

Matthew S. Wells
Director

Frank N. Stovall
*Deputy Director
for Operations*



COMMONWEALTH of VIRGINIA
DEPARTMENT OF CONSERVATION AND RECREATION

Darryl Glover
*Deputy Director for
Dam Safety,
Floodplain Management and
Soil and Water Conservation*

Laura Ellis
*Interim Deputy Director for
Administration and Finance*

April 11, 2024

The Town of Vinton
Anita J. McMillan, CZA
Planning and Zoning Director
311 South Pollard Street
Vinton, VA 24179

Your nutrient management plan (NMP) dated 07/01/2024 located in Roanoke County has been approved by the Virginia Department of Conservation and Recreation (DCR). The approved plan is for 3.00 acres. Only nutrient recommendations for applications to be made after the date of this letter are approved by this letter. Your NMP was written by Robert Habel, a nutrient management planner certified by DCR.

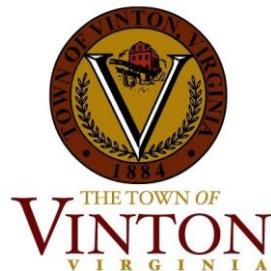
This site has not been inspected by DCR and this approval is contingent upon site conditions being as stated in the NMP. Any revisions to this plan must be approved by DCR. Any change in personnel resulting in a change to the plan manager should be reported to the Certified Nutrient Management Planner who will then make DCR aware. Please note that this letter should be kept with the NMP and supporting documentation including nutrient application records. This plan expires on 07/01/2027. Please feel free to contact me with any questions or concerns regarding this approval.

Best regards,

Gonzalo Ortiz

Gonzalo Ortiz
Urban Nutrient Management Specialist
Division of Soil and Water Conservation
600 East Main Street, 24th Floor
Richmond VA 23219
(804) 217-2010

600 East Main Street, 24th Floor | Richmond, Virginia 23219 | 804-786-6124



Nutrient Management Plan

Prepared For:

The Town of Vinton

Anita J. McMillan, CZA

Planning and Zoning Director

311 South Pollard Street

Vinton, VA 24179

Phone: (540) 283-7008 Cell: (540) 355-1371

Fax: (540) 983-0621 Email: amcmillan@vintonva.gov

www.vintonva.gov



Prepared By:

Five Oaks Agronomy Consulting

Robert Habel, CNMP

206 Briarherst Drive

Amherst, Virginia 24521

Cell: 434-665-2813 habelrf@gmail.com

Certification Code: 654

Acreage Total: 3

| | |
|------------|---------|
| County: | Roanoke |
| Watershed: | RU13 |

Plan Written: July 1, 2024

Plan Expires: July 1, 2027

Planner Signature

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Sources:

Maps – Maps are produced using Google Earth or provided by client.

Photos/Logos – Obtained from client, clients website, or taken by planner.

Site information – Obtained from client or clients website.

Technical Information –

Agronomy Handbook – A&L Labs – 2001

Best Golf Course Management Practices – McCarty – 2001

Environmental Best Management Practices for Golf Courses – Virginia GCSAA – January 2012

Golf Course Management and Construction, Environmental Issues – Balogh, Walker, USGA – 1992

Soil Fertility and Fertilizers 6th Ed. – Havlin, Beaton, Tisdale, Nelson – 1999

Spectrum Analytic Agronomic Library – www.spectrumanalytic.com

Sports Turf Management in the Transition Zone – Goatley, Askew, Ervin, McCall, VSTMA, Etc. – 2008

Turf Management for Golf Courses 2nd Ed. – Beard, USGA – 2002

Turfgrass Soil Fertility and Chemical Problems – Carrow, Waddington, Rieke – 2001

Urban Nutrient Management Handbook – VA DCR, Virginia Tech, Virginia State Uni. – May 2011

Virginia Nutrient Management Standards and Criteria – Commonwealth of Virginia – July 2014

Disclaimer: Statements and recommendations made within this document based on published research data and experience. Recommendations are based on the soil tests included in this document and not intended for use on any other facility. Products suggested are used in methods suggest by label guidelines when available, be sure to read label before using products as labels can change. Maximum rates are provided by Virginia Department of Conservation and Recreation Standards and Criteria and are not to be exceeded even when product label suggests otherwise. No guarantee or warranty is made, expressed or implied, concerning crop performance as a result of using the contents of this document.

Definitions:

M = 1000 FT²

= Pounds of product

N = Nitrogen

P = Phosphorus

K = Potassium

NMP = Nutrient Management Plan

MS4 = Municipal Separate Storm Sewer System

1. Statement of Compliance

The Town of Vinton is required to have and follow this Nutrient Management Plan according to the Rules and Regulations of the Code of Virginia. According to 9VAC25-890-40 MS4 General permit, permittees are required under the “Turf and Landscape Management” section of the permit (GP Section II.B.6.c) to develop NMPs on “all lands owned or operated by the MS4 operator where nutrients are applied to a contiguous area greater than one acre.” Thus, the Town of Vinton agrees to comply with all requirements set forth in the Nutrient Management Training and Certification Regulations, 4VAC50-85-10 et seq., and to follow recommendations for turf fertilization and management as described in the Virginia Nutrient Management Standards and Criteria, Revised July 2014. This includes implementing this Department of Conservation and Recreation approved Nutrient Management Plan and maintaining fertilization records. All nutrient applications to Vinton War Memorial, performed by Town of Vinton staff or other contractors, shall comply with the provisions of this Nutrient Management Plan as of July 1, 2024. This plan is affective for three years (until July 1, 2027) or until major renovations or major changes to maintenance practices occur. The planner should be alerted if this occurs or if new soil tests are taken within the three-year period, a minor revision may be needed if tests show major differences. The process of updating this plan for a new three year cycle should begin no later than 6 months prior to plan expiration (January 2027).

2. Plan Overview

The Vinton War Memorial is one of the region's crown jewels for meetings, social and outdoor events. The War Memorial offers corporate, association, civic, government and social groups a state of the art space to host a wide variety of special events. Situated on a beautiful 11.5 acre park and located in the heart of Virginia's Blue Ridge, the Vinton War Memorial is only an 8-10 minute drive from downtown Roanoke.

The Vinton War Memorial was originally conceived as the centerpiece of an 11-acre park that could be enjoyed by the community while honoring those who made the ultimate sacrifice in service to our country during World War II. The park was finished in 1946 and the two-story brick building known as the Vinton War Memorial was dedicated and opened to the public on August 20, 1948. Initially, the Vinton War Memorial included the town's library, small meeting rooms, and the Dogwood Ballroom. After an extensive renovation in 2007, the Vinton War Memorial continues to be recognized as a premier event space in Virginia's Blue Ridge.



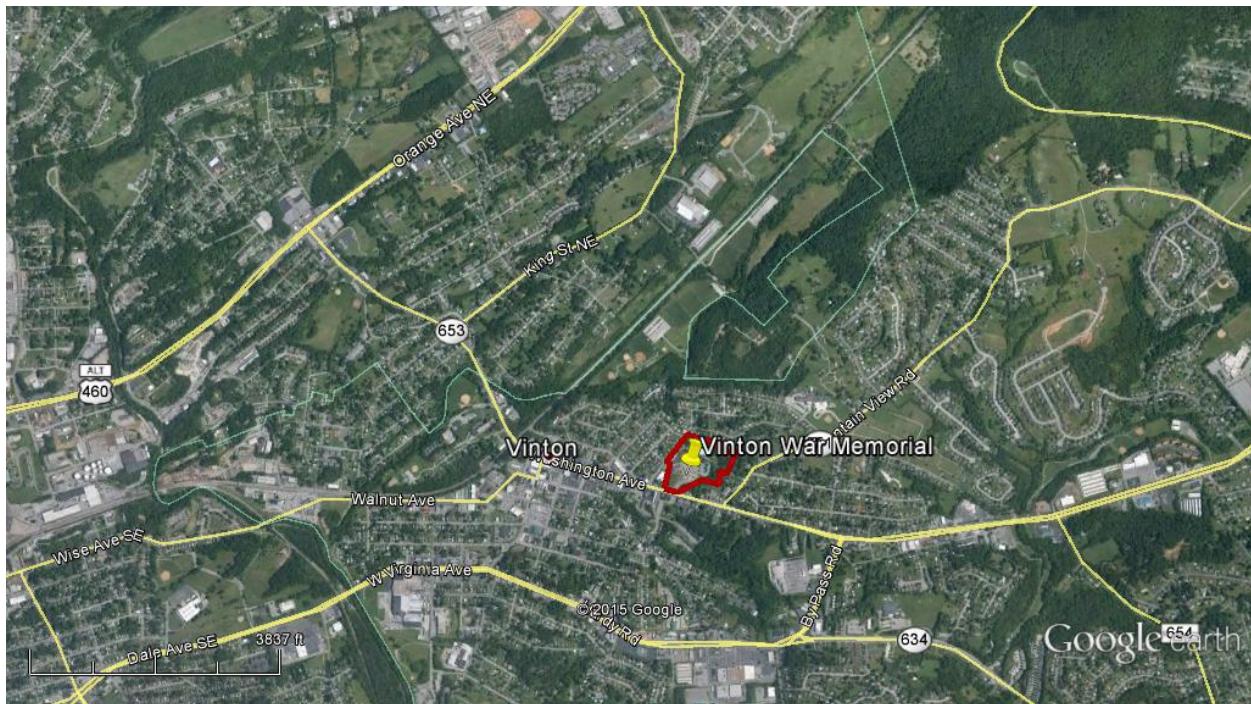
3. Location

Vinton War Memorial is 8-10 minutes from Downtown Roanoke.

From Rt. 460 between 581 and 220, turn onto Gus Nicks Blvd which turns into Washington Avenue. War Memorial will be on left 0.7 miles from 460.

Address: 814 Washington Avenue, Vinton, VA 24179

GPS: 37.280431, -79.890093



4. Nutrient Management Principles

Nutrient Management Plans focus on two primary objectives healthy plants and clean water. The *Standards and Criteria* are based upon many years of scientific research and the rates suggested are optimal for plant health within the intended usage. Low input areas, like home lawns, require some fertilizer to maintain plant vigor thus maintaining turf cover and preventing erosion. High use areas, like sports fields, require frequent fertilizer input to help maintain plant health and to aid in recovery from stress. Clean water is maintained by applying fertilizer in a responsible manner ensuring minimum movement away from the intended site.

There are four different types of elements essential for plant health. Non-mineral, Primary and Secondary elements are all considered Macronutrients. The fourth is Micronutrients. Non-mineral elements consist of carbon, hydrogen, and oxygen; these elements are obtained from air and water. The Primary nutrients are nitrogen, phosphorus, and potassium. Secondary elements are calcium, magnesium, and sulfur. Micronutrients are iron, manganese, boron, zinc, copper, molybdenum, chlorine, cobalt, and nickel. All of these elements are obtained from the soil and must be supplemented with fertilizer, lime or other soil amendments when a soil test

shows a deficiency. In high maintenance situations, some elements are spray applied and absorbed through the leaf tissue.

Nitrogen and Phosphorus are the focus of a nutrient management plan, as these nutrients cause ecological problems. Lime is also important because having improper pH can make applied fertilizers unavailable to the plant and more likely to leach or runoff. While nitrogen and phosphorus are the focus, other nutrients are also discussed in the plan, these nutrients are beneficial to plant health, but do not cause water quality problems.

Nitrogen (N) – This element is responsible for green color, shoot growth and density, root growth, carbohydrate reserves, recuperative potential, heat, cold, drought hardiness, wear tolerance, and disease susceptibility. Nitrogen has a very complex cycle and only certain forms are available to the plant. It leaches through the soil rapidly and does not accumulate thus you cannot soil test for N. Due to these factors, nitrogen management is a large part of nutrient management. Nitrogen management includes but is not limited to using slow release materials, timing the applications in accordance with plant growth, and making multiple applications so that the element is available when it is needed by the plant.

3.5 #/M is the max N rate for “Commercial” cool season turf.

Phosphorus (P) – Phosphorus controls the establishment rate of newly seeded turf, plant maturation, root growth, and seed production. Like nitrogen, P also has a complex cycle. The major difference is that P readily attaches soil, it can be quantified by a soil test and only leaches when it completely saturates the soil. Phosphorus moves away from the application site when it is improperly applied to compacted soil or other impervious surfaces, when applied in excess, and since it attaches to the soil, with sediment rich runoff. Phosphorus management is also important to nutrient management. It should only be applied when called for by a soil test, to soils that are not compacted to prevent runoff and only applied to actively growing turf with sufficient turf cover/rooting to hold the soil in place.

Maximum P rates are outlined in application worksheets. Do not exceed this number.

Potassium (K) - Potassium is responsible for root growth, heat, cold, and drought hardiness, wear tolerance, and disease susceptibility. While the *Standards and Criteria* do regulate the application of K, but in some cases, K input may exceed recommended levels, as it does not have the same detrimental effects on the health of Virginia’s waters as N and P. Potassium is considered the plant nutrient most responsible for turf quality. It helps plants respond to stresses like drought, extreme heat/cold, and insect/disease pressure. The plants increased ability to respond to stress in a positive manner can help reduce the need for increased N and P fertility and reseeding caused by stress. In addition to the benefits of K, it is difficult to limit the amount of K used as most modern slow release fertilizers contain both N and K while limiting or completely removing P. Nitrogen only products are not readily available in slow release form and custom blended fertilizers are expensive.

Lime - Liming is a critical management practice for maintaining soil pH at optimal levels for plant growth. Liming supplies the essential elements Calcium (Ca) and/or Magnesium (Mg), reduces the solubility and potential toxicity of Aluminum and Manganese, and increases the availability of essential nutrients. Many soil elements change form because of chemical reactions in the soil due to pHs that are either too acidic or too basic. Plants may not be able to use elements in some of these forms making some elements essential to plant health unavailable. Most plants grow well in the pH range 5.8 to 6.5.

Buffer pH is used to provide an indication of the soil's total (active + reserve) acidity and ability to resist a change in pH. This buffer measurement is the major factor in determining the amount of lime to apply. The Buffer pH starts at 7 (no lime needed) and goes lower as the soil's total acidity increases and more lime is needed to raise the soil pH. As an example, a clay soil with a pH of 6.1 could have a buffer pH of 6.8 and need 1 ton/A of lime in order to maintain/increase that pH around 6.2. A sandy soil could have a much lower pH but have the same buffer pH thus, needing the same amount of lime to change the pH to 6.2. This is because sandy soils have a lower cation exchange capacity thus, less storage for reserve acid.

Attempting to change the pH in the deep rooting zone of an established turf is difficult at best. One method of getting lime somewhat deeper in established turf areas is to apply lime in conjunction with aeration. Applying lime in the fall and winter months is recommended because the freeze/thaw cycle aids in mixing lime throughout the root zone.

Lime provides the essential nutrients Calcium and Magnesium. Calcium is the main component of plant cell walls while magnesium is the atom upon which chlorophyll is built. It is important that these elements be present in the soil not only to help regulate the soil's acidity but to insure plant health. When a soil's pH is acidic, these elements can be added with lime. Calcitic lime should be used when calcium is deficient and magnesium is high. Dolomitic lime, which is more common, is used when both are deficient or balanced. If pH does not need to be adjusted, calcium levels can be raised with gypsum and magnesium is raised with Epsom salts. The *Standards and Criteria* provide guidance on adjusting soil pH levels but do not include any recommendations for Ca or Mg, as they do not affect water quality.

Not all liming materials are the same, if the liming material chosen does not equate to 100% Calcium Carbonate Equivalent (CCE% should be listed on bag) see chart on page 31 to adjust the required amount of lime.

No lime is required at this time.

Sulfur (S) - Sulfur is responsible for the plants green color, shoot growth and density, root growth, carbohydrate reserves, and disease susceptibility. Elemental sulfur applications should be avoided unless you are attempting to acidify (lower pH) the soil and should be applied at no more than 5#/M and watered in due to the turf burn potential. Unless called for by a soil test, the occasional use of sulfur containing fertilizers and micro nutrient packages should be the only S input needed to supplement the soil S content. This element is not included in the *Standards and Criteria*.

Iron (Fe) – Iron contributes to the plants green color, shoot growth and density, root growth, carbohydrate reserves, heat, cold and drought hardiness and wear tolerance. Iron is often included in fertilizer and micronutrient blends because it produces a faster greening of turf than nitrogen. According to the *Standards and Criteria*, Fe applications can be occasionally substituted for N applications because it produces greening. This is a good strategy, but Fe apps cannot replace N. While Fe is used inside the plant, the greening created by Fe is superficial and caused by the iron rusting on the plants surface. Fe should be used as an N replacement only when the plant is healthy and greening is desired without increased growth.

Micros – Other micronutrients are not mentioned by the *Standards and Criteria*. These elements are very important to plant growth, but regular input is not needed unless you are managing a sand based soil with low nutrient holding capacity. Most soils contain all the necessary micros and they will be available for the plant as long as the proper pH is maintained.

5. Best Management Practices for Water Quality Protection

The following list comes from the *Urban Nutrient Management Handbook* page 8-12 and details steps that can reduce the impact of nutrient management practices on water quality. A PDF of the complete handbook can be found online through ext.vt.edu, on the CD provided with the plan or a printed copy can be obtained from DCR.

- Base fertilization practices on a soil test.
- Supplement the soil test with a plant tissue test when necessary.
- Aerate compacted soil to reduce runoff and aid phosphorus and lime in entering the soil.
- Minimize fertilizer rates on slopes and sandy soils. If using quickly available sources of nitrogen on deep, sandy soils or near shallow water tables, use no more than 0.25 to 0.50 pound of nitrogen per 1,000 square feet per application.
- Establish and maintain a buffer zone of reduced- to zero-input vegetation around bodies of water. In some cases, native vegetation might be appropriate, but whatever plant material is selected, it must persist indefinitely to serve as a functional buffer zone.
- Consider using iron as a supplement to nitrogen for greening response.
- Use at least 50 percent slowly available sources of nitrogen on soils subject to leaching.
- Time applications carefully. Do not apply fertilizer before a heavy rainfall.
- Irrigate lightly (0.10 to 0.25 inch) after each application of quick-release fertilizer so it is washed off the foliage and moved into the soil. (Wait to irrigate if foliar activity is desired)
- Avoid over irrigation.
- Return grass clippings to the turf to improve nutrient cycling and reduce the amount of fertilizer needed to produce healthy plants. Use a mulching mower whenever possible and consider that a mulching mower can even be used to manage fall leaves (Goatley 2006).
- When collected, compost grass clippings rather than disposing of them in landfills.
- Use a drop (gravity) spreader near bodies of water or impenetrable areas to lessen the chance of spreading material on these surfaces.
- Perhaps the most important best management practice toward improving water quality is to simply sweep or blow fertilizers and clippings off hardscape surfaces and back into the turf.

6. Application Equipment Calibration

An agronomically and environmentally sound fertilizer program can be negated by improperly calibrated equipment. It is important to calibrate your equipment prior to every application. Even moving from one location to another can knock your application equipment out of adjustment so once you have your equipment calibrated for a particular product write down the setting. Use that setting to check the calibration for every site and adjust if necessary. The next time you use that product, use your records as a starting point and not a final calibration as equipment can wear over time thus changing the calibration point. For more information on how to calibrate your equipment see the *Urban Nutrient Management Handbook* Chapter 10 (ext.vt.edu) or visit your equipment manufacturer's website. Please remember that the number on the bag is not sufficient, every spreader and every application is different, and that the bag number only serves as a calibration starting point.

7. Season of Fertilization

According to the *Virginia Nutrient Management Standards and Criteria, Revised July 2014*, fertilizers must be applied in between the following dates. These are guidelines and averages, in warmer years fertilizers could be applied earlier and in cooler years fertilizers should be applied later. Fertilizers should not be applied to frozen ground or to grass that is not actively growing. For warm season grasses please wait for green up to occur. For warm season grasses that are overseeded, follow the cool season application window. If overseeding is skipped, please revert to warm season window.

| | Average Frost Dates | Cool Season Applications | Warm Season Applications |
|---------------|----------------------------|---------------------------------|---------------------------------|
| Spring | April 15 | March 4 | April 15 |
| Fall | October 25 | December 6 | September 25 |

Maps - Satellite and topo maps created using Google Earth are to scale as shown in bottom left of each map. For all maps, unless otherwise indicated, North is oriented towards top of page.

8. Management Area



Description

The fertilized areas of the Vinton War Memorial are highlighted above in red. They total about 3 acres of cool season turf.

9. Environmentally Sensitive

The map below highlights several environmentally sensitive sites.

- There are numerous sidewalks and roadways throughout this site. Please be aware of these areas and clean up any fertilizer that may have been overspread on these areas. There are numerous storm drains in the parking lot; drains that can be seen on the map are marked with yellow pins. Any fertilizer overspread will end up in these drains when it rains if it is not cleaned up properly.
- In the middle of the large field to the south of the building, there is a large storm drain; also marked with a yellow pin. Fertilizer applications should be avoided when heavy rains are expected and please do not spread fertilizer directly onto drain.
- To the North West, there is a storm water retention pond, highlighted in yellow. According to the map, no fertilizer is applied near this area, but any fertilizer miss-applied to the sidewalks, roadways and parking lots will most likely end up here with the potential of going out the overflow.
- Applications of inorganic fertilizers will not occur on frozen or snow-covered ground.
- Again, any fertilizer that makes its way onto impervious surfaces (sidewalks, roads, parking lots, etc.) should be swept or blown back into pervious turfgrass-covered areas.
- Do not use fertilizers as ice melt.



10. Soil Test Summaries

Soil samples were taken by Robert Habel on 3/13/24. A minimum of 10 random sub samples were collected, at a depth of 3-4 inches, using a soil probe and placed in plastic bags. Thatch and other organics were removed prior to boxing. Testing was conducted by Waypoint Analytical and converted to VT Soil Lab using formulas provided by DCR.

Soil tests are rated in terms of Very Low to Very High. In order to comply with Virginia Nutrient Management Standards and Criteria, Revised July 2014, no phosphorus or potassium may be applied if a soil test rates that element Very High. In economic terms, nutrients are not necessarily needed if they test above a medium rating; plant response is not guaranteed if soils already test above medium and therefore money can be saved by using a nitrogen only fertilizer. (See plant response chart page 17)

| Soil Test Summary | | | | | | | | |
|----------------------|-------------------------------|-----------|---|-----------|------------|----------------------------|------------|------------|
| Customer Name: | Vinton War Memorial | | | | | | | |
| Testing Lab: | Waypoint Analytical | | | | | | | |
| Sample Date: | 3/13/2024 | | | | | | | |
| Analysis Date: | 3/27/2021 | | | | | | | |
| Planner Name | Five Oaks Agronomy Consulting | | | | | | | |
| Certification Number | 654 | | | | | | | |
| Managed Area ID | Soil pH | Buffer pH | Lab P ₂ O ₅ (ppm) | VTP (ppm) | VT (H/M/L) | Lab K ₂ O (ppm) | VT K (ppm) | VT (H/M/L) |
| Soil Test ID# | | | | | | | | |
| TOVWM | 6.90 | | 49 | 19.2 | H- | 188 | 133.5 | H |
| Recommendations | Lime | 0 | | P | 1#/M | | K | .75#/M |

11. Soil Test Results

Discussion of soil test results and allowable nutrient inputs. Specific applications details can be found in Nutrient Application Worksheet.

Soil test shows high (H-) levels of phosphorus and high (H) levels of potassium. Regulations allow for up to 1#/M of phosphorus and .75 #/M potassium. Regulations allow for up to 3.5 #/M of nitrogen per year.

Soil test shows no need for lime.

12. Nutrient Application Worksheet

The following worksheet details specific fertilizer applications using the previously discussed soil test information. All nutrient input level recommendations come from the Department of Conservation and Recreation's Nutrient Management Standards and Criteria, this document is part of the Code of Virginia and thus is law for those required to have a Nutrient Management Plan. While applications do not have to be followed specifically, it is important to note that per month nitrogen levels shall not be exceeded and per year phosphorus levels shall not be exceeded. In some cases, potassium input may exceed recommended levels, as it does not have the same detrimental effects on the health of Virginia's waters as nitrogen and phosphorus. Potassium is considered the plant nutrient most responsible for quality. It helps plants respond to stresses like drought, extreme heat/cold and insect/disease pressure. The plants increased ability to respond to stress in a positive manner can help reduce the need for increased N and P fertility and reseeding caused by stress.

| NUTRIENT APPLICATION WORK SHEET | | | | | | | | | | | | |
|---------------------------------|--|--------------------|-----------------|-------------------------------|--------|---------|---------------------|--|-------------------|----------------|--------|---------|
| Name: | Town of Vinton | | | Management Area: | | | Vinton War Memorial | | | | | |
| Prepared: | 7/1/2024 | | | Area: | 3 | | Turf Type: | | Mixed Cool Season | | | |
| Expires: | 7/1/2027 | | | | | | | | | | | |
| Total Yearly Nutrient Needs | Application Month/Day | Analysis N - P - K | Interval (days) | Fertilizer Description | Rate/M | Ibs/app | % Slow Release N | Total/M | | Lime | Gypsum | Ibs/app |
| Nitrogen | After March 4 | 12 - 0 - 0 | 30 | Greenyard Crabgrass Preventer | 4.17 | 545 | 0% | 0.5 | - 0 - 0 | | | |
| 3.5 | | | | | | | | | | | | |
| Phosphorus | August/Sept | 25 - 0 - 0 | 30 | GreenGro 50% SCU | 3.60 | 470 | 50% | 0.9 | - 0 - 0 | | | |
| 1 | | | | | | | | | | | | |
| Potassium | Oct/Nov | 25 - 0 - 0 | 30 | GreenGro 25% SCU | 3.60 | 470 | 25% | 0.9 | - 0 - 0.00 | | | |
| 0.75 | | | | | | | | | | | | |
| No applications after Dec 6 | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | Lime | | | | | | | | | | | |
| | No lime needed at this time. | | | | | | | | | | | |
| | | | | | | | | Total used: | | 2.3 - 0 - 0.00 | 0 | |
| | | | | | | | | Do not exceed yearly maximum allowed by Regulation: | | 3.5 - 1 - 0.75 | 0 | |
| Notes | <ul style="list-style-type: none"> • Tested H- in Phosphorus and H in Potassium • If using 100% water-soluble nitrogen .7 lbs may be applied every 30 days. If using slow release materials, .9 lbs may be used every 30 days. • All fertilizer analyses are subject to change; do not exceed stated monthly Total N or yearly total P. Please contact your planner if you need help adjusting a fertilizer application to meet the requirements of this plan. • Attempt to coordinate lime apps with aerification | | | | | | | | | | | |

13. Fertilizer Application Records

Fertilizer Application Records

When was the last time your fertilizer equipment was calibrated???

For information on calibration, see Chapter 10 of the "Urban Nutrient Management Handbook".

Available for download at <http://pubs.ext.vt.edu/430/430-350/430-350.html>

14. Reference Material

Nutrient Availability According to pH

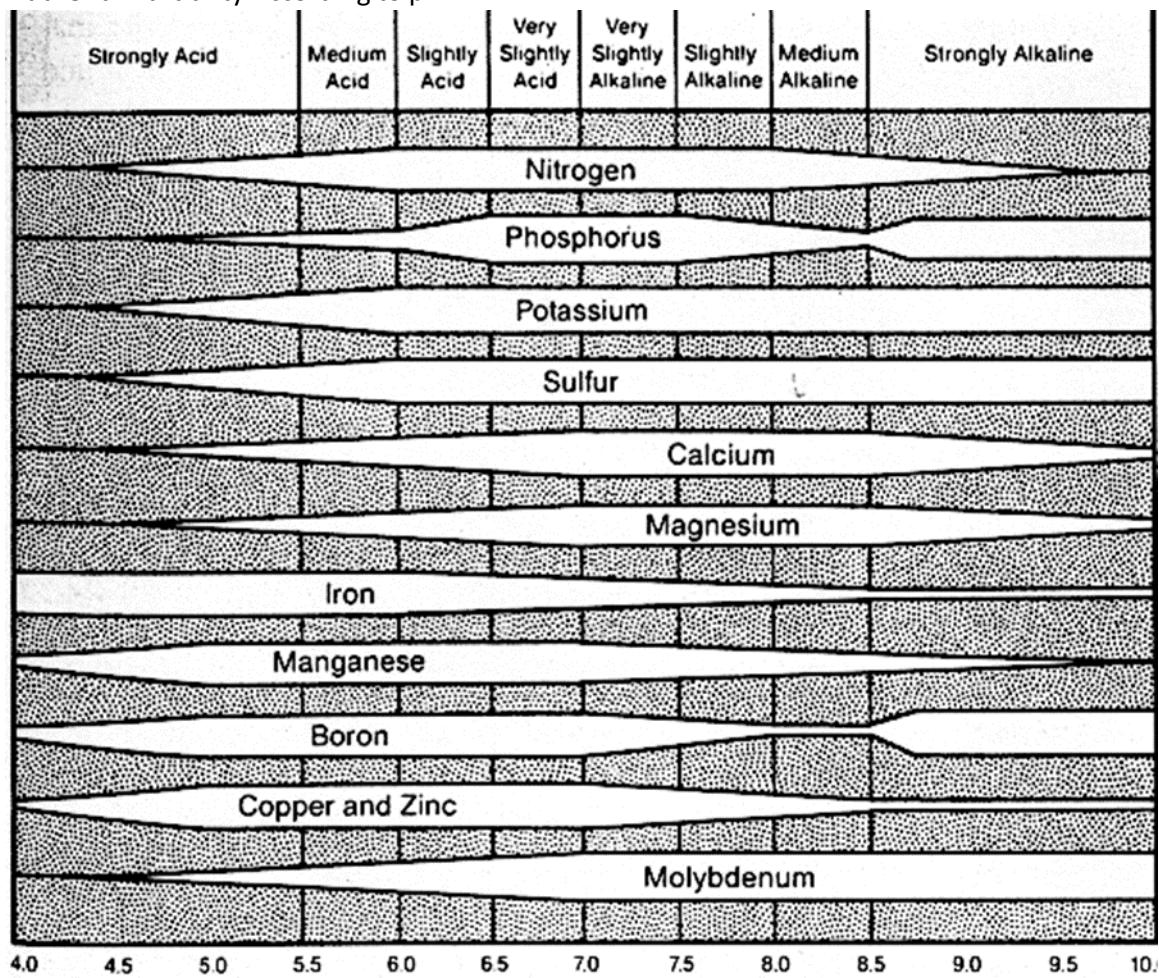


Figure 1: Nutrient Availability at pH

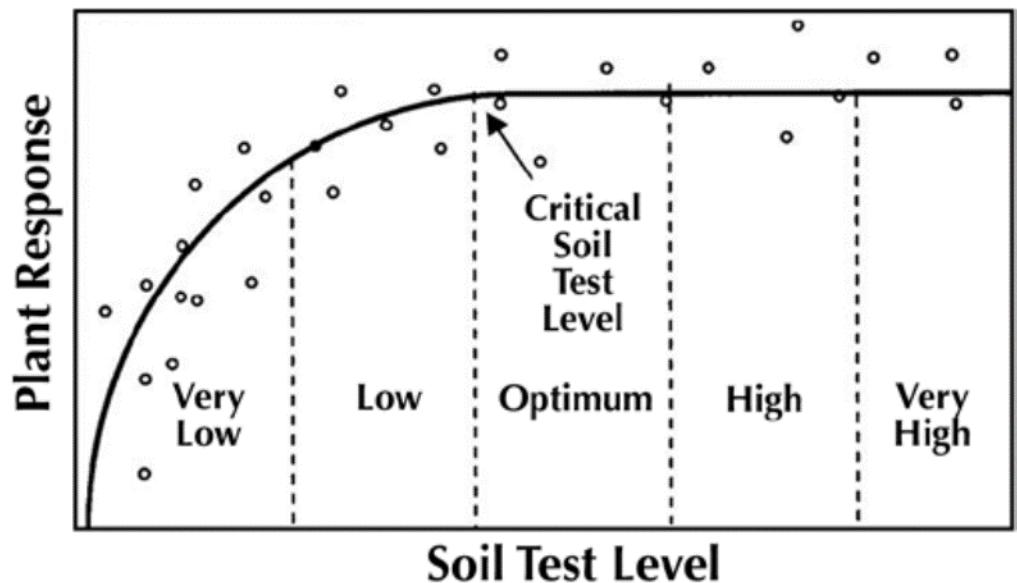


Figure 2: Plant Response Chart

Very low: A plant response is most likely if the indicated nutrient is applied. A large portion of the nutrient requirement must come from fertilization.

Low: A plant response is likely if the indicated nutrient is applied. A portion of the nutrient requirement must come from fertilization.

Medium: A plant response may or may not occur if the indicated nutrient is applied. A small portion of the nutrient requirement must come from fertilization.

High: Plant response is not expected. No additional fertilizer is needed.

Very high: Plant response is not expected. The soil can supply much more than the turf requires. Additional fertilizer should not be added to avoid nutritional problems and adverse environmental consequences.

Standards and Criteria

Section VI. Turfgrass Nutrient Recommendations for Home Lawns, Office Parks, Public Lands and Other Similar Residential/Commercial Grounds

Definitions

For the purposes of this section, the following definitions, as presented by the Association of American Plant Food Control Officials (AAPFCO), apply:

“Enhanced efficiency fertilizer” describes fertilizer products with characteristics that allow increased plant nutrient availability and reduce the potential of nutrient losses to the environment when compared to an appropriate reference product.

“Slow or controlled release fertilizer” means a fertilizer containing a plant nutrient in a form which delays its availability for plant uptake and use after application, or which extends its availability to the plant significantly longer than a reference “rapidly available nutrient fertilizer” such as ammonium nitrate, urea, ammonium phosphate or potassium chloride. A slow or controlled release fertilizer must contain a minimum of 15 percent slowly available forms of nitrogen.

“Water soluble nitrogen”, “WSN”, or “readily available nitrogen” means: Water soluble nitrogen in either ammonical, urea, or nitrate form that does not have a controlled release, or slow response.

Recommended Season of Application For Nitrogen Fertilizers - Applies to all Turf

A nitrogen fertilization schedule weighted toward fall application is recommended and preferred for agronomic quality and persistence of cool season turfgrass; however, the acceptable window of applications is much wider than this for nutrient management. The nutrient management recommended application season for nitrogen fertilizers to cool season turfgrasses begins six weeks prior to the last spring average killing frost date and ends six weeks past the first fall average killing frost date (see Figures 6-1 & 6-2). Applications of nitrogen during the intervening late fall and winter period should be avoided due to higher potential leaching or runoff risk, but where necessary, apply no more than 0.5 pounds per 1,000 ft² of water soluble nitrogen within a 30-day period. Higher application rates may be used during this late fall and winter period by using materials containing slowly available sources of nitrogen, if the water soluble nitrogen contained in the fertilizer does not exceed the recommended maximum of 0.5 pounds per 1,000 ft² rate. Do not apply nitrogen or phosphorus fertilizers when the ground is frozen.

The acceptable nitrogen fertilizer application season for non-overseeded warm season turfgrass begins no earlier than the last spring average killing frost date and ends no later than one month prior to the first fall average killing frost date (see Figures 6-1 & 6-2).

Figure 6-1

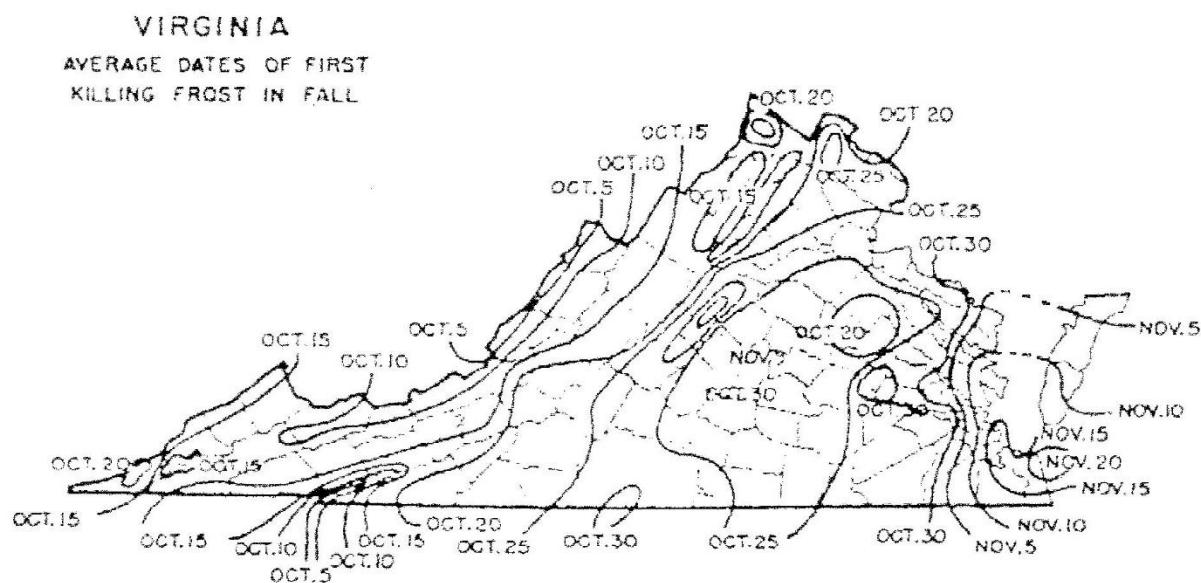
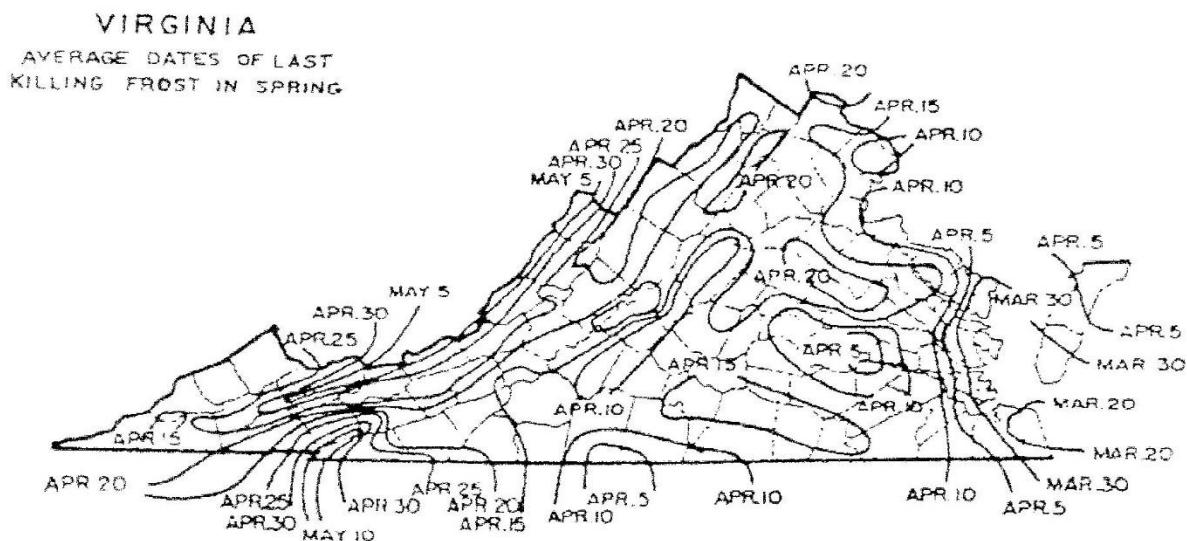


Figure 6-2



Per Application Rates

Do not apply more than 0.7 pounds of water soluble nitrogen per 1,000 ft² within a 30-day period. For cool season grasses, do not apply more than 0.9 pounds of total nitrogen per 1,000 ft² within a 30-day period. For warm season grasses, do not apply more than 1.0 pounds of total nitrogen per 1,000 ft² within a 30-day period. Lower per application rates of water soluble nitrogen sources or use of slowly available nitrogen sources should be utilized on very permeable sandy soils, shallow soils over fractured bedrock, or areas near water wells.

Annual Application Rates for Home Lawns and Commercial Turf

Up to 3.5 pounds per 1,000 ft² of nitrogen may be applied annually to cool season grass species or up to 4 pounds per 1,000 ft² may be applied annually to warm season grass species using 100 percent water soluble nitrogen sources. Lower rates of nitrogen application may be desirable on those mature stands of grasses that require less nitrogen for long-term quality. As a result, lower application rates will probably be more suited to the fine leaf fescues (hard fescue, chewings fescue, creeping red fescue, and sheep fescue) and non-overseeded zoysiagrass. Lower rates should also be used on less intensively managed areas.

Use of Slowly Available Forms of Nitrogen

For slow or controlled release fertilizer sources, or enhanced efficiency fertilizer sources, no more than 0.9 pounds of nitrogen per 1,000 ft² may be applied to cool season grasses within a 30-day period and no more than 1.0 pounds of nitrogen per 1,000 ft² may be applied to warm season grasses within a 30-day period.

Provided the fertilizer label guarantees that the product can be used in such a way that it will not release more than 0.7 pounds of nitrogen per 1,000 ft² in a 30-day period, no more than 2.5 pounds of nitrogen per 1,000 ft² may be applied in a single application. Additionally, total annual applications shall not exceed 80 percent of the annual nitrogen rates for cool or warm season grasses.

Phosphorus and Potassium Nutrient Needs (Established Turf)

Apply phosphorus (P₂O₅) and potassium (K₂O) fertilizers as indicated necessary by a soil test using the following guidelines:

| <u>Soil Test Level</u> | <u>Nutrient Needs (pounds per 1,000 ft²)*</u> | |
|------------------------|--|------------------|
| | P ₂ O ₅ | K ₂ O |
| L | 2-3 | 2-3 |
| M | 1-2 | 1-2 |
| H | 0.5-1 | 0.5-1 |
| VH | 0 | 0 |

- * For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range. (For example the recommendation for a P₂O₅ soil test level of L- would be 3 pounds per 1,000 ft².)

Do not use high phosphorus ratio fertilizers such as 10-10-10 or 5-10-10, unless soil tests indicate phosphorus availability below the M+ level.

Recommendations for Establishment of Turf

These recommendations are for timely planted turfgrass, that is, the seed or vegetative material (sod, plugs, and /or sprigs), are planted at a time of the year when temperatures and moisture are adequate to maximize turfgrass establishment. These recommended establishment periods would be late summer to early fall for cool-season turfgrasses and late spring through mid-summer for warm-season turfgrasses.

Nitrogen Applications

At the time of establishment, apply no more than 0.9 pounds per 1,000 ft² of total nitrogen for cool season grasses or 1.0 pounds per 1,000 ft² of total nitrogen for warm season grasses, using a material containing slowly available forms of nitrogen, followed by one or two applications beginning 30 days after planting, not to exceed a total of 1.8 pounds per 1,000 ft² total for cool season grasses and 2.0 pounds per 1,000 ft² for warm season grasses for the establishment period. Applications of WSN cannot exceed more than 0.7 pounds per 1,000 ft² within a 30-day period.

Phosphorus and Potassium Recommendations for Establishment

| <u>Soil Test Level</u> | <u>Nutrient Needs (pounds per 1,000 ft²)</u> * | |
|------------------------|---|-----------------------|
| | <u>P₂O₅</u> | <u>K₂O</u> |
| L | 3-4 | 2-3 |
| M | 2-3 | 1-2 |
| H | 2-1 | 0.5-1 |
| VH | 0 | 0 |

* For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range.

Nutrient Recommendations for Golf Courses

Nitrogen Timing

The beginning and ending dates for application of nitrogen shall be determined using guidance and frost date maps contained in the Season of Application for Nitrogen section, Figures 6-1 and 6-2.

If the full rate or the highest rate of the recommendation range for a monthly application is applied in a single application, then the interval of application for nitrogen shall be at least 30 days to allow turf to utilize previous nitrogen applications. If several applications are to be made for the monthly nitrogen rate, then the timing of the applications shall be at approximately even intervals, with the rate per application to be evenly divided between each application with the total nitrogen applied not to exceed the maximum monthly rate. Use of Water Insoluble Nitrogen forms of Nitrogen is encouraged.

Nitrogen Rates

| | Grass Type | Maximum WSN Rate Per Application - pounds per 1,000 ft ² | Total Annual Nitrogen Rate - pounds per 1,000 ft ² ^a |
|----------------------------------|-------------|---|--|
| Greens | | 0.7 ^(b) | 3-6 |
| Tees | | 0.7 ^(b) | 2-5 |
| Fairways | Cool Season | 0.7 ^(c) | 2-3 |
| | Warm Season | 0.7 ^(c) | 3-4 |
| Fairways – Intensive Management | Cool Season | 0.5 ^(d) | 3-4 |
| | Warm Season | 0.5 ^(d) | 3.5-4.5 |
| Overseeding Warm Season Fairways | | .5 | 1.25 |
| Roughs | | 0.7 ^(e) | 1-3 |

Fairways-Overseeding Warm Season Fairways

- For warm season grasses, up to 0.7 pounds of nitrogen per 1,000 ft² in a 30-day period may be applied in the Fall after perennial ryegrass overseeding is well established. An additional nitrogen application of 0.7 pounds per 1,000 ft² may be made in February-March to overseeded perennial ryegrass if growth and color indicate need. Applications using WSN may not exceed 0.7 pounds per 1,000 ft² within a 30-day period.
- Soluble nitrogen rates of 0.25 pounds per 1,000 ft² or less which may be a component of a pesticide or minor element application, may be applied any time during the application windows described in Recommended Season of Application for Nitrogen Fertilizers of this section, but must be considered with the total annual nitrogen application rate.
 - (a) Use higher rates for intensively used turf where accelerated growth and/or rapid recovery are required, use lower rates for maintenance of lesser used areas; do not exceed total annual nitrogen levels as stated above.

- (b) Greens and Tees – Per application timing must be a minimum of 30 days between applications. A rate of 0.9 pounds per 1,000 ft² of total nitrogen may be applied for cool season grasses or 1.0 pounds per 1,000 ft² of total nitrogen may be applied for warm season grasses using a material containing slowly available forms of nitrogen.
- (c) Fairways-Normal Management (Non-Irrigated or Irrigated) - Per Application timing must be a minimum of 30 days between applications. Total nitrogen application rates of 0.9 pounds per 1,000 ft² of total nitrogen may be applied for cool season grasses or 1.0 pound per 1,000 ft² of total nitrogen may be applied for warm season grasses using a material containing slowly available forms of nitrogen.
- (d) Fairways-Intensive Management (Irrigated)- Per Application timing must be a minimum of 15 days between applications. This option requires optimized timing of more frequent applications of nitrogen with lesser rates per application. Alternatively, a maximum application rate of 0.9 pounds per 1,000 ft² of total nitrogen for cool season grasses or 1.0 pounds per 1,000 ft² of total nitrogen for warm season grasses using a material containing slowly available forms of nitrogen may be applied with a minimum of 30 days between applications.
- (e) Foliar fertilizer may be applied to warm season grasses within 30 days prior to the first killing frost in the fall, at a rate not to exceed 0.1 pounds per 1,000 ft² of nitrogen per application. This application must be accounted for in the total annual nitrogen rate.

Phosphorus and Potassium Recommendations for Established Golf Courses

Apply phosphorus (P₂O₅) and potassium (K₂O) fertilizers as indicated by a soil test using the following guidelines:

| <u>Soil Test Level</u> | <u>Nutrient Needs (pounds per 1,000 ft²)*</u> | |
|------------------------|--|------------------|
| | P ₂ O ₅ | K ₂ O |
| L | 2-3 | 2-3 |
| M | 1-2 | 1-2 |
| H | 0.5-1 | 0.5-1 |
| VH | 0 | 0 |

- * For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range.
- For irrigated turf grown on Naturally Occurring and Modified Sand Based soils only, up to 0.5 pounds of P₂O₅ per 1,000 ft² may be applied, if needed, to aid in recovery of damaged turf during times of extreme use. No phosphorus applications shall be made when the soil phosphorus test level is above 65% saturation, based on the soil test phosphorus values and region as listed in Table 4-1 of Section IV.
- Avoid the general use of high phosphorus ratio fertilizers such as 10-10-10 or 5-10-10, unless soil tests indicate phosphorus availability below the M+ level.

Nitrogen Management on Athletic Fields - Cool Season Grasses

- This program is intended for those fields which are under heavy use.
- Nitrogen recommendations are based on the assumption that there is adequate soil moisture to promote good turf growth at the time of application. If no rainfall has occurred since the last application, further applications should be delayed until significant soil moisture is available.

| Cool Season Grasses | Maintenance Program ^a | |
|----------------------------|---|------------------|
| | Normal | Intensive |
| When to Apply ^b | Pounds per 1,000 ft ² Nitrogen | |
| After August 15 | ---- | 0.5 |
| September | 0.7 | 0.7 ^c |
| October | 0.7 ^c | 0.7 ^c |
| November | 0.5 | 0.7 ^c |
| April 15 - May 15 | 0.5 | 0.5 |
| June 1 - June 15 | ---- | 0.5 |

Notes:

- Soluble nitrogen rates of 0.25 pounds per 1,000 ft² or less which may be a component of a pesticide or minor element application may be applied any time the turf is actively growing, but must be considered with the total annual nitrogen application rate.
- WSN = water soluble nitrogen; WIN = water insoluble nitrogen
 - (a) Intensive managed areas must be irrigated.
 - (b) The beginning and ending dates for application of nitrogen shall be determined using guidance and frost date maps contained in the preceding Season of Application for Nitrogen section, using Figures 6-1 and 6-2.
 - (c) Rates up to 0.9 pounds per 1,000 ft² of total nitrogen can be applied using a material containing slowly available forms of nitrogen, with a minimum of 30 days between applications.
 - (d) Make this application only if turf use warrants additional nitrogen for sustaining desirable growth and /or color.

Nitrogen Management on Athletic Fields - Warm Season Grasses

The following comments apply to both Naturally Occurring or Modified Sand based Fields and Predominantly Silt/Clay Soil Fields:

- Annual nitrogen rates for warm season grasses shall not exceed **4 pounds** in areas which have the average first killing frost on or before October 20, and shall not exceed **5 pounds** in areas which have the average first killing frost after October 20 as shown in Figure 6-1. Nitrogen rates and timings for overseeding warm season grasses are not included in these rates.
- April 15 - May 15 applications should not be made until after complete green-up of turf.
- Nitrogen applications June through August should be coordinated with anticipated rainfall if irrigation is not available.
- Use the lower end of the ranges for non-irrigated fields and the higher end of the ranges should be used on fields with irrigation.

- Nitrogen rates towards the higher end of the ranges may be applied on heavily used fields to accelerate recovery, however per application and annual rates cannot be exceeded.

| Bermudagrass - Predominantly Silt/Clay Soil Fields ^a | | |
|--|---|--|
| When to Apply^b | Pounds per 1,000 ft² Nitrogen^c | First Fall Killing Frost Date^b |
| April 15 - May 15 | 0.5- 0.7 ^(c) | Before Oct. 20 |
| June | 0.7 | |
| July | 0.5 – 0.7 ^(d) | |
| August | 0.5 - 0.7 ^(d) | |
| Sept 1 - Sept 15 | 0.5 -0.7 ^(c) | After Oct. 20 |
| If overseeded with perennial ryegrass | | |
| Oct - Nov | 0.5 ^(e) | |
| Feb-Mar | 0.5 ^(e) | |

| Bermudagrass - Naturally Occurring or Modified Sand based Fields ^a | | |
|--|---|--|
| When to Apply^b | Pounds per 1,000 ft² Nitrogen | First Fall Killing Frost Date^b |
| April 15 - May 15 | 0.5 -0.7 ^(c) | Before Oct. 20 |
| June 1 | 0.7 ^(c) | |
| July | 0.7 ^(c) | |
| August | 0.7 ^(c)) | |
| Sept 1 - Sept 15 | 0.7 ^c | After Oct. 20 |
| If overseeded with perennial ryegrass | | |
| Oct - Nov | 0.5 ^(e) | |
| Feb - Mar | 0.5 ^(e) | |

The following notes apply to both of the Bermudagrass tables above:

- In the Piedmont and the Ridge and Valley areas of Virginia, the existing native soil will normally be comprised predominantly of clay and/or silt and these soils have inherently lower water infiltration and percolation rates and greater nutrient holding capacity. However, most areas of the Coastal Plain have existing native soils that are predominantly sandy textured soils and other facilities throughout the state may choose to install modified soil root zones that are predominantly sand (>50%) in order to maximize drainage and reduce compaction tendency. If subsurface drain tile surrounded by sand and/or gravel has been installed under the playing surface of any of these fields, their nitrogen programs should be managed as predominantly sand-based systems to minimize nutrient leaching.
- The beginning and ending dates for application of nitrogen shall be determined using guidance and frost date maps contained in the Season of Application for Nitrogen section, Figures 6-1 and 6-2.
- WSN must be applied as two applications not to exceed 0.35 pounds per 1,000 ft² each with a minimum of 15 days between applications. Alternatively, using a material that contains slowly available nitrogen sources, split applications of 0.5 pounds per 1,000 ft² may be applied with a minimum of 15 days between applications.

- (d) If a material containing slowly available forms of nitrogen is used, rates up to 1.0 pounds of nitrogen per 1,000 ft² may be applied in a single application with a minimum of 30 days between applications.
- (e) For overseeded warm season grasses, an additional 0.7 pounds per 1,000 ft² of WSN may be applied in the Fall after the perennial ryegrass overseeding is well established. The WSN must be applied as two applications not to exceed 0.35 pounds per 1,000 ft² of nitrogen each, with a minimum of 15 days between applications. Additional WSN application of 0.5 pounds per 1,000 ft² may be made in February-March to overseeded perennial ryegrass if growth and color indicate need. Alternatively, split applications of 0.5 pounds of nitrogen per 1,000 ft² each with a minimum of 15 days between applications may be applied using a material containing slowly available nitrogen sources.

Phosphorus and Potassium Recommendations Athletic Fields

Apply phosphorus (P₂O₅) and potassium (K₂O) fertilizers as indicated by a soil test using the following guidelines:

| <u>Soil Test Level</u> | <u>Nutrient Needs (pounds per 1,000 ft²)*</u> | |
|------------------------|--|------------------|
| | P ₂ O ₅ | K ₂ O |
| L | 2-3 | 2-3 |
| M | 1-2 | 1-2 |
| H | 0.5-1 | 0.5-1 |
| VH | 0 | 0 |

- * For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range.
- For irrigated turf grown on Naturally Occurring and Modified Sand Based soils only, up to 0.5 pounds of P₂O₅ per 1,000 ft² may be applied, if needed, to aid in recovery of damaged turf during times of extreme use. No phosphorus applications shall be made when the soil phosphorus test level is above 65% saturation, based on the soil test phosphorus values and region as listed in Table 4-1 of Section IV.
- Avoid the general use of high phosphorus ratio fertilizers such as 10-10-10 or 5-10-10, unless soil tests indicate phosphorus availability below the M+ level.

**Establishment/Grow-In Recommendations for Golf Courses, Athletic Fields,
and Sod Production**

(These rates replace normal maintenance fertilizer applications that would have occurred during these time periods.)

Warm Season Grasses:

Predominantly Silt/Clay Soils

- ◆ Plant Date - late May -June for sprigs, plugs, sod, or seeding.
- ◆ Apply P₂O₅ and K₂O as needed based on soil test recommendations, incorporate into the top 2 inches if possible.
- ◆ At Planting - Up to 1.0 pounds of nitrogen per 1,000 ft² using a material containing slowly available forms of nitrogen may be applied as one application or lesser amounts applied at regular intervals, through the first 4 weeks, not to exceed a total of 1.0 pounds of nitrogen per 1,000ft².
- ◆ Four weeks after planting - 0.25 pounds.of WSN per 1,000 ft² per week for the next 4 weeks.

Naturally Occurring or Modified Sand Based Soils

- ◆ Plant Date - late May -June for sprigs, plugs, sod, or seeding.
- ◆ Apply P₂O₅ and K₂O as needed based on soil test recommendations, incorporate into the top 2 inches if possible.
- ◆ At Planting - Up to 1.0 pounds of nitrogen per 1,000 ft² using a material containing slowly available forms of nitrogen may be applied as one application or lesser amounts at regular intervals through the first 4 weeks, not to exceed a total of 1.0 pounds of nitrogen per 1,000 ft².
- ◆ Four weeks after planting - 0.25 pounds per1,000 ft² using a material containing slowly available forms of nitrogen per week for the next 4 weeks.

Cool Season Grasses:

Predominantly Silt/Clay Soils

- ◆ Plant Date - August - September (preferred)
- ◆ Apply P₂O₅ and K₂O as needed based on soil test recommendations, incorporate into the top 2 inches if possible.
- ◆ At Planting - up to 0.9 pounds of nitrogen per 1,000 ft² using a material containing slowly available forms of nitrogen may be applied; 30 days after planting, apply up to 0.5 pounds of nitrogen per 1,000 ft² every week for the next 4 weeks.

Naturally Occurring or Modified Sand Based Soils

- ◆ Plant Date - August -September (preferred)
- ◆ Apply P₂O₅ and K₂O as needed based on soil test recommendations, incorporate into the top 2 inches if possible.
- ◆ At Planting - up to 0.9 pounds of nitrogen per 1,000 ft² using a material containing slowly available forms of nitrogen may be applied.
- ◆ Apply up to 0.25 pounds of nitrogen per 1,000 ft² per week after germination is complete, for the next 8 weeks. If using a material that contains slowly available forms of nitrogen, up to 0.5 pounds of nitrogen per 1,000 ft² every two weeks may be applied after germination is complete for the next 8 weeks.

Sod Installations:

Site preparation should include a soil test, which can be done several months before the project begins in order to have time to get test results back. Phosphorus, potassium and lime applications should be based on soil test analysis to increase the likelihood of a successful installation. Shallow incorporation of material into the top 2 inches of the soil is preferred prior to sod installation, especially if lime is required.

No more than 0.7 pounds of nitrogen per 1,000 ft² of WSN may be applied before sod is installed. Alternatively, using a material with slowly available forms of nitrogen, 0.9 pounds of nitrogen per 1,000 ft² for cool season grasses or 1.0 pounds of nitrogen per 1,000 ft² for warm season grasses may be applied before sod is installed.

After installation apply adequate amounts of water to maintain sufficient soil moisture (i.e. to prevent visible wilt symptoms). Excessive water will limit initial root development. After roots begin to establish (as verified by lightly tugging on the sod pieces), shift irrigation strategy to a deep and infrequent program in order to encourage deep root growth. Apply approximately 1 inch of water per week (either by rainfall or irrigation), making sure that the water is being accepted by the soil profile without running off. This will insure thorough wetting of the soil profile.

After sod has completed rooting and is well established, initiate the normal nitrogen management program as described for the appropriate use shall be recommended.

Phosphorus and Potassium Recommendations for Establishment/Grow-In/Installation

| Soil Test Level | Nutrient Needs (pounds per 1,000 ft²)* | |
|------------------------|--|-----------------------|
| | P₂O₅ | K₂O |
| L | 3-4 | 2-3 |
| M | 2-3 | 1-2 |
| H | 2-1 | 0.5-1 |
| VH | 0 | 0 |

* For the lower soil test level within a rating, use the higher side of the range and for higher soil test level within a rating use the lower side of the recommendation range.

Other Turf Management Considerations for Golf Courses, Athletic fields, and Home Lawns

Lime Recommendations

Lime should be recommended based on a soil test to maintain soil pH within an agronomic range for turfgrass.

For new seedings where lime is recommended, incorporate the lime into the topsoil for best results.

Returning Grass Clippings

Recycling of clippings on turf should be encouraged as an effective means of recycling nitrogen, phosphorus, and potassium. Proper mowing practices that ensure no more than 1/3 of the leaf blade is removed in any cutting event will enhance turf appearance and performance when clippings are returned. Return all leaf clippings from mowing events to the turf rather than discharging them onto sidewalks or streets. Rotary mulching mowers can further enhance clipping recycling by reducing the size of clippings being returned to the turfgrass canopy.

Management of Collected Clippings

If clippings are collected they should be disposed of properly. They may be composted or spread uniformly as a thin layer over other turf areas or areas where the nutrient content of the clippings can be recycled through actively growing plants. They should not be blown onto impervious surfaces or surface waters, dumped down stormwater drains, or piled outside where rainwater will leach out the nutrients creating the potential for nutrient loss to the environment.

Use of Iron

Iron applications (particularly foliar applications) may periodically be used for enhanced greening as an alternative to nitrogen. These applications are most beneficial if applied in late spring through summer for cool season grasses and in late summer/fall applications for warm-season grasses.

Impervious Surfaces

Do not apply fertilizers containing nitrogen or phosphorus to impervious surfaces (sidewalks, streets, etc.). Remove any granular materials that land on impervious surfaces by sweeping and collecting, and either put the collected material back in the bag, or spread it onto the turf and /or using a leaf blower etc. to return the fertilizer back to the turfgrass canopy.

Table 3-1
Lime Recommendations for Virginia Crops (tons/acre)
Lime Rates based on Va Tech Soil buffer pH

| Buffer pH | Target Soil pH | | | | | Acidity meq/100g |
|-----------|----------------|------|------|------|------|------------------|
| | 5.2 | 5.8. | 6.2 | 6.5 | 6.8 | |
| 6.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |
| 6.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.50 | 0.06 |
| 6.38 | 0.00 | 0.00 | 0.25 | 0.25 | 0.50 | 0.12 |
| 6.36 | 0.00 | 0.00 | 0.25 | 0.25 | 0.75 | 0.24 |
| 6.34 | 0.00 | 0.00 | 0.25 | 0.50 | 0.75 | 0.36 |
| 6.32 | 0.00 | 0.00 | 0.50 | 0.50 | 0.75 | 0.48 |
| 6.30 | 0.00 | 0.00 | 0.50 | 0.75 | 1.00 | 0.59 |
| 6.28 | 0.00 | 0.25 | 0.75 | 0.75 | 1.00 | 0.71 |
| 6.26 | 0.00 | 0.25 | 0.75 | 1.00 | 1.25 | 0.83 |
| 6.24 | 0.00 | 0.25 | 0.75 | 1.00 | 1.25 | 0.95 |
| 6.22 | 0.00 | 0.50 | 1.00 | 1.00 | 1.50 | 1.07 |
| 6.20 | 0.00 | 0.50 | 1.00 | 1.25 | 1.50 | 1.19 |
| 6.18 | 0.00 | 0.75 | 1.25 | 1.25 | 1.75 | 1.30 |
| 6.16 | 0.00 | 0.75 | 1.25 | 1.50 | 1.75 | 1.42 |
| 6.14 | 0.25 | 0.75 | 1.50 | 1.50 | 2.00 | 1.54 |
| 6.12 | 0.25 | 1.00 | 1.50 | 1.75 | 2.00 | 1.66 |
| 6.10 | 0.50 | 1.00 | 1.50 | 1.75 | 2.25 | 1.78 |
| 6.08 | 0.50 | 1.25 | 1.75 | 2.00 | 2.25 | 1.90 |
| 6.06 | 0.50 | 1.25 | 1.75 | 2.00 | 2.25 | 2.02 |
| 6.04 | 0.75 | 1.25 | 2.00 | 2.00 | 2.50 | 2.13 |
| 6.02 | 0.75 | 1.50 | 2.00 | 2.25 | 2.50 | 2.25 |
| 6.00 | 1.00 | 1.50 | 2.00 | 2.25 | 2.75 | 2.37 |
| 5.95 | 1.00 | 1.75 | 2.25 | 2.50 | 3.00 | 2.67 |
| 5.90 | 1.25 | 2.00 | 2.50 | 3.00 | 3.25 | 2.96 |
| 5.85 | 1.50 | 2.25 | 2.75 | 3.25 | 3.50 | 3.26 |
| 5.80 | 1.75 | 2.50 | 3.25 | 3.50 | 3.75 | 3.56 |
| 5.75 | 2.00 | 2.75 | 3.50 | 3.75 | 4.25 | 3.85 |
| 5.70 | 2.25 | 3.00 | 3.75 | 4.00 | 4.50 | 4.15 |
| 5.65 | 2.50 | 3.25 | 4.00 | 4.25 | 4.75 | 4.45 |
| 5.60 | 2.75 | 3.50 | 4.25 | 4.50 | 5.00 | 4.74 |
| 5.55 | 3.00 | 3.75 | 4.50 | 4.75 | 5.25 | 5.04 |
| 5.50 | 3.25 | 4.00 | 4.75 | 5.25 | 5.50 | 5.34 |
| 5.40 | 3.75 | 4.50 | 5.25 | 5.75 | 6.25 | 5.93 |
| 5.30 | 4.25 | 5.00 | 5.75 | 6.25 | 6.75 | 6.52 |

Lime recommendations in the table above are based on the use of a liming material equivalent in neutralizing power to 100% CaCO₃. For application rates of liming material that is less than 100% neutralizing power of CaCO₃ (pure calcium carbonate) use the table in this section, Lime Rate Adjustment for CCE.

Lime Recommendations Using Other Testing Labs

For approved labs other than Virginia Tech, use the lime recommendations given by the lab. IF there are no recommendations with the soil analysis, use the table below for A&L Agricultural, Spectrum Analytical, and Brookside Laboratories.

Table 3-2
Lime Application Rate¹ (tons/acre) to achieve desired pH based on SMP Buffer Test

| Soil- Buffer pH | Target Soil pH | | | | |
|-----------------------|----------------|------|------|------|------|
| | 5.2 | 5.8 | 6.2 | 6.5 | 6.8 |
| 6.9 | 0 | 0.25 | 0.50 | 0.50 | 0.75 |
| 6.8 | 0.50 | 0.75 | 1.00 | 1.00 | 1.25 |
| 6.7 | 1.00 | 1.50 | 1.50 | 1.75 | 2.00 |
| 6.6 | 1.50 | 1.75 | 2.00 | 2.25 | 2.50 |
| 6.5 | 2.00 | 2.25 | 2.50 | 3.00 | 3.25 |
| 6.4 | 2.75 | 3.00 | 3.25 | 3.75 | 4.00 |
| 6.3 | 3.25 | 3.50 | 4.00 | 4.50 | 5.00 |

¹ Ag-ground lime of 90% plus total neutralizing power (TNP) or CaCO₃ equivalent., and fineness of 40% < 100 mesh, 50% < 60 mesh, 70% < 20 mesh and 95% < 8 mesh. Adjustments in the application rate should be made for liming materials with different particle sizes, or neutralizing value.

Waters Agricultural Laboratories uses the Adams and Evans single buffer method which uses a different table for recommendations than the Mehlich or the SMP tables supplied here. In the event you would have lab reports from Waters Lab, which do not have lime recommendations, contact the lab for recommendations based on their analysis procedure.

Lime Rate Adjustment for CCE

Using the lime application rate to achieve the desired target pH based on the soil test buffer pH, use the table below to adjust that rate based on the % CCE of the liming material to be applied.

Table 3-3
Lime Application Rate Adjustment Based on % CCE of Material

| T/ac* | % CCE of Your Liming Material | | | | | | | | | | |
|-------|-------------------------------|------|------|------|------|------|------|------|------|------|------|
| | 50 | 60 | 70 | 80 | 90 | 100 | 110 | 120 | 130 | 140 | 150 |
| 0.5 | 1.00 | 0.75 | 0.75 | 0.75 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.25 | 0.25 |
| 1.0 | 2.00 | 1.75 | 1.50 | 1.25 | 1.00 | 1.00 | 1.00 | 0.75 | 0.75 | 0.75 | 0.75 |
| 1.5 | 3.00 | 2.50 | 2.25 | 2.00 | 1.75 | 1.50 | 1.25 | 1.25 | 1.25 | 1.00 | 1.00 |
| 2.0 | 4.00 | 3.25 | 2.75 | 2.50 | 2.25 | 2.00 | 1.75 | 1.75 | 1.50 | 1.50 | 1.25 |
| 2.5 | 5.00 | 4.25 | 3.50 | 3.25 | 2.75 | 2.50 | 2.25 | 2.00 | 2.00 | 1.75 | 1.75 |
| 3.0 | 6.00 | 5.00 | 4.25 | 3.75 | 3.25 | 3.00 | 2.75 | 2.50 | 2.25 | 2.25 | 2.00 |
| 3.5 | 7.00 | 5.75 | 5.00 | 4.50 | 4.00 | 3.50 | 3.25 | 3.00 | 2.75 | 2.50 | 2.25 |
| 4.0 | 8.00 | 6.75 | 5.75 | 5.00 | 4.50 | 4.00 | 3.75 | 3.25 | 3.00 | 2.75 | 2.75 |

* Lime recommendation to adjust pH as determined from soil test analysis.

Figure 3: CEC Chart

11. Soil Test Results



A&L Eastern Laboratories

7621 Whitepine Road, Richmond, Virginia 23237 (804) 743-9401 Fax (804) 271-6446

Send To: FIVE OAKS AGRONOMY CONSULTING |
 ROBERT HABEL
 192 BRIARHERST DR
 AMHERST VA 24521

Grower:
 TOWN OF VINTON

Farm ID:

SOIL ANALYSIS REPORT

Analytical Method(s):
 Mehlich 3

"Every acre...Every year.™"

Date Received: 06/15/2015

Date Of Analysis: 06/16/2015

Date Of Report: 06/16/2015

| Sample ID Field ID | Lab Number | Organic Matter | | | Phosphorus | | | Potassium | | Magnesium | | Calcium | | Sodium | | pH | | Acidity | C.E.C | |
|-----------------------|-------------------------|----------------|---------|--------------|------------------|------------------------|----------------|-----------|-----------|-----------|-----------|----------|---------------|-----------|-----------|------|------------|-----------------|---------------|----------|
| | | % | Rate | ENR lbs/A | Mehlich 3 ppm | Rate | Reserve ppm | Rate | K ppm | Rate | Mg ppm | Rate | Ca ppm | Rate | Na ppm | Rate | Soil pH | Buffer Index | H meq/100g | meq/100g |
| TOVWM | 16483 | 5.0 | H | 134 | 28 | L | | | 201 | VH | 292 | H | 1520 | M | | | 6.6 | | 0.7 | 11.2 |
| Sample ID Field ID | Percent Base Saturation | | | | | Nitrate | Sulfur | Zinc | Manganese | Iron | Copper | Boron | Soluble Salts | Chloride | Aluminum | | | | | |
| | K % | Mg % | Ca % | Na % | H % | NO ₃ ppm | S Rate | Zn ppm | Mn ppm | Fe ppm | Cu ppm | B ppm | SS ms/cm | Cl ppm | Al ppm | | | | | |
| TOVWM | 4.6 | 21.7 | 67.9 | | 5.9 | | | | | | | | | | | | | | | |

Values on this report represent the plant available nutrients in the soil. Rating after each value: VL (Very Low), L (Low), M (Medium), H (High), VH (Very High). ENR - Estimated Nitrogen Release. C.E.C. - Cation Exchange Capacity.

Explanation of symbols: % (percent), ppm (parts per million), lbs/A (pounds per acre), ms/cm (milli-mhos per centimeter), meq/100g (milli-equivalent per 100 grams). Conversions: ppm x 2 = lbs/A, Soluble Salts ms/cm x 640 = ppm.

This report applies to sample(s) tested. Samples are retained a maximum of thirty days after testing.

Analysis prepared by: A&L Eastern Laboratories, Inc.

by: *Pauric McGroarty*

Pauric McGroarty