transport and install in areas where large equipment access is limited.

Site preparation for washed sod is like that of conventional sod. However, due to lack of soil base, washed sod lacks side-to-side stability and moisture retention. Therefore, it is important to conform with vendor guidelines.

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- Sod should be machine cut at a uniform depth of 1/2 - 2 inches (excluding shoot growth and thatch).
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- Harvest, delivery, and installation of sod should take place within a period of 36 hours.

Soil preparation—Test soil to determine the exact requirements for lime and fertilizer. Soil tests may be conducted by the State soil testing lab or a reputable commercial laboratory. Information on free soil testing is available from the Agronomic Division of the North Carolina Department of Agriculture or the Agricultural Extension Service. Where sodding must be planned without soil tests the following soil amendments may be sufficient:

- **Pulverized agricultural limestone** at a rate of 2 tons/acre (100 lb/1,000 ft²)
- **Fertilizer** at a rate of 1,000 lb/acre (25 lb/1,000 ft²) of 10-20-20 or similar ratio providing same nutrient content. ~~of 10-10-10 in fall or 5-10-10 in spring.~~

~~Equivalent nutrients may be applied with other fertilizer formulations.~~ These amendments should be spread evenly over the area~~,~~ and incorporated into the top 4-8 inches of soil by disking, harrowing, or other effective means. If topsoil is applied, follow specifications given in Practice 6.04, *Topsoiling*.

Prior to laying sod, clear the soil surface of trash, debris, roots, branches, stones, and clods larger than 2 inches in diameter. Fill or level low spots in order to avoid standing water. Rake or harrow the site to achieve a smooth and level final grade.

Complete soil preparation by rolling or cultipacking to firm the soil. Avoid using heavy equipment on the area, particularly when the soil is wet, as this

Commented [WL7]: add in Stormwater design manual

Commented [WL8]: Group Comment: soil less sod, site prep, more intensive practice, handling, storage, installation

Commented [WL9R8]: Group Provided: https://extension.msstate.edu/news/feature-story/2006/msu-developed-sod-has-worldwide-appeal

Commented [WL10R8]: Group Provided: https://archive.lib.msu.edu/tic/tgtre/article/2000jan9.pdf

Commented [WL11R8]: washed sod

Commented [WL12R8]: added section to cover washed sod

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Commented [WL15]: Same as Alabama

Commented [WL16]: Group Comment: 10-20-20 fertilizer recommendation ratio instead of calling for specific fertilizer

Commented [WL17R16]: look at seeding specs

Commented [WL18]: Alabama 6"

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may cause excessive compaction, and make it difficult for the sod to take root.

Sod installation—A step-by-step procedure for installing sod is illustrated in Figure 6.12a and described below.

1. Moistening the sod after it is unrolled helps maintain its viability. Store it in the shade during installation.

2. Rake the soil surface to break the crust just before laying sod. During the summer, lightly irrigate the soil, immediately before laying the sod to cool the soil, reduce root burning, and dieback.

Commented [WL21]: Remove and replace.

Commented [WL22]: Alabama sod detail

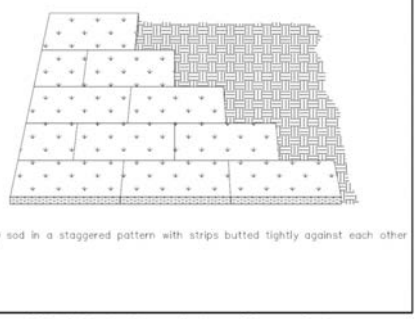


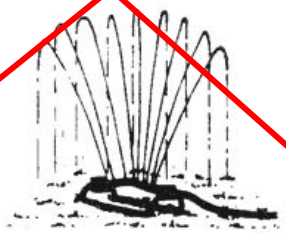
Figure SOD-2 Typical Installation of Grass Sod

Lay sod in a staggered pattern with strips buttered tightly against each other. A sharpened mason's trowel can be used to tuck down the ends and trim pieces.

Correct
Incorrect

Butting – angled ends caused by the automatic sod cutting must be matched correctly.

Roll sod immediately to achieve firm contact with the soil.



Water to a depth of 4" as soon as the sod is ~~laid, and~~laid and continue watering as

Mow when the sod is established (2-3 wks). Set the mower high 2-3").

Figure 6.12a Proper installation of grass sod (modified from Va SWCC).

3. Do not sod on gravel, frozen soils, or soils that have been treated recently with sterilants or herbicides.

4. Lay the first row of sod in a straight line with subsequent rows placed parall~~el~~ed to and butting tightly against each other. Stagger strips in a brick-like pattern. Be sure that the sod is not ~~streached~~stretched or overlapped and that all joints are butted tightly to prevent voids. Use a knife or sharp spade to trim and fit irregularly shaped areas.

Install strips of sod with their longest dimension perpendicular to the slope. On slopes 3:1 or greater, or wherever erosion may be a problem, secure sod with ~~pegs or~~ staples or other approved method.

Commented [WL23]: Group Comment: staple everything

5. When staples are utilized, staples shall be at least 6 inches in height. At a minimum, staples shall be applied at each corner of the sod, in the middle of the sod and once every foot on the uphill leading edge.

6. As sodding of clearly defined areas is completed, roll sod to provide firm contact between roots and soil.

7. After rolling, irrigate until the soil is wet 4 inches below the sod.

8. Keep sodded areas moist to a depth of 4 inches until the grass takes root. This can be determined by gently tugging on the sod—resistance indicates that rooting has occurred.

9. Mowing should not be attempted until the sod is firmly rooted, usually 2-3 weeks.

Commented [WL24]: Temporary stabilization until roots

Sodded waterways—Sod can provides a resilient channel lining, providing immediate protection from concentrated runoff and eliminating the need for installing mats or mulch. The following points apply to the use of sod in waterways:

1. Prepare the soil as described in Practice 6.30, Grass-lined Channels. The sod type must be able to withstand the velocity of flow specified in the channel design (Appendix 8.05).

2. Lay sod strips perpendicular to the direction of flow, with the lateral joints staggered in a brick-like pattern. Edges should butt tightly together (Figure 6.12b).

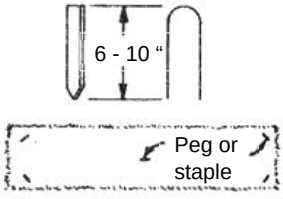
3. After rolling or tamping to create a firm contact, ~~peg or~~ staple individual sod strips to resist washout during establishment.

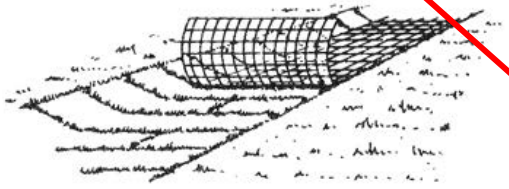
Flow

Lay sod across the direction of flow.

6.1

Use pegs or stables to fasten sod firmly at the ends of strips and in the center, or every 3-4' if the strips are long. When ready to mow drive pegs or staples flush with the ground.





In critical areas, secure sod with netting and staples.

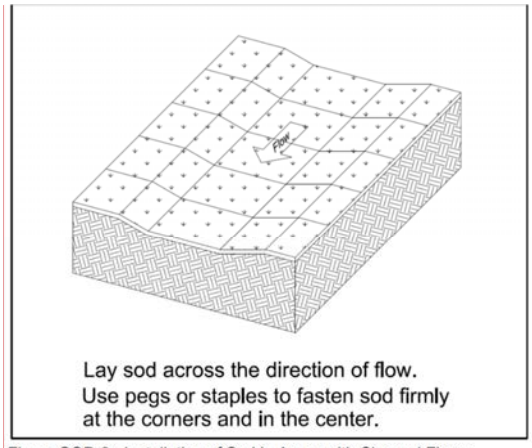


Figure SOD-3 Installation of Sod in Areas with Channel Flows

Table 6.12~~b~~
Characteristics of the Principal Lawn grasses grown as sod in North Carolina

Species or Mixture	Adaptation					Maintenance		
	Shade	Heat	Cold	Drought	Wear	Annual Fertilizer (lb N/1000 ft²)	Mowing Height (in.)	Mowing Frequency
Kentucky bluegrass	good	fair	very good	good	good	~~2.5-4~~2-3	~~2~~1.5-2.5	med.
Kentucky bluegrass/ Tall fescue	good	good	very good	very good	very good	2.5-3	~~3~~2.5-3.5	high
Tall fescue	good	good	very good	very good	very good	2.5-3.5	~~3~~2.5-3.5	high
Hybrid Bermudagrass	very poor	very good	poor	excel.	excel.	~~5-6~~3-6	~~1~~0.75	med-high
Centipedegrass	~~fair~~good	good	poor	good	poor	~~0.5~~1-2	1	low
St. Augustinegrass	very good	very good	poor	good	poor	2.5	2-3	m~~M~~ed-high~~.~~
Zoysiagrass	~~fair~~good	very good	~~fair~~good	excel.	good	1.5	~~1~~0.75	high-very high

Adapted from *Carolina Lawns*, NCAES Bulletin no. AG-69.

~~2.~~ ~~After rolling or tamping to create a firm contact, peg or staple individual sod strips to resist washout during establishment. Jute or other netting material may be pegged over the sod for extra protection on critical areas.~~

Commented [WL25]: Alabama Sod in Channel Detail

Commented [WL26R25]: Group Comment: Add a staple pattern per sq ft, square vs. rectangular (rolled)

Commented [WL27R25]: Group Comment: table for staples?

Commented [WL28R25]: Group Comment: uphill leading edge every 4 ft (1 every ft), square 3x3 (at least 3 on uphill leading edge.

Commented [WL29]: Compared adaptations against https://content.ces.ncsu.edu/extension-gardener-handbook/9-lawns and AG-69, Revised

Commented [WL30R29]: Checked Annual Fertilizer taken from AG-69, Revised - Fertilizer is different than from the above reference

6 Maintenance

After the first week, water as necessary to maintain adequate moisture in the root zone and prevent dormancy of the sod.

Permanent stabilization is achieved when sod roots completely bind into the underlying soil with no slumping of the sod or die-off.

Do not remove more than one-third of the shoot in any mowing. Grass height should be maintained between 2 and 3 inches unless otherwise specified.

After the first growing season, established sod requires fertilization, and may also require lime. Follow soil test recommendations when ~~possible, or~~possible or use the rates in Table 6.12b.

References

Site Preparation
6.04, Topsoiling

Surface Stabilization
6.11, Permanent Seeding

Runoff Conveyance Measures
6.30, Grass-lined Channels

Inlet Protection
6.53, Sod Drop Inlet Protection

Appendices
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Warm season grasses:									
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[1] Region of Adaptation: C-Coastal Plain, F-Foothills, M-Mountains, P-Piedmont, S-Sandhills
[2] Mowing Frequency is dictated by season, intensity of management, and use

Adapted from *Carolina Lawns*, NCAES Bulletin no. AG-69, Revised and Miller, G. 2022. Lawns, Chapter 9. In: K.A. Moore, and. L.K. Bradley (eds). *North Carolina Extension Gardener Handbook*, 2nd ed. NC State Extension, Raleigh, NC.

DEMLR Comments to CTC Edits

6.12

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SODDING

Definition

Stabilizing areas by laying a continuous cover of grass sod.

Purpose

To prevent erosion and damage from sediment and runoff by stabilizing the soil surface with permanent vegetation where specific goals might be:

- to provide immediate ground cover,
- to stabilize disturbed areas with a suitable plant material that cannot be established by seed, or
- to stabilize drainageways, channels, and other areas of concentrated flow where flow velocities will not exceed that specified for a grass lining (*Appendix 8.05*).

Condition Where Practice Applies

Disturbed areas which require immediate and permanent vegetative cover, or where sodding is preferred to other means of grass establishment. Locations particularly suited to stabilization with sod are:

- waterways and channels carrying intermittent flow at acceptable velocities (*Appendix 6.05*),
- areas around drop inlets, when the drainage area has been stabilized (Practice 6.53, *Sod Drop Inlet Protection*),
- areas where prompt use and/or aesthetics are important, and
- highly erodible or steep critical areas.

Planning Considerations

Quality turf can be established with either seed or sod; site preparation for the two methods is similar. The practice of sodding for soil stabilization eliminates both the seeding and mulching operations and is a much more reliable method of producing adequate cover and sediment control. However, compared to seed, sod is more difficult to obtain, transport, and store.

Advantages of properly installed sod include:

- immediate erosion and dust control,
- nearly year-round establishment capability,
- less chance of failure than with seedings,
- freedom from weeds, and
- rapid stabilization of surfaces for traffic areas, channel linings, or critical areas.

Sod can be laid during times of the year when seeded grasses may fail, provided there is adequate water available for irrigation in the early weeks. Irrigation is essential, at all times of the year, to install sod. It is initially more costly to

install sod than to plant seed. However, the higher cost may be justified for specific applications where sod performs better than seed.

In waterways and channels that carry concentrated flow, properly stapled sod is preferable to seed because it provides immediate protection. Drop inlets placed in areas to be grassed can be protected from sediment by placing permanent sod strips around the inlet (Practice 6.53, *Sod Drop Inlet Protection*). Sod also maintains the necessary grade around the inlet.

Because sod is composed of living plants that must receive adequate care, final grading and soil preparation should be completed before sod is delivered. If left rolled or stacked, heat can build up inside the sod, causing severe damage and loss of costly plant material.

Specifications

Choosing appropriate types of sod—The type of sod selected should be composed of plants adapted to both the site and the intended purpose. In North Carolina these are limited to Kentucky bluegrass, tall fescue, bluegrass tall fescue blends, fine-turf (hybrid) Bermudagrass, St. Augustinegrass, centipedegrass, and zoysiagrass. Species selection is primarily determined by region, availability, and intended use (Table 6.12). Availability varies across the state and from year to year. New varieties are continually being developed and tested. A complete and current listing of sod recommendations can be obtained from suppliers or the North Carolina State Cooperative Extension office. Sod composed of a mixture of varieties may be preferred because of its broader range of adaptability.

Washed Sod - Washed sod is sod that has been specially pressure washed to remove the soil, leaving only plants and roots. This process eliminates the possibility of soil incompatibility and it forces the grass to establish its root system more quickly than soil-based sod.

It is commonly used in areas that need to be well drained with underlying sandy media such as sports pitches, golf greens and tees, or stormwater control infiltration devices containing sensitive media. Washed sod weighs half as much as conventional sod and is therefore, easy to transport and install in areas where large equipment access is limited.

Site preparation for washed sod is like that of conventional sod. However, due to lack of soil base, washed sod lacks side-to-side stability and moisture retention. Therefore, it is important to conform with vendor guidelines.

Quality of sod—Use only high-quality sod of known genetic origin, free of noxious weeds, disease, and insect problems. It should appear healthy and vigorous, and conform to the following specifications:

- Sod should be machine cut at a uniform depth of 1/2 - 2 inches (excluding shoot growth and thatch).
- Sod should not have been cut in excessively wet or dry weather.
- Sections of sod should be a standard size as determined by the supplier, uniform, and untorn.
- Sections of sod should be strong enough to support their own weight and retain their size and shape when lifted by one end.

- Harvest, delivery, and installation of sod should take place within a period of 36 hours.

Soil preparation—Test soil to determine the exact requirements for lime and fertilizer. Soil tests may be conducted by the State soil testing lab or a reputable commercial laboratory. Information on free soil testing is available from the Agronomic Division of the North Carolina Department of Agriculture or the Agricultural Extension Service. Where sodding must be planned without soil tests the following soil amendments may be sufficient:

- **Pulverized agricultural limestone** at a rate of 2 tons/acre (100 lb/1,000 ft^2)

• **Fertilizer** at a rate of 1,000 lb/acre (25 lb/1,000 ft^2) of 10-20-20 or similar ratio providing same nutrient content. These amendments should be spread evenly over the area and incorporated into the top 4-8 inches of soil by disking, harrowing, or other effective means. If topsoil is applied, follow specifications given in Practice 6.04, *Topsoiling*.

Prior to laying sod, clear the soil surface of trash, debris, roots, branches, stones, and clods larger than 2 inches in diameter. Fill or level low spots in order to avoid standing water. Rake or harrow the site to achieve a smooth and level final grade.

Complete soil preparation by rolling or cultipacking to firm the soil. Avoid using heavy equipment on the area, particularly when the soil is wet, as this may cause excessive compaction, and make it difficult for the sod to take root.

Sod installation—A procedure for installing sod is illustrated in Figure 6.12a and described below.

1. Moistening the sod after it is unrolled helps maintain its viability. Store it in the shade during installation.

2. Rake the soil surface to break the crust just before laying sod. During the summer, lightly irrigate the soil immediately before laying the sod to cool the soil and to reduce root burning and dieback.

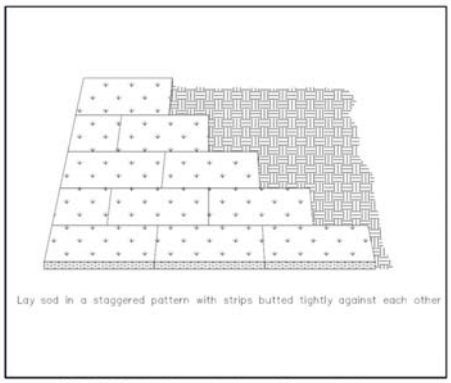

Figure SOD-2 Typical Installation of Grass Sod

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Remove text inside box and make consistent with next image.

3. Do not sod on gravel, frozen soils, or soils that have been treated recently with sterilants or herbicides.

4. Lay the first row of sod in a straight line with subsequent rows placed parallel to and butting tightly against each other. Stagger strips in a brick-like pattern. Be sure that the sod is not stretched or overlapped and that all joints are butted tightly to prevent voids. Use a knife or sharp spade to trim and fit irregularly shaped areas.

5. Install strips of sod with their longest dimension perpendicular to the slope. On slopes 3:1 or greater, or wherever erosion may be a problem, secure sod with staples or other approved method.

6. When staples are utilized, staples shall be at least 6 inches in height. At a minimum, staples shall be applied at each corner of the sod, in the middle of the sod and once every foot on the uphill leading edge.

7. As sodding of clearly defined areas is completed, roll sod to provide firm contact between roots and soil.

8. After rolling, irrigate until the soil is wet 4 inches below the sod.

9. Keep sodded areas moist to a depth of 4 inches until the grass takes root. This can be determined by gently tugging on the sod; resistance indicates that rooting has occurred.

10. Mowing should not be attempted until the sod is firmly rooted, usually 2-3 weeks.

Sodded waterways—Sod can provide a resilient channel lining, providing immediate protection from concentrated runoff and eliminating the need for installing mats or mulch. The following points apply to the use of sod in waterways:

1. Prepare the soil as described in Practice 6.30, *Grass-lined Channels*. The sod type must be able to withstand the velocity of flow specified in the channel design (*Appendix 8.05*).

2. Lay sod strips perpendicular to the direction of flow, with the lateral joints staggered in a brick-like pattern. Edges should butt tightly together (Figure 6.12b).

3. After rolling or tamping to create a firm contact, staple individual sod strips to resist washout during establishment.

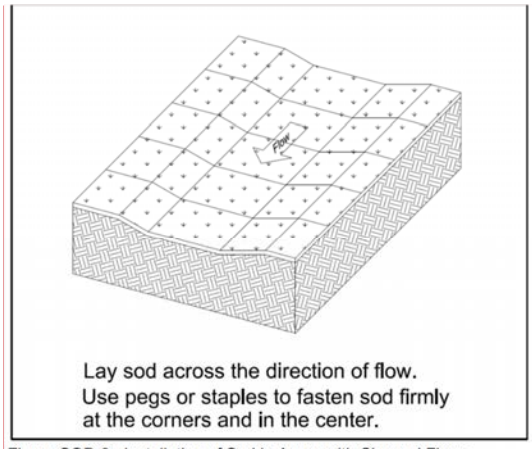

Figure SOD-3 Installation of Sod in Areas with Channel Flows

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Table 6.12
Characteristics of the Principal Lawn grasses grown as sod in North Carolina

Maintenance

After the first week, water as necessary to maintain adequate moisture in the root zone and prevent dormancy of the sod.

Permanent stabilization is achieved when sod roots completely bind into the underlying soil with no slumping of the sod or die-off.

Do not remove more than one-third of the shoot in any mowing. Grass height should be maintained between 2 and 3 inches unless otherwise specified.

After the first growing season, established sod requires fertilization, and may also require lime. Follow soil test recommendations when possible or use the rates in Table 6.12.

References

Site Preparation
6.04, Topsoiling

Surface Stabilization
6.11, Permanent Seeding

Runoff Conveyance Measures
6.30, Grass-lined Channels

Inlet Protection
6.53, Sod Drop Inlet Protection

Appendices
8.02, Vegetation Tables
8.05, Design of Stable Channels and Diversions

Table 6.12
Characteristics of the Principal Lawn grasses grown as sod in North Carolina

Type of Sod	Region of Adaptation[1]	Tolerance Ratings					Maintenance		
Cool season grasses:		**Shade**	**Heat**	**Cold**	**Drought**	**Wear**	**Annual Fertilizer (lb N/1000 ft^2)**	**Mowing Height (in.)**	**Mowing Frequency[2]**
Kentucky bluegrass blend	F/M	good	Fair	Very good	Good	good	2-3	1.5-2.5	Medium
Tall fescue blend	C/F/M/P/S	Good	Good	Very good	Very good	Very good	2.5-3.5	2.5-3.5	High
Tall fescue/Kentucky bluegrass	F/M/P	Good	Good	Very good	Very good	Very good	2-3	2.5-3.5	High
Warm season grasses:									
Hybrid Bermudagrass	C/P/S	Very poor	Very good	Poor	Excellent	Excellent	3-6	0.75-2	Medium-high
Zoysiagrass	C/F/M/P/S	Good	Very good	Good	Excellent	Good	1-3	0.75-2	Low-high
Centipedegrass	C/P/S	Good	Good	Poor	Good	Poor	1-2	1-1.5	Low
St. Augustinegrass	C/P/S	Very good	Very good	Poor	Good	Poor	2-3	2.5-4	Med-high

[1] Region of Adaptation: C-Coastal Plain, F-Foothills, M-Mountains, P-Piedmont, S-Sandhills
[2] Mowing Frequency is dictated by season, intensity of management, and use

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