BACKYARD CONSERVATION
It'll grow on you.

Nutrient Management

Apply only the nutrients plants can use.

In your backyard

Twenty nutrients have been identified that are required by plants. Of these, nitrogen, phosphorus, and potassium are required in relatively large amounts. Nitrogen is associated with lush vegetative growth, adequate phosphorus is required for flowering and fruiting, and potassium is necessary for durability and disease resistance. Calcium, sulfur, and magnesium are also required in comparatively large quantities. These six nutrients are referred to as macronutrients.

The other nutrients, referred to as micronutrients, are required in very small amounts. These include such elements as copper, zinc, iron, and boron. While both macro and micronutrients are required for good plant growth, over-application can be as detrimental as a deficiency. Over-application of plant nutrients not only may impair plant growth, but may contaminate groundwater by leaching through the soil or pollute surface waters by washing away.

Soil testing is key to applying the correct amount and kind of nutrients.

Backyard Conservation

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Soil testing

Testing your soil for nutrients and pH is important to provide your plants with the proper balance of nutrients while avoiding over-application. If you are establishing a new lawn or landscaping, a soil test is strongly recommended. The cost of soil testing is minor in comparison to the cost of plant materials and labor. Correcting a problem before planting is much simpler and cheaper than afterwards.

Once your yard is established, continue to take periodic soil samples. While many people routinely lime their lawns, this can result in raising the pH too high. However, since many fertilizers tend to lower the pH, the pH may drop below desirable levels after several years, depending on fertilization and other soil factors.

Home tests for pH, nitrogen, phosphorus, and potassium are available from garden centers. While these may give you a general idea of the nutrients in your soil, they are not as reliable as tests performed by the Cooperative Extension Service at land grant universities. University and other commercial testing services will provide more detail and you can request special tests for micronutrients if you suspect a problem. In addition to the analysis of nutrients in your soil, they often provide recommendations for the application of nutrients or on adjusting the pH.

The test for soil pH is very simple– pH is a measure of how acidic or alkaline your soil is. A pH of 7 is considered neutral. Below 7 is acidic and above 7 is alkaline. Since pH greatly influences plant nutrients, adjusting the pH will often correct a nutrient problem. At a high pH, several of the micronutrients become less available for plant uptake. Iron deficiency is a common problem even at a neutral pH on such plants as rhododendrons and blueberries. At very low pH, other micronutrients may be too available, resulting in a plant toxicity.

Phosphorus and potassium are tested regularly by commercial testing labs. While there are soil tests for nitrogen, these may be less reliable. Nitrogen is present in the soil in several forms and the forms can change rapidly. Therefore, a precise analysis of nitrogen is more difficult to obtain. Most university soil test labs do not routinely test for nitrogen. Home testing kits often contain a test for nitrogen which may give you a general idea of the presence of nitrogen, but again, due to the various transformations of nitrogen, the reading may not be reliable.

Organic matter is often part of a soil test. Soil organic matter is highly desirable. Organic matter has a large influence on soil structure. Good soil structure improves aeration and water movement and retention. This encourages increased microbial

It's a good idea to test your soil before applying nutrients, to be sure you are not overapplying and loading nutrients into lakes or streams.

activity and root growth, both of which influence the availability of nutrients for plant growth. Soil organic matter also affects the availability of plant nutrients and how pesticides react in the soil. Soils high in organic matter tend to have a greater supply of plant nutrients compared to many soils low in organic matter. Organic matter tends to bind up some soil pesticides, reducing their effectiveness.

Tests for micronutrients are usually not performed unless there is reason to suspect a problem. Certain plants have greater requirements for specific micronutrients and may show deficiency symptoms. Iron deficiency is common on blueberries, rhododendrons, and pin oaks unless the soil is quite acidic. On these plants, the younger leaves will usually show signs of the deficiency first. The areas between the veins will be yellowish while the veins remain green. Other plants growing in the same soil will show no signs of a deficiency. In this case, altering the pH will often correct the problem.

Taking a soil test

1. If you intend to send your sample to the land grant university in your state, contact the local Cooperative Extension Service for information and sample bags. If you intend to send your sample to a private testing lab, contact them for specific details about submitting a sample.

2. Follow the directions carefully for submitting the sample. The following are general guidelines for taking a soil sample.

a. Sample when the soil is moist but not wet.

b. For each acre of land to be tested, 10 to 15 sub-samples are recommended. Areas that appear different or that have been used differently should be sampled separately. For example, a separate sample should be submitted for an area that has been in a garden and one that has been lawn.

c. Obtain a clean pail or similar container.

d. Clear away the surface litter or grass.

e. With a spade or soil auger, dig a small amount of soil to a depth of 6 inches.

f. Place the soil in the clean pail.

g. Repeat steps d through f until the required number of samples have been collected.

h. Mix the samples together thoroughly.

i. From the mixture, take the sample that will be sent for analysis.

j. Send immediately. Do not dry before sending.

3. If you are using a home soil testing kit, follow the above steps for taking your sample. Follow the directions in the test kit carefully.

Fertilizers and soil amendments

Once you have the results of the soil test, you can add nutrients or soil amendments such as lime, as needed. If you need to raise the pH, use lime. Lime is most effective when it is mixed into the soil, therefore it is best to apply before planting. For large areas, rototilling is most effective. For small areas or around plants, working the lime into the soil with a spade or cultivator is preferable. When working around plants, be careful not to dig too deeply or so roughly that you damage plant roots. Depending on the form of lime and the soil conditions, the change in pH may be gradual. It may take several months before a significant change is noted. Soils high in organic matter and clay tend to take larger amounts of lime to change the pH than do sandy soils.

If you need to lower the pH significantly, especially for plants such as rhododendrons, you can use aluminum sulfate. Other commercially available fertilizers will also help lower the pH. In all cases, follow the soil test or manufacturer's recommended rates of application. Again, mixing well into the soil is recommended.

There are numerous choices for providing nitrogen, phosphorus, and potassium. If your soil is of adequate fertility, applying compost may be the best method of applying additional nutrients. While compost is relatively low in nutrients compared to commercial fertilizers, it is especially beneficial in improving the condition of the soil. By keeping the soil loose, compost allows plant roots to grow well throughout the soil, allowing them to extract nutrients from a larger area. A loose soil enriched with compost is also an excellent habitat for earthworms and other beneficial soil microorganisms that are essential for releasing nutrients for plant use. The nutrients from compost are also released slowly so there is no concern for "burning" the plant with an over-application.

Manure is also an excellent source of plant nutrients and organic matter. Manure should be composted before applying. Fresh manure may be too strong and can injure plants. Be careful when composting manure. If left in the open, exposed to rain, nutrients may leach out of the manure and the runoff can contaminate waterways. Make sure the manure is stored in a location away from wells and any waterways, and that any runoff is confined or slowly released into a vegetated area. Improperly applied manure also can be a source of pollution. For best results, work

composted manure into the soil. If preparing a bed before planting, compost and manuremay be worked into the soil to a depth of 8 to 12 inches. If adding to existing plants, work carefully around plants.

Green manures are another source of organic matter and plant nutrients. Green manures are crops that are grown and then tilled into the soil. As they break down, nitrogen and other plant nutrients become available. Green manures may also provide additional benefits of reducing soil erosion. Green manures such as rye and oats are often planted in the fall after the crops have been harvested. In the spring, these are tilled under before planting.

With all organic sources of nitrogen, whether compost or manure, the nitrogen must be changed to an inorganic form before the plants can use it. Therefore, it is important to have well-drained, aerated soils that provide the favorable habitat for the soil microorganisms responsible for these conversions.

There are numerous sources of commercial fertilizers that supply nitrogen, phosphorus, and potassium. The first number on the fertilizer analysis is the percentage of nitrogen, the second number is phosphorus, and the third number is the potassium content. A fertilizer like 10-20-10 has twice as much of each of the nutrients as a 5-10-5. How much of each nutrient you need depends on your soil test results and the plants you are fertilizing. As was mentioned before, nitrogen stimulates vegetative growth while phosphorus stimulates flowering. Too much nitrogen can inhibit flowering and fruit production. For many flowers and vegetables, a fertilizer higher in phosphorus than nitrogen is preferred such as a 5-10-5. For lawns, nitrogen is required in greater amounts so a fertilizer with a greater amount of nitrogen is beneficial.

Fertilizer application

Commercial fertilizers are normally applied as a dry granular material, or mixed with water and watered onto the garden. If using granular materials, avoid spilling on sidewalks and driveways. These materials are water soluble and can cause pollution problems if rinsed into storm sewers. Granular fertilizers are a type of salt, and if applied too heavily on plants, they can burn the plants. If using a liquid fertilizer, apply directly to or around the base of the plant.

For the most efficient use and to decrease the potential for pollution, fertilizer should be applied when the plants have the greatest need for the nutrients. Plants that are not actively growing do not have a high requirement for nutrients. Therefore, applications of nutrients to dormant plants, or plants growing slowly due to cool temperatures, are more likely to be wasted. While light applications of nitrogen may be recommended for lawns in the fall, generally, nitrogen fertilizers should not be applied to most plants in the fall in regions of the country that experience cold winters. Since nitrogen encourages vegetative growth, if it is applied in the fall it may reduce the plant's ability to harden for winter.

In some gardens, fertilizer use can be reduced by applying it around the individual plants rather than broadcasting across the entire garden. In the case of phosphorus, much of the fertilizer phosphorus becomes unavailable to the plants once spread on the soil. For better plant uptake, apply the fertilizer in a band near the plant. Do not apply directly to the plant or in contact with the roots.

On the farm

Farmers routinely test their soils to determine the nutrient status. For both ecological and economic reasons, the farmer does not want to apply any more than is needed for healthy crop development. Based on soil test results from across their fields, farmers can vary the rate of application depending on soil conditions. Precision application of fertilizer is becoming more common as global positioning technology develops. Global positioning uses satellite technology to help the farmer apply the proper amount of fertilizer based on the soil tests results when traveling across the field.

The late spring test for soil nitrate allows many corn growers to reduce the amount of nitrogen they apply to their cornfields. Farmers sample their fields when the corn is about 6 inches tall, and apply only the amount of nitrogen needed for crop growth.

Farmers apply a variety of fertilizer materials. Manure is recognized as an excellent source of plant nutrients as well as a source of organic matter. Farmers with access to livestock manure often find that manure alone can meet the nutrient needs of their crops. Commercial sources of nitrogen are commonly applied by farmers with limited access to manure. One source of nitrogen that many farmers use is anhydrous ammonia. This gaseous form of nitrogen is "knifed" into the soil between the rows, placing the fertilizer where it can readily be used by the plant roots.

Green manure crops and crop rotations involving legumes also provide farmers with an additional source of plant nutrients.

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