Virginia Cooperative Extension
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Publication SPES-60P

A Spreadsheet-Based Soil Test Converter for Turfgrass Professionals and Nutrient Management Planning in Virginia

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Nutrient management involves controlling the rate, timing, placement, and application of plant nutrients to grow high-quality plants while protecting the environment. Nitrogen (N), phosphorus (P), and potassium (K) are a few elements essential for plant growth. When fertilizer, organic materials, or other compounds containing N and P are applied improperly to agricultural crops, turfgrass, or other landscape plants, these nutrients can be harmful to lakes, streams, or other water resources. The Virginia Department of Conservation and Recreation (DCR) has compiled specific nutrient recommendations in the Virginia Nutrient Management Standards and Criteria (S&C; DCR 2014) to protect water resources as turfgrass is being established or maintained. Following these recommendations is required by law for those managing turfgrass on golf courses, state-owned land, and land owned by localities in the Commonwealth of Virginia. For-hire applicators are also required by law to follow the S&C as part of the Virginia Department of Agriculture and Consumer Services Certified Fertilizer Applicator program.

Soil testing is a critical component of nutrient management. The information provided allows applicators to make informed decisions regarding fertilizer and lime applications. Basic soil testing will generally provide the applicator with the soil pH, P, K, calcium, magnesium, and micronutrient levels in the soil. Nitrogen levels are not typically provided with basic soil testing because N rapidly changes form, and it is difficult to measure the levels in a meaningful way. The soil fertility recommendations in the S&C are based on input from the research of Virginia Tech faculty members and the Virginia Tech Soil Testing Laboratory. Those required by law to follow the S&C must use DCR-approved soil testing laboratories and testing methods. Depending on the laboratory used, the information could need to be converted and correlated to Virginia Tech's fertility ratings for P and K before a final recommendation can be determined.

A spreadsheet-based workbook has been developed with the intent to standardize and simplify P and K soil test conversions for DCR-approved soil testing laboratories. The formulas and conversions in the workbook were based primarily on the S&C, revised July 2014. For labs without information in the S&C, the DCR's (2016) Approved Soil Testing Labs document found on the DCR website was used. The DCR could update the S&C in the future. A copy of this document can be found in the Nutrient Management section under the Soil and Water Conservation section at www.dcr.virginia.gov.

The workbook was developed using Excel 2013 for Windows. Some of the visual formatting or functionality may not be available with earlier or Mac versions of Excel. If a newer version of the S&C has been released or a different version of Excel is used, applicators should check the calculations by hand using the equations in the new document to make sure the conversions and fertility recommendations suggested by this converter are still accurate. The DCR's Urban Nutrient Management program or Virginia Cooperative Extension can also be contacted for assistance. The workbook can be downloaded at https//pubs.ext.vt.edu/spes/spes-60A/spes-60A.

www.ext.vt.edu
Produced by Virginia Cooperative Extension, Virginia Tech, 2018

VT/1018/SPES-60P

Before submitting soil samples for analysis, applicators should ensure the soil testing lab is approved by DCR and confirm that the correct testing procedure is used by the lab. Only the Mehlich I or Mehlich III testing procedures may be used to determine P levels and recommendations. Bray, Olsen, and other P testing methods are not suitable for use with the S&C.

The workbook was developed using the DCR's approved soil testing labs as of August 2018. Applicators can contact the DCR or visit the website described above for the list of currently approved labs. Applicators are advised to check the lab addresses because a company could have multiple locations (other locations might not be approved by DCR). The spreadsheet currently supports soil tests from the following labs:

1. Agri-Analysis Testing Laboratory (Leola, Pennsylvania)
2. Agrolab Inc. (Harrington, Delaware)
3. AgSource Harris Laboratories (Lincoln, Nebraska)
4. A&L Great Lakes Laboratory Inc. (Fort Wayne, Indiana)
5. Brookside Laboratories (New Bremen, Ohio)
6. Logan Labs (Lakeview, Ohio)
7. Midwest Laboratories (Omaha, Nebraska)
8. Spectrum Analytic (Washington Court House, Ohio)
9. Virginia Tech (Blacksburg, Virginia)
10. Waters Agricultural Lab (Camilla, Georgia)
11. Waters Agricultural Lab (Warsaw, North Carolina)
12. Waypoint Analytical (Richmond, Virginia)

Workbook Instructions

It is recommended that these instructions be read in their entirety before using the spreadsheet. The workbook is intended to help with conversions and recommendations, but it does not replace any information found in the Virginia Nutrient Management Standards and Criteria (DCR 2014).

Once you have your soil test reports, use the small arrows on the bottom left side of the screen to navigate through the different tabs or use the Quick Links on the Instructions tab. Each tab corresponds to a particular soil testing lab. Click on any tab to activate it. Additional instructions or notes are included for some of the tabs. You will be able to enter data in the data entry columns (first column in each table, bright yellow heading) for the P tables (orange) or the K tables (green). Up to 50 entries can be made at a time in each table.

Before entering data, check to make sure the units and forms of P or K on your soil test report match the units and forms in the data entry column. The units could be in pounds per acre (lb/A) or parts per million (ppm). Phosphorus forms could be reported as P or phosphate (P_2O_5). If the soil testing lab has reported information that is different from what is in the data entry column, additional conversions will need to be made before you proceed. On the PPM & Lb per Ac tab, values can be converted from pounds per acre to parts per million. These lines can be copied and pasted into other areas of the workbook (select the data, right click to copy, and then right click to paste the values in the desired location). There is also a tab for conversions from Mehlich III P_2O_5 lb/A to Mehlich III P PPM.

The worksheets will automatically calculate Mehlich I P and K values as well as their associated fertility ratings. The phosphate and potash recommendations provided are for established turfgrass only. If turf is going to be established, the calculator can be used to determine the fertility ratings, but the P and K establishment rates and guidelines from the S&C will need to be used. Additional notes for P applications and K applications are also included in the last column for each of the tables. If any of the calculated cells in the P tables turn red, it means that there are further restrictions associated with P use. Check the Notes columns and the S&C for additional information on P restrictions.

Practical Considerations

Before applying fertilizers, the pH of the soil should be adjusted to an appropriate level for the plant being grown. It is important to provide the correct "crop code" when soil samples are submitted for analysis. Applications of lime or sulfur might be recommended in the soil test results to adjust pH and

maximize the availability of nutrients to the plant. Applicators should follow the lime recommendations provided on the soil test report or those in the S&C if recommendations were not provided. If a soil testing lab other than Virginia Tech is used, the buffer pH test might need to be requested separately from routine/basic soil testing to get lime recommendations.

Applicators can choose to apply N, P, and K as long as the recommendations in the Standards and Criteria manual (DCR 2014) are followed. Nitrogen should be applied during the growing season based on the type of plant being grown and the intended use, as outlined in the Standards and Criteria manual. Potassium and P should be applied based on the final/converted soil test results, which will give recommendations for the annual amount of phosphate (P_2O_5) and potash (K_2O) to apply. For the applicator's convenience, recommendations in the Excel workbook are given in either pounds per acre or pounds per 1,000 square feet. If the fertility ratings for P or K are above the medium (M) level and the turfgrass appears to be healthy, additional applications of P or K might not be beneficial. These notes will appear in the last column in the P and K tables for each of the soil testing labs.

For additional information regarding soil sampling, turfgrass nutrient needs, or other topics pertaining to nutrient management, refer to the Urban Nutrient Management Handbook (VCE 2011), the Virginia Tech Soil Testing Laboratory Report Notes at www.soiltest.vt.edu/report-notes.html, and other Virginia Cooperative Extension publications found at www.ext.vt.edu. Turfgrass-related publications can be found on the VCE website by clicking on the Lawn & Garden menu on the website followed by the Publications tab and then either Lawns or Turf. Please note that some of the rates in documents published before July 2014 might not reflect the most current per-application or annual restrictions for nitrogen and phosphorus.

Always refer to the most current version of the Virginia Nutrient Management Standards and Criteria manual (DCR 2014) before making nutrient applications. In the July 2014 version of the S&C, the sections most relevant to turfgrass are found on pages 39-46 and 96-107.

Literature Cited

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