Virginia Cooperative Extension
Virginia Tech • Virginia State University

Publication SPES-40P

A Spreadsheet-Based Calculator for Lawn Fertilizer and Lime Applications in Virginia

Chantel Wilson, Assistant Professor and 4-H STEAM Extension Specialist, College of Agriculture, Virginia State University
Michael Goatley Jr., Professor & Extension Specialist, School of Plant and Environmental Sciences, Virginia Tech

Fertilizing a lawn can seem like a difficult and confusing task, especially for a new homeowner or individuals without turfgrass management experience. When fertilizers and lime are used properly, they can help to remedy nutrient deficiencies, improve plant appearance, stimulate plant growth, and improve stress tolerance in lawns. Improper fertilizer use can damage plants, promote diseases, or pollute water resources such as groundwater, lakes, streams, and rivers.

This publication and its complementary spreadsheet are designed to help you determine the type of turfgrass you have, whether fertilizer or lime applications are needed, what kind of/how much fertilizer or lime to buy, when to make applications, and how much to apply during each application. This publication is intended for granular or dry (not liquid) fertilizer or lime applications to established turfgrass areas, using information from the Virginia Tech Soil Testing Laboratory in Blacksburg. **If further assistance is needed with any aspect of this publication or with lawn maintenance in general, contact the staff at your nearest Virginia Cooperative Extension office.** Office locations and contact information are provided at https://ext.vt.edu/offices.html. The authors recommend to read this entire publication and other publications described below as needed before attempting to use the spreadsheet-based fertilizer calculator. Please note that the calculator's functionality and formatting could vary if the spreadsheet is opened in a program other than the program it was designed in.

Before Using the Calculator

It is important to determine the turfgrass type and its nutritional needs before making fertilizer or lime applications. Nitrogen (N), phosphorus (P), and potassium (K) are three major nutrients a turfgrass plant needs to be healthy; they are commonly supplied by fertilizer applications. The nutrient needs of turfgrasses vary depending on species, age, how it is managed, and the environment it is growing in.

If the turf has been established for a long time, it is dense, the clippings are left on the lawn after mowing, and you are satisfied with its appearance, it might not need fertilizer applications. The soil is probably carrying and cycling enough nutrients for plant growth to meet your expectations.

If the lawn appears to be unhealthy, is less than 10 years old, or you remove the clippings from the lawn after it is mowed, fertilizer applications could be needed. Issues such as soil compaction, improper pH, excessive moisture, or shade can cause unhealthy turf. Fertilizer applications generally will not solve these problems, and these issues should be addressed **before** making new fertilizer applications. Soil testing (described below) will provide information for lime applications if the soil pH is too low, or for sulfur applications if the soil pH is too high. Iron applications might be more appropriate than N applications to temporarily improve turf color in some circumstances.

Other turfgrass-related publications and advice to tackle common problems can be found on the Lawn & Garden page of Virginia Cooperative Extension's website (https://ext.vt.edu/lawn-garden.html).

1. The first step required for lawn fertilizer applications is to determine what type of turfgrass you have in your lawn. This information will help you determine how much nitrogen the grass needs and when to make fertilizer applications. It is best to determine what species of grass you have, although determining a cool- versus a warm-season lawn will also work. An Extension agent can help you to identify the type of turfgrass in your lawn, or you can use the following tips to identify the general type of turfgrass.

Produced by Virginia Cooperative Extension, Virginia Tech, 2018

VT/1018/SPES-40

a. Cool-season lawns typically thrive and grow actively during the cool fall and spring months. The grass does not grow as well and could struggle during the hot summer months. The grass stays mostly green in the late fall and winter months. If you look closely at the blades of grass, the leaves should not be hairy, or they will have very short hairs that are difficult to see. Fall is the best time to make fertilizer applications to cool-season turf (when it is actively growing), although lighter fertilizer applications can also be made in the spring. Kentucky bluegrass, fescues, and ryegrasses are examples of cool-season grasses.

b. Warm-season lawns typically thrive and grow actively during the warmer summer months. The grass will go dormant and turn brown if temperatures are cool enough in the late fall or winter. If you look closely at the blades of grass, hairs are typically on the blade itself, or a hairy tuft is on the base of the blade where it meets the "stalk." You might have to pull the leaf back slightly to see the tuft. Summer is the best time to make fertilizer applications to warm-season turf (when it is actively growing). Bermudagrass, zoysiagrass, and St. Augustinegrass are examples of warm-season grasses.

Fertilizer applications, as suggested in the calculator, will target the fall for cool-season grasses and the summer for warm-season grasses. If you are using the calculator for the first time, you might find that the optimal time for fertilizer applications has either passed or is approaching.

2. Soil testing is the next step to be completed before lawn fertilizer applications are made. Soil testing will help you to determine if the pH of your lawn needs to be adjusted and if nutrients such as N, P, and K are needed. Soil samples can be taken at any time of the year when the ground is not frozen, although it is best to sample before the active growing season of turf, when fertilizer applications will be made. If fertilizer or lime applications were made in the past, wait at least two months before taking new soil samples. Soil sample boxes and sample submission sheets for the Virginia Tech Soil Testing Lab can be obtained from any Virginia Cooperative Extension office and are also available in some public libraries. The sample submission sheet should have general sampling instructions included on the back of the form, along with information on properly taking an accurate and representative sample of your area. When completing the Soil Sample Information Sheet for Home Lawns, Gardens, Fruits, and Ornamentals, fill out all requested information and select "routine" for the Soil Tests Desired. Be sure to select the correct plant code from the Plant Code List. If your lawn is mostly cool-season grass, select the plant code for Lawn: Kentucky Bluegrass, Fescue or Ryegrass (202 Maintaining Lawn). If your lawn is mostly warm-season grass, select the plant code for Lawn: Bermudagrass, Zoysiagrass, or St. Augustinegrass (204 Maintaining Lawn).

Soils should be tested at least once every three years. Refer to "Soil Sampling for the Home Gardener," Virginia Cooperative Extension publication 452-129 (2011), available at http://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/452/452-129/452-129_pdf.pdf, for detailed soil testing instructions.

The soil test report you receive will provide recommendations for lime or sulfur as well as the ratio of N, phosphate (P_2O_5 to supply P), and potash (K_2O to supply K) to be applied. Recommendations for other nutrients might be included on the soil test report and should be applied as needed. Soil test results are typically good for three years before the lawn should be retested. The spreadsheet calculator available at: https://pubs.ext.vt.edu/SPES/spes-40A/spes-40A.html will use the fertility ratings for P and K from your soil test report, the lime recommendations from the soil test report, and the type of turfgrass found in your lawn to help you decide the type and amount of fertilizer and lime to buy and apply. The calculator exclusively focuses on N, P, K, and lime applications.

Information from other soil testing labs can be used, as long as the P and K amounts reported can be converted to Virginia Tech fertility ratings first. Consult a Virginia Cooperative Extension agent for assistance making the conversions.

3. Determine the size of your lawn in square feet. A measuring wheel is best for small areas and can also be used for large areas. Refer to "How to Measure Your Yard," University of Maryland Extension publication HG 306 (2013), for help. It is available at https://extension.umd.edu/sites/extension.umd.edu/files/_images/programs/hgic/Publications/HG306_How_to_Measure_Your_Yard.pdf.

Instructions for the Calculator

1. Open the calculator spreadsheet and click the tab at the bottom that represents your lawn type for fertilizer applications. The Cool-Season Lawns tab is blue, and the Warm-Season Lawns tab is orange.

2. Enter information for each item, in order, from 1 to 6. You might have to scroll down to see each item, depending on the size of your computer screen. Some items could have further instructions included under the questions. When you enter information in items 1-6, you might receive an alert or additional information in the adjacent white box.

a. For item 1, be sure to enter the size of your lawn in **square feet.**

b. For item 2, choose the amount of N you want to add to your lawn. Recommendations are provided next to the input area. Keep in mind that the need for mowing and the number of applications will increase as the N amount is increased. The authors recommend to initiate the fertility program at the lower end of the N range in the first year because excessive N can encourage some turfgrass diseases. If the turf does not respond well or does not meet your expectations, increase the annual N amount by 0.5 pound the following year. If the N amount you choose is outside of the highest recommended amount for either cool-season or warm-season lawns in general, you will receive an alert instructing you to reduce the amount.

c. For item 3, enter the P fertility rating from your Virginia Cooperative Extension soil test report. This letter is included below the P lb/A box on the report. **Make sure you enter the + or − symbol, if present**. You can also click on the gray arrow to select from a list of choices. You will receive an alert telling you whether or not you need a fertilizer containing phosphorus. **Do not apply phosphorus to your lawn unless it is needed**. If the fertility rating for phosphorus is L−, L, or L+, you might want to consider lowering the N amount you chose in item 2 if you chose the maximum allowable amount of N.

Analysis	P (lb/A)
Result	13
Rating	M–

↖ **P fertility rating**

d. For item 4, enter the K fertility rating from your Virginia Cooperative Extension soil test report. This letter is included below the K lb/A box on the report. **Make sure you enter the + or − symbol, if present.** You can also click on the gray arrow to select from a list of choices. You will receive an alert letting you know if K is needed.

Analysis	P (lb/A)	K (lb/A)
Result	13	158
Rating	M–	M+

↖ **K fertility rating**

e. For item 5, you will need to enter information from the fertilizer bag you have or intend to buy. **This calculator is not intended to be used with "weed and feed" or other products containing pesticides.** It could be useful to have a separate window open on your computer so you can explore what your local store/online retailer has in stock. You will then enter the "grade" information from the fertilizer bag/description. These are three large numbers representing N-P-K (nitrogen, P as phosphate, and K as potash). Check the alerts you received from items 3 and 4 to see if you need phosphorus or potassium. If you need P or K, the boxes where you enter the P and K information will be highlighted. If you don't need phosphorus, choose an N-only or an N + K fertilizer. The second number in the fertilizer grade will be zero for fertilizers without P (e.g., 25-0-5, 13-0-44, etc.). N-only fertilizers will have the first number only and zero for P and K (e.g., 10-0-0, 46-0-0, etc.). You will receive alerts if the fertilizer chosen will supply too little or too much P or K.

f. For item 6, enter the size of the bag found on the product's label or in the online description (net weight in pounds). The calculator will determine the number of bags needed for your lawn. If this information is not entered, the calculator will only give the total pounds of fertilizer needed for all applications during the growing season.

3. For the Lime tab, enter information for each item in order, from 1 to 5. You might need to check availability of products in-store (or possibly on the internet, although labels for lime products can be difficult to find online) before using all of the features of this calculator (see note after entering information in item 3). At a minimum, you should

know the calcium carbonate equivalent (CCE) value of available products. You would need more of a product with a lower CCE value and less of a product with a higher CCE value. Lime products without a CCE value listed (except for 100% pure calcium carbonate) should be avoided because there is no way to determine the product's ability to adjust pH or the proper application rates needed.

a. For item 1, be sure to enter the size of your lawn **in square feet**.

b. For item 2, enter the recommended amount of lime from your Virginia Cooperative Extension Soil Test Report. This number is provided at the bottom of the soil test report as a note under Lime Recommendations. The value reported should be in pounds per 1,000 square feet.

c. For item 3, enter the type of lime recommended from the soil test report (you can select an item from the drop-down list by clicking the gray arrow). The type recommended should be either "agricultural" or "dolomitic" and is found in the note for Lime Recommendations. A note will appear giving more detailed instructions regarding the selection of lime products and consideration of CCE.

d. For item 4, enter the CCE value found on the bag of the lime product you have or you intend to buy. This value is a percentage found under the Guaranteed Analysis section on the bag. This calculator is designed to work with products with a CCE value between 50% and 100%. Do not include the % symbol when entering the information in the calculator.

e. For item 5, enter the size of the lime bag in pounds. The calculator will determine the number of bags needed for your lawn.

4. Once all of the information is entered in either the Fertilizer or the Lime tabs, recommendations will appear on the right-hand side of the screen. The fertilizer recommendations can be used each growing season for up to three years. New soil testing and re-entry of information for P and K is recommended after three years. The amount of lime recommended on your soil test report is the **total** amount needed for three years. For example, if the soil test report recommended 60 pounds per 1,000 square feet of agricultural lime, only 60 pounds per 1,000 square feet lime **total** will be needed until the next time you test the soil in three years (you might or might not need additional lime according to the new soil test). The following recommendation information will appear after entering information:

a. **Number of fertilizer or lime applications needed per year**. The number of fertilizer applications generally increases as the N amount increases. If you don't want to make as many fertilizer applications or if you don't want to mow as frequently, you might want to consider having a lower-maintenance lawn and choosing an N amount on the lower side of the range in item 2. The lime calculator will split the total lime needed as necessary to avoid applying more than 50 pounds of lime per 1,000 square feet at a time.

b. **Timing of fertilizer or lime applications**. This is based on the number of applications needed, the best time to fertilize the grass according to its type, or the best time to lime. Most fertilizer applications for cool-season grasses should occur in the fall months. Most fertilizer applications for warm-season grasses should occur in the summer months. It is best to lime in the fall or winter months when the ground is not frozen or snow-covered, although lime applications can occur anytime the turfgrass is not under heat or drought stress.

c. **Pounds of fertilizer or lime needed to cover your lawn per application**. This is the actual amount you will measure out and add to your spreader for each scheduled application, based on the timing of applications in the box above. If your spreader's capacity is lower than the suggested per-application amount, you will need to split the application and apply a smaller amount of material at a time. For example, if the spreader can only hold 10 pounds of fertilizer and 20 pounds are recommended, split the application in half and apply 10 pounds at a time.

d. **Pounds of fertilizer or lime needed to cover your lawn for all applications**. This box tells you the total amount of fertilizer you will need to buy and apply during the entire growing season. The amount of fertilizer suggested here will be needed every growing season for up to three years, until soil testing is repeated. The amount of lime suggested is the **total** amount needed (do NOT repeat every year), and the pH adjustment should be good for at least three years in most cases.

e. **Total number of fertilizer or lime bags needed for all applications**. This box tells you how many bags of the product are needed based on the information entered in box 5 (and 6 for fertilizer applications). The amount listed for fertilizer applications is the amount needed for the entire growing season (this is the number of bags you should buy, although you might not use the entire amount and could have some leftover fertilizer at the end of the season). The amount listed for lime applications is the **total** number of bags needed for the lime adjustment until the soils are retested.

OPTIONAL: If you used this calculator in the previous year and have leftover fertilizer, you can use the last box in the recommendations section to enter the amount of fertilizer remaining (in pounds) to determine how many new bags you will need. You will need to make sure that the fertilizer is the same grade and product as the current grade and product you will be using.

Application Information/ Instructions

The appropriate amount of fertilizer or lime should be measured out for each application (the per application amount from the calculator). Hanging scales or electronic scales are available for purchase at many stores. Kitchen scales or luggage scales can also be used. Place an empty container on the scale and press the "tare/zero" button to subtract out the weight of the container. If the scale does not have a tare button, the weight of the container will need to be accounted for when adding the fertilizer to the container. For example, if you need to weigh out 2 pounds of fertilizer and the empty container weighs 0.5 pound, the total weight (container plus fertilizer) should be 2.5 pounds after adding fertilizer to the container.

Fertilizer bags or spreaders sometimes come with instructions for application equipment calibration. Use the instructions provided to appropriately calibrate your spreader. Purchasing the same fertilizer and spreader brand could be more convenient in some cases because some manufacturers will provide equipment settings to match particular products. If instructions are not included, please consult Virginia Cooperative Extension for help, or use one of the following options:

Option 1: If you are applying to a small area (or if you don't mind a lot of walking on a larger area), there is no need to calibrate your spreader as long as the product can be applied over the lawn evenly. Add the per-application amount of fertilizer from the calculator to the spreader and put the spreader on the lowest setting possible. The material should dispense through the opening properly. If the per-application amount of fertilizer will not fit in your spreader, you might have to split the application and go over the area twice or more. Walk back and forth across the lawn in a checkerboard pattern (at an even pace) until the spreader is empty (north to south until you cover the lawn in one direction, and then east to west to cover the lawn in a second direction, for example). Be sure to pick up where you left off if splitting the application was necessary. Uneven fertilizer applications can damage the lawn or cause unappealing color streaks to appear.

Option 2: If you are applying to a large area, you will need to calibrate your spreader. Consider applying fertilizer in two different directions (the checkerboard pattern described in Option 1) for even coverage. Refer to "Calibrating Your Lawn Spreader," Virginia Cooperative Extension publication 430-017 (2009), for help. It is available at https://pubs.ext.vt.edu/430/430-017/430-017.html

Conclusion

Maintaining a lawn is an ongoing process. The spreadsheet-based fertilizer and lime calculator is designed to help with product applications, and it works best when the information entered is as accurate as possible. Good soil sampling is crucial for accurate P and K recommendations, and testing should be completed at least once every three years. The information should be used to update the recommendations in the calculator as needed. Keep in mind that fertilization and liming might not be the solution to common problems such as overwatering, mowing the turf too close to the ground, soil compaction, or disease.

If the N amount selected is too high for particular turf types or conditions, diseases such as brown patch can appear in the lawn. Frequent or high applications of N will also increase the need for mowing. Starting out with an N amount closer to the lower end of the range (especially if P is needed as indicated by a soil test) and increasing the amount if needed is recommended to balance maintenance needs with your expectations.

If you have any problems with your lawn or need help with any aspect of fertilizer or lime applications, please contact your local Virginia Cooperative Extension office for assistance.

Literature Cited

University of Maryland Extension. 2013. How to Measure Your Yard. Publication HG 306. https://extension.umd.edu/sites/extension.umd.edu/files/_images/programs/hgic/Publications/HG306_How_to_Measure_Your_Yard.pdf

Virginia Cooperative Extension. 2009. Calibrating Your Lawn Spreader. Publication 430-017. https://pubs.ext.vt.edu/430/430-017/430-017.html

Virginia Cooperative Extension. 2011. Soil Sampling for the Home Gardener. Publication 452-129. http://pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/452/452-129/452-129_pdf.pdf