



Are Freedom
LAWNS
Environmentally Responsible?

Most Virginians live within the Chesapeake Bay Watershed and have a home lawn. Many are also aware that Bay health remains impaired due to excess nitrogen (N) and phosphorus (P) and sediment loading from the daily activities required in our densely populated society. These pollutants come from many sources, including sewage-treatment plants, city streets, development sites, agricultural operations and deposition from the air.

Do nutrient pollutants come from home lawns? Lawn fertilizer contains N and P, so it is easy to jump to the conclusion that they do. Many who value the environmental and economic health of the Bay have come to this conclusion, leading them to advocate something called the Freedom Lawn.

What is a Freedom Lawn? The basic concept is to take any existing lawn and continue only one cultural practice: periodic mowing. All other practices are to be discontinued: no fertilizer, no pesticides and no irrigation. The homeowner is then free to pursue other interests, free from the added costs of these inputs and free to proclaim to interested neighbors that he or she is protecting the water quality of the Chesapeake Bay. But is that so? In what follows, I discuss and present data on how the Freedom Lawn choice may actually result in more potential for degraded Bay water quality.

Let's review the research

What happens when all inputs, except periodic mowing, are removed from lawns? All around us, we see the results in our parks, lawns and school grounds: weeds and open soil areas increase. Ignoring the aesthetic drawbacks, what are the potential water-quality impacts? A recently published study at the University of Minnesota provides some answers.

The researchers installed Kentucky bluegrass sod on a silt loam soil with a

5% slope to easily allow runoff collection. To simulate soil compaction resulting from home-building activities, the compaction caused by the bulldozer during laser-leveling was not relieved by tillage prior to sodding. No fertilizer was applied during the first year. In the second year, the following treatments were applied to various plots in this study and continued over years three through five:

- No fertilizer
- Standard N (3 lbs./1,000 ft²/yr) + no P + standard potassium (K)
- Standard N (3 lbs./1,000 ft²/yr) + 1x P (as recommended by soil test) + standard K
- Standard N (3 lbs./1,000 ft²/yr) + 3x P (as recommended by soil test) + standard K

Fertilizer treatments were applied in 1/3 equal increments in May, September and October of each year, based on standard lawn fertilization guidelines from Minnesota Cooperative Extension. These guidelines closely match those of Virginia Cooperative Extension. No irrigation was used on these lawn plots. The initial soil test P level was 25 ppm; this level is in the sufficiency range, so the testing lab recommended little to no P for normal lawn maintenance.

What happened? By year three, the no-fertilizer plots had greatly reduced turf density, greater weed density, more exposed soil and more dead grass/weed tissue than the N fertilized plots.

Adding P at a 1x or 3x rate did not improve turf density relative to applying N-alone. Significantly, total P runoff from the no-fertilizer plots was greatest over the three years of monitoring because of greater runoff depth. That is, more water was lost from the plots that did not receive N fertilizer because of insufficient turf cover to impede flow, especially when the soil surface was frozen. Contained within this runoff water was also a greater load of P bound to soil and leaf-litter sediment.

Thus, as long as enough N was applied to maintain density and retard weed invasion, less P was lost in runoff, relative to the no-fertilizer control, **even when** P was applied at 3 times the recommended rate. I do not make this point to justify over-application of P to lawns, but merely to highlight that the controlling factor in reducing P runoff from lawns is turf density.

Researchers in New York (a Chesapeake Bay state) have reported similar results. They established an 80% Kentucky bluegrass/20% perennial ryegrass area from seed on a sandy loam soil with an 8% slope, using various natural organic and synthetic fertilizer treatments. Once the plots were mature (year 2,) results showed that the unfertilized control plots had significantly higher P-mass losses compared to any of the fertilized plots. These losses strongly correlated with less shoot density and lower infiltration rates on the unfertilized control plots. A direct quote is that "as shoot density doubled, the infiltration rate increased, which reduced runoff by three-fold." The highest annual rate of fertilizer N applied in this study was moderate, at 2 lbs./1,000 ft², but it was enough to ensure adequate turf density and water infiltration. Nitrate-N runoff

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from the organic or synthetic fertilizer treatments did not differ from the unfertilized control, averaging between 2 to 4.5 ppm, considerably below the EPA limit for safe drinking water (10 ppm).

Interpreting the research

Given these data, what does a Freedom Lawn offer for water quality in the Chesapeake Bay Watershed? The unfertilized control plots in the studies above received only periodic mowing (fitting the definition of a Freedom Lawn), and it took only two or three years for the “Freedom plots” to become greater contributors of P loading via runoff than the areas moderately fertilized with nitrogen.

Eleanor Roosevelt is credited with saying that “with freedom comes responsibility.” In my analysis, Freedom Lawns do not embrace their environmental responsibility and, in fact, can fairly rapidly become irresponsible. A more responsible approach heeds the scientific data, recognizes the limitations imposed by urban soil disturbance during development and recommends that we strive for “Sustainable Lawns” by following a set of best management practices (BMPs), with the goal of maintaining lawn surfaces with minimized water-quality impacts.

BMPs for Sustainable Lawns

Below are 12 BMPs for Sustainable Lawns in Virginia and throughout the Chesapeake Bay Watershed.

BMP#1: Improve the soil at establishment to reduce compaction and improve infiltration.

In new-housing construction, much of the topsoil is removed, and the remaining subsoil is severely compacted. Replacing a shallow topsoil layer prior to grassing is helpful in getting the lawn established, but the underlying soil compaction remains. Subsequently, long term, water infiltration is poor, greatly increasing the possibility of thin turf and off-site movement of nutrients.

Thus, prior to topsoil placement, the subsoil should be cleared of all debris and rip-plowed and tilled. Topsoil can then be distributed and a seedbed prepared. Adding a 1" to 2" layer of quality compost prior to seedbed preparation would also be very beneficial to lawn health and water infiltration over time.

BMP#2: Plant or re-plant best-adapted turfgrass species and varieties.

Each year, the turfgrass programs at Virginia Tech and the University of Maryland collaborate to put out a list of recommended turf varieties, based on field evaluations (found here: <http://www.pubs.ext.vt.edu/3008/3008-1456/3008-1456.html>). To make the list, each variety must have performed above average at both test sites for at least three years. Each listed variety must also be available as certified seed, ensuring genetic purity and seed quality to the buyer. With adequate establishment, odds are that these varieties will

provide greater stress persistence than those not on the list.

BMP#3: Improve the soil after establishment to reduce compaction and improve infiltration.

Most homeowners inherit a lawn with compacted soil. Core aeration and compost topdressing can slowly correct compaction. The rolling-drum aerators commonly used or rented, however, pull up cores from only 1% to 3% of the lawn surface area and do not go much deeper than 2".

To improve water infiltration and relieve compaction, go over the lawn in two to four directions during moist (not wet) soil conditions, twice a year during periods of active turfgrass growth. If possible, hand-spread and rake in a quality compost applied at 100 lb./1,000 ft². The average size of home lawns across Virginia is 5,000 ft², requiring 500 lbs. of compost for each application.

Repeatedly applying organic matter via the compost will build topsoil, bind

nutrients and water and promote soil aggregation for improved water infiltration and compaction resistance.

Further, it will serve as a natural organic slow-release fertilizer, providing approximately 1.5 lb. N/1,000 ft² each time it is applied. Two compost applications per year would, then, provide all the fertility the lawn requires to remain healthy and dense enough to greatly limit any potential P or N runoff.

BMP#4: Soil test every 1 to 3 years to determine if fertilizer P is needed; use fertilizers with 0% P (e.g., 30-0-10) if the soil test indicates no need.

Binding readily to clay minerals and soil organic matter, phosphorus does not leach. Thus, soil-test P levels change quite slowly in most Virginia soils. With our moderate rainfall, soil pH does fall, but not fast enough to require re-liming more frequently than every two to three years. Soil testing every one to three years, therefore, is sufficient to ensure sufficient P availability. If the soil test

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indicates no P need, then select fertilizers that contain no P.

BMP#5: Implement a moderate fertilizer N program based on Virginia Cooperative Extension and Virginia Department of Conservation and Recreation recommendations.

Our research review (above) clearly indicated that not applying N-containing fertilizer is not a responsible choice for pollution prevention. A moderate amount of N per year (1 to 4 lbs. actual N/1,000 ft²) is needed to maintain enough turf cover to impede sediment-bound P loss. Refer to these online sources to guide your N fertilization practices: <http://www.pubs.ext.vt.edu/452/452-717/452-717.html> and <http://www.dcr.virginia.gov/soil/water/documents/tipsstate.pdf>.

High-use lawns will need N at the 3- to 4-lb. level to push enough growth to ensure adequate cover against runoff.

Adequate cover on low-use lawns can be maintained via 1- or 2-lb. programs.

For added insurance against N runoff or leaching losses, use fertilizers with higher proportions of slow- or controlled-release N sources. Using slow-release sources, including organics, also reduces surge growth, reducing mowing requirements relative to using quick-release N sources.

BMP#6: Do not apply fertilizers to frozen soils.

Several studies have noted that 60% to 90% of P-runoff occurs during winter thawing periods when the surface soil is still frozen. Such large runoff events occur because the soils are either frozen or saturated, prohibiting water infiltration and allowing soil- or leaf-litter-bound P present in open soil areas to be quickly lost. Applying P-containing fertilizers too late (November or December) or too early (February or

March) greatly increases the potential of P loading into Bay waters.

BMP#7: Do not apply fertilizer to impervious surfaces; immediately sweep or blow any granules back onto the lawn.

Fertilizer, compost, grass clippings and tree leaves all contain nutrients. As such, it is irresponsible to leave any of them on impervious surfaces where they can move unimpeded into storm drains.

BMP#8: Mow high, and follow the 1/3 rule.

This BMP is all about maintaining density and high biomass on your lawn: both factors increase water-flow resistance, slowing runoff and increasing infiltration. Mowing turf at the higher end of recommended ranges (3"-4" for bluegrass and fescue; 1.5"-2.5" for bermudagrass and zoysiagrass) will accomplish this, while also providing a deeper-rooted, more stress-tolerant lawn.

Mowing high also means you can mow less frequently without breaking the 1/3 rule. The 1/3 rule is to never remove more than 33% (1/3) of the grass height at one mowing. Repeatedly removing too much at each mowing (e.g., mowing a 5" lawn down to 2" = 60% removal) results in a shallow root system that produces turf thinning and weed invasion. For fescue lawns, not breaking the 1/3 rule means mowing back to a 3" height each time the lawn reaches 4.5".

BMP#9: Leave clippings on the lawn, removing any that reach impervious surfaces.

Grass clippings contain 2% to 5% N and about 0.5% P, and they break down quickly, re-releasing these nutrients for root uptake. Clipping return can serve as an organic fertilizer, providing more than 1 lb. N/1,000 ft²/yr.

Left on the street, however, these nutrients can quickly move into storm drains to pollute the Bay. If large clipping clumps accumulate, either rake them up and compost them on-site, or mow the lawn in 2-3 directions to disperse them.

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BMP#10: Mulch tree leaves into the lawn and clean up any that accumulate on impervious surfaces.

Studies at Michigan State, Purdue and Cornell have documented that mulching a 2" to 5" layer of deciduous tree leaves onto cool-season lawns for three to five consecutive autumns had no significant effects on lawn health or vigor. These studies also reported no increases in thatch or undue reduction in soil pH due to this practice.

Recycling tree leaves back into your lawn is safer for the environment than piling them on the street and risking the loss of N and P to stormwater runoff. Mowing when the leaves are dry mulches them much more effectively.

BMP#11: Irrigate only if severe drought persists and threatens to significantly reduce turf cover.

Adherence to the first 10 BMPs should result in a fairly deep-rooted lawn that should recover from summer droughts of two to three weeks. Droughts of more than four weeks could result in the loss of some turf cover, especially if there is any traffic on the lawn during drought-dormancy. In this case, lawn cover should be preserved by applying 0.75" to 1" of water per week until rainfall returns.

BMP#12: Use pesticides only when weed, insect or disease levels threaten to significantly thin the lawn; strictly follow label directions.

Careful application of the preceding BMPs to ensure a dense, healthy lawn should greatly minimize the need for pesticides.

For homeowners who wish to have lawns that are environmentally friendly or more sustainable than what current suburban development gives them, there are two primary choices: take what you are given and improve it by following these 12 BMPs, or start over by improving the soil and establishing a no-mow prairie and herbaceous/woody perennial landscape. Simply stopping all management inputs and calling it a "Freedom Lawn" is easy and cheap, but it may ultimately be irresponsible. ☹️