

Acid-loving Shrubs

Management Highlights

- Target pH: 5.6
- Fertilize acid-loving shrubs in the spring.
- Use of organic fertilizers specifically formulated for acid-loving plants will reduce the risk of fertilizer burn on sensitive plants and help maintain soil pH in the appropriate range.

Introduction

Acid-loving shrubs include such plants as azalea, andromeda, leucothoe, rhododendron and mountain laurel. These shrubs require a lower soil pH (~ 5.6) than do most other shrubs for optimum plant growth. At higher soil pH's, plants may exhibit reduced growth or symptoms of iron deficiency such as light colored leaves. Maintaining an appropriate soil pH should minimize the occurrence of these conditions. Since many acid-loving shrubs are broadleaf evergreens grown for their flowers, avoid overfertilization which can result in plant injury and/or reductions in the number of flowers.

Soil pH and Liming

The target pH for acid-loving shrubs on Delaware soils is **5.6**. The lime recommendation is calculated from the soil pH and buffer pH measurements using the steps outlined in *Calculating the Lime Requirement – Chapter 4, Section 4.4*. Avoid overliming in order to encourage good plant growth and prevent deficiency of micronutrients such as iron. In most cases, the lime requirement can be met by either calcitic or dolomitic limestone. When soil test Mg is less than 38 FIVs, use dolomitic limestone to prevent Mg deficiency and increase soil Mg concentrations.

If soil pH is too high, elemental sulfur can be used to lower it. See *Chapter 4, Section 4.4.5 -- Soil Acidification* to determine the appropriate application rate.

Nutrient Recommendations

Nutrient recommendations for acid-loving shrubs are based on the nutrient requirements of the plant and the soil test values for P and K. To determine the nutrient recommendation for a specific site, select the **P-K Index Value** from Table 1 using the soil test P and soil test K values shown on the Soil Test Report Form. Next, using that index value, select the appropriate nutrient recommendation from Table 2, below.

Lawn and Garden Plants

In general, acid-loving shrubs should be fertilized in the spring. Applying nutrients at other times of the year may lead to fertilizer burn, if applied during hot weather, or encourage succulent growth late in the season that will be subject to frost damage or winter-kill. To improve the color of broadleaf evergreens, a *small* amount of fertilizer containing water-soluble N can be applied in June or July.

Table 1. P-K Index value as a function of soil test P and soil test K.

Soil Test K (FIVs)	Soil Test P (FIV)s			
	1 - 25	26 - 50	51 - 100	101 - 150
1 - 25	1	2	3	4
26 - 50	5	6	7	8
51 - 100	9	10	11	12
101 - 150	13	14	15	16

Table 2. Nutrient recommendations as a function of the P-K index value.

P-K Index Value	Nutrient Recommendation
1-16	Apply ½ cup 3-2-1 or ¼ cup 10-6-4 per square yard of soil surface beneath the shrub. An equivalent organic fertilizer specifically formulated for acid-loving plants can be substituted for the inorganic materials listed above.
11, 12 15, 16	If the shrub is growing in a well-fertilized lawn area, routine lawn fertilization will meet the needs of the shrub.

Additional Information

See Soil Test Notes 1 and 13 (Appendix APP-7) Extension Bulletin #154: *The Care of Ornamental Plants – Delaware Home Gardeners Manual* for additional information about nutrient management of acid-loving shrubs.

Bermudagrass - Zoysiagrass Lawn - Maintenance

Management Highlights

- Target pH: **6.0**
- Apply lime in the fall (August 15 - November 1).
- Apply a total of 3 lbs N/1000 square feet in two **spring** applications. Apply 1 lb N in a soluble source between March 1 and April 2. Apply 2 additional lbs N/1000 square feet either in a source containing 35% or more of the total as water-insoluble N or in a source specified as slow-release between May 1 and June 1.
- Never apply more than 1 lb N/1000 square feet as a soluble source.

Introduction

Bermudagrass - zoysiagrass mixes are occasionally used for lawns in the Delaware Valley. These species are warm season grasses which grow best during the summer months (optimum temperature range 80-90°F) and go dormant during cold weather. For that reason, fertilization of bermudagrass-zoysiagrass lawns is recommended during the spring months (March 1 - June 1) to ensure that adequate nutrients are available during the time when the grass is actively growing. Fertilization at other times of the year when the plants are not actively growing can result in the loss of nutrients by leaching or runoff.

Soil pH and Liming

The target pH for bermudagrass-zoysiagrass mixes on Delaware soils is **6.0**. The lime recommendation for a particular site is calculated from the soil pH and buffer pH measurements using the steps outlined in *Calculating the Lime Requirement -- Chapter 4, Section 4.4*. Avoid overliming in order to encourage good plant growth and prevent deficiency of micronutrients such as iron.

In most cases, the lime requirement can be met by either calcitic or dolomitic limestone. *Dolomitic limestone* is recommended if:

- soil test Mg is less than 50 FIVs, or
- soil test Mg is between 50 and 100 FIVs *and less than soil test Ca*.

Calcitic limestone is recommended if:

- soil test Mg is greater than 100 FIVs, or
- soil test Mg is between 50 and 100 FIVs *and greater than soil test Ca*.

Lawn and Garden Plants

Lime is best applied in the fall between August 15 and November 1. Do not spread more than 50 lbs lime per 1000 square feet at a time. If more than 50 lbs/1000 square feet has been recommended, make two or more treatments of 40-50 lbs each several months apart until the full rate has been applied.

Nutrient Recommendations

Nutrient recommendations for lawns can be grouped into two broad classes: *corrective applications*, designed to correct any problems in the soil and establish an optimum level of fertility, and *maintenance programs*, which are suitable for use once any problems have been addressed. *Corrective applications* are based on the nutrient requirements of the turf grass and the soil test values for P and K. To determine the nutrient recommendation for a specific site, select the **P-K Index Value** from Table 1 using the soil test P and soil test K values shown on the Soil Test Report Form. Next, using that index value, select the appropriate nutrient recommendation from Table 2, below.

Fertilizer recommendations for turf grass vary with the N availability of the source(s) used. Nitrogen availability is primarily dependent upon the chemical composition of the source and can range from immediately available to slowly available in which N is released over a period of weeks, months or even years. Nitrogen sources described as *water-soluble* produce a rapid response since the applied N is available immediately. These materials are usually less expensive than other sources but have several drawbacks: shorter residual response, increased chance of plant injury due to fertilizer burn and greater potential for loss due to leaching. Application rates, methods and timing for *water-soluble N (WSN) materials* must be carefully monitored to prevent plant injury and ensure that N is available to the plant when needed. Common sources of WSN include ammonium nitrate, ammonium sulfate, and urea. Fertilizer recommendations for materials high in WSN usually specify two applications of 1-1¼ lbs N/1000 square feet applied several weeks apart. To avoid foliar injury, application rates should never exceed 1½ lbs N/1000 square feet per treatment.

Nitrogen sources described as *slow-release or water-insoluble* release N over a much longer time period (e.g., several weeks or months). These materials are less likely to injure the plants, have a longer residual response and are less likely to be lost through leaching. Two drawbacks of *water-insoluble N (WIN) materials* are their higher cost relative to WSN materials and their slow response time. Common sources of WIN in turfgrass fertilizers include ureaformaldehyde products (UF), isobutylidene diurea (IBDU), sulfur-coated urea (SCU) and natural organic materials. Given their slow-release, materials high in WIN can often be applied in a single application per growing season. Application rates per individual treatment can be higher than those allowed for WSN sources since the risk of plant injury is low. The total recommended N rate for the season, however, (e.g., 2-3 lbs N/1000 square feet/season), remains the same.

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Since most mixed fertilizers available in the retail market contain more than one source of N, the N availability of a particular fertilizer is dependent upon both the type and relative quantities of the N sources included in the material. *When 35% or more of the N present in a fertilizer comes from WIN materials, the fertilizer is considered a slow-release or insoluble fertilizer. These materials are also referred to as turf-type fertilizers. When less than 35% of the N in the fertilizer is supplied by WIN materials, the fertilizer is considered quickly available or water soluble.* The percentage of WIN in a fertilizer material can be calculated using the equation:

$$WIN(\%) = \frac{\sum \text{ of WIN Sources}}{\text{Fertilizer N Content}} \times 100$$

A fertilizer with a total N content of 10% that contains 4% WIN materials would be classified as a *water-insoluble or turf-type fertilizer* since 40% of the N is supplied by WIN materials (e.g., [(4% / 10%) X 100]=40%).

Table 1. P-K Index value as a function of soil test P and soil test K.

Soil Test K (FIVs)	Soil Test P (FIV)s			
	1 - 25	26 - 50	51 - 100	101 - 150
1 - 25	1	2	3	4
26 - 50	5	6	7	8
51 - 100	9	10	11	12
101 - 150	13	14	15	16

Lawn and Garden Plants

Table 2. Corrective nutrient recommendations for bermudagrass-zoysiagrass lawns as a function of the P-K index value.

PK Index Value	Nutrient Recommendation
1, 2	<p>Between March 1 and April 1, apply 20 lbs 5-10-10 (or equivalent water-soluble fertilizer as described in Soil Test Note 10) per 1000 square feet.</p> <p>Repeat application between May 1 and June 1. Re-sample 1 month later to see if P and K are adequate.</p>
3,4	<p>Between March 1 and April 1, apply 12 lbs 12-4-8 (or equivalent fertilizer as described in ST Note 10) <i>and</i> 5 lbs muriate of potash (0-0-60) per 1000 square feet.</p> <p>Repeat application between May 1 and June 1.</p>
5, 9,13	<p>Between March 1 and April 1, apply 30 lbs 5-10-5 (or equivalent water-soluble fertilizer as described in ST Note 10) per 1000 square feet.</p> <p>In May, switch to one of the lawn maintenance programs outlined below.</p>
6	<p>Between March 1 and April 1, apply 15 lbs 10-10-10 (or equivalent water-soluble fertilizer as described in ST Note 10) per 1000 square feet.</p> <p>In May, switch to one of the lawn maintenance programs outlined below.</p>
7,8	<p>Between March 1 and April 1, apply 12 lbs 12-4-8 (or equivalent water-soluble fertilizer as described in ST Note 9) per 1000 square feet.</p> <p>In May, switch to one of the lawn maintenance programs outlined below.</p>
10,14	<p>Between March 1 and April 1, apply 15 lbs 10-6-4 or equivalent water-soluble fertilizer per 1000 square feet.</p> <p>In May, switch to one of the lawn maintenance programs outlined below.</p>
11,12, 15,16	<p>Soil test P and soil test K levels are adequate. Follow one of the lawn maintenance programs outlined below.</p>

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Lawn Maintenance Programs

Lawn maintenance programs are designed to meet the annual nutrient needs of the turf grass while maintaining an optimum level of soil fertility. Unless problems develop, *maintenance programs* can be followed for 2-3 years before a new soil test is required. Three *maintenance programs* for bermudagrass-zoysiagrass lawns are outlined below. *Program 1*, summarized in Table 3, is based on the use of soluble fertilizers. Application rates and fertilizer materials depend upon whether clippings will be left or removed. *Program 2*, summarized in Table 4, is also based on the use of WSN fertilizers and the assumption that clippings will be removed. *Program 3*, summarized in Table 5, is based on the use of water-insoluble or slow-release materials. Again, application rates and fertilizer materials depend upon whether clippings will be left or removed. When clippings are left on, fertilizers should contain little or no P and K since these nutrients will be returned to the soil as the clippings decompose. Additional information about these programs can be found in Soil Test Note 10 or Extension Bulletin #155, *Successful Lawn Management* (Barton, 1992).

Table 3. Maintenance program 1 for bermudagrass-zoysiagrass lawns using water-soluble nitrogen fertilizers.

Date to Apply	Amount to Apply (lbs/1000 square feet)	
	Clippings Removed	Clippings Left On
March 1 - April 1	10-12 lbs 12-4-8 (containing less than 35% WIN)	2 lbs ammonium nitrate (34-0-0) or 1½ lbs urea (46-0-0)
May 1 - June 1	10-12 lbs 12-4-8 (containing less than 35% WIN)	2 lbs ammonium nitrate (34-0-0) or 1½ lbs urea (46-0-0)

Table 4. Maintenance program 2 for bermudagrass-zoysiagrass lawns using water-soluble nitrogen fertilizers - grass clippings removed - all P and K applied in early spring.

Date to Apply	Amount to Apply (lbs/1000 square feet)
March 1 - April 1	15 lbs 10-10-10 or equivalent fertilizer containing less than 35% WIN
May 1 - June 1	3 lbs ammonium nitrate or 2 lbs urea

Lawn and Garden Plants

Table 5. Maintenance program 3 for bermudagrass-zoysiagrass using a single application of water-insoluble or slow-release nitrogen fertilizer.

Date to Apply	Amount to Apply (lbs/1000 square feet)	
	Clippings Removed	Clippings Left On
March 1- April 1	30-35 12-4-8 or equivalent fertilizer containing at least 35% WIN	10 lbs 26-4-6, 27-3-3 or equivalent fertilizer containing at least 35% WIN

Additional Information

See Soil Test Notes 1 and 10 (Appendix APP-7) and Extension Bulletin #155: *Successful Lawn Management* for additional information about nutrient management of bermudagrass-zoysiagrass lawns.