WOODY AND TURF MANAGEMENT
Lesson 14: FERTILIZERS

Segment One – Assessing Plant Health and Soil

A fertilizer is defined as a substance used to make the soil or growing medium more fertile. Frequently, the act of applying fertilizer to the soil is erroneously referred to as feeding the soil or the plant. What is actually being done is the application of chemical nutrients to the soil to enrich the supply of nutrients available to the plant. The plant utilizes the soil nutrients in its growth and development. In other words, the nutrients are the raw materials taken from the soil by the plant roots and used in manufacturing the food and energy needed in plant growth processes.

Symptoms of Nutrient Deficiencies

A nutrient deficiency shows first as a general slowdown of the growth processes. If not corrected, the deficiency can result in a change in foliage color, chlorosis, or even malformed growth. Chlorosis is the yellowing of a leaf; yellowing between the veins is called interveinal chlorosis.

Poor soil drainage, over-watering, root nematodes, or any other condition that will cause root injury can also produce chlorosis. Soils either near the neutral point (pH=7) or alkaline (pH>7) generally have such a low amount of iron available to plants as to be insufficient for proper growth. Such an iron deficiency condition sometimes develops around homes where plaster, cement and other debris have been discarded around the foundation and covered with soil. It may be difficult to grow “acid-loving” plants such as azaleas and rhododendrons under such conditions.

You need considerable experience to become adept in recognizing deficiency symptoms. Since it is often difficult to detect nutrient deficiencies by visual symptoms alone, a soil test, and perhaps foliar analysis, is required.

Soil Testing

Soil pH will have a decided effect upon the availability of many of the chemical nutrients needed by plants. The soil pH, as well as the relative amounts of the primary and secondary nutrients, can be determined with a reliable soil test made on a representative soil sample. Many times cultural problems or physiological disorders in the plant will cause symptoms that are very similar to nutrient deficiencies.

- Consider doing a soil test. The Soil Testing Laboratory at the University of Minnesota offers soil testing. Follow the instructions on the website to collect samples of soil, mail them in, and then evaluate the results when you receive the report. For more information, visit their website at http://soiltest.cfans.umn.edu/index.htm.

Segment Two - Correcting Soil pH

Most plants prefer a soil pH of 6 to 7. Acid-loving plants such as azaleas and rhododendrons require an acidic soil of pH 4.5 to 6.0.

If soil pH is too low, in other words too acid, apply some form of lime. Ground agricultural limestone is the most frequently used. The finer the grind the more rapidly it becomes effective.

If soil pH is too high, in other words too alkaline, aluminum sulfate may be added to the soil at the rate of 1 pound per 100 square feet. Thoroughly water this into the soil if plants are already planted; otherwise broadcast and spade or cultivate it into the soil before planting. A second liquid application may be made in 4 to 6 weeks if a soil still shows that it is not sufficiently acid. While aluminum sulfate is one option, the type of material used will depend on the specifics of the site.

Finely powered sulfur is another material used to acidify soil. Apply this at a rate of one to two pounds per 100 square feet and thoroughly work it into the soil along with organic matter before planting.

Segment Three - Synthetic and Organic Fertilizers

In broad terms there are two approaches to fertilization. One approach uses synthetic or inorganic fertilizers. The other approach uses organic fertilizers.

Synthetic Fertilizers

In the early 1900's scientists developed a number of artificial fertilizers. Most of them combined natural rock bases with soluble chemicals. Some examples of synthetic fertilizers include:

- aluminum sulphate
- ammonium nitrate
- iron sulphate
- muriate of potash
- superphosphate
- urea

Organic Fertilizers

The word organic applied to fertilizers simply means that the nutrients contained in the product are derived solely from the remains or a by-product of a once-living organism. An organic regimen also includes bacterial inoculants, and powdered rock minerals such as rock phosphate (for phosphorus), glauconite greensand (for iron, potassium, and silica), and granite dust (for potassium). A few examples of organic fertilizers and their N-P-K analyses include:

- Cottonseed meal – usually 7-3-2.
- Blood meal - rich source of nitrogen; some essential trace elements, e.g. iron.
- Bone meal - phosphorus and nitrogen.
- Fish emulsion - high in nitrogen; several trace elements.
- Manure – usually 1-1-1.

Manures are best used as soil conditioners instead of nutrient suppliers. Most gardeners prefer to use composted forms of manure to ensure a lesser amount of salts, thereby reducing the chance of burning plants. Manure can be a source of weed seed.

In general, organic fertilizers release nutrients over a fairly long period; the potential drawback is that they may not release enough of their principal nutrient at a time to give the plant what it needs for growth. Because organic fertilizers depend on soil organisms to break them down to release nutrients, most of them are effective only when soil is moist and soil temperature is warm enough for the soil organisms to be active.

Compared to synthetic fertilizer formulations, organic fertilizers contain relatively low concentrations of actual nutrients but they perform other important functions that the synthetic formulations do not. Some of these functions include: increasing organic content of the soil; improving physical structure of the soil; increasing bacterial and fungal activity, particularly the mycorrhizae fungus which alone makes other nutrients more available to plants.

Segment Four – Fertilizer Analysis and Formulas

Fertilizer Analysis

Since you will be handling many types of fertilizers, it will be important that you have knowledge of the ingredients in the various mixes. Each fertilizer container, whether bottle, bag, or box must have a label showing the percentage of available N-P-K in the fertilizer mix as well as any other nutrient they may claim for the product. The letters N-

P-K refer to the primary nutrients nitrogen, phosphorus and potassium and a fertilizer containing some of each of these primary nutrients is said to be a complete fertilizer. The numbers expressing the percentages of N, P, and K are referred to as the analysis or fertilizer formula and the sequence is the same worldwide.

If the label on the 50 pound bag of fertilizer shows a formula of 10-20-10, it indicates the mix consists of 5 pounds (10%) of available nitrogen, 10 pounds (20%) of available phosphorus and 5 pounds (10%) of potassium, or potash as it is often called. The remaining 30 pounds consists of other chemical components making up the compounds furnishing these three primary nutrients plus a filler. The filler may be mineral such as fine clay or talc or it can be an organic material such as ground peanut hulls.

Fertilizer Formulations

Some of the formulations available to the homeowner include water soluble powders, slow release pellets, slow release collars or spikes, liquids, tablets, and granular solids. Plants can take up fertilizers continuously, so it is beneficial to provide them with a balance of nutrients throughout their growth period. Perhaps the most efficient way to achieve this is to apply a slow-release fertilizer, which is supposed to release nutrients at the same rate they are taken up by the plants.

Segment 5 - Fertilizer Application

Timing of Fertilizer Application

Soil type dictates the frequency of fertilizer application. Sandy soils require more frequent applications of nitrogen and other nutrients than clay soils. Other factors affecting frequency of application include the crop being grown, frequency and amount of irrigation, type of fertilizer applied, and the fertilizer release rate.

Proper use of nutrients can control plant growth rate and character. Nitrogen is the most critical nutrient in this regard. If tomatoes are fertilized heavily with a nitrogen fertilizer in the summer, the plants may be all vine, and no flowers and fruit. This is also the case with potatoes which will show excess vining and poor tuber formation.

After July 1, late fertilization of trees and shrubs can cause new flushes of growth to occur on woody plants that are normally adjusting themselves for the coming winter. The late season growth may not harden off completely and excessive winter damage may occur.

Application Methods

Nitrogen fertilizers do not burn or damage plants if they are applied correctly. Fertilizers are salts, much like our familiar table salt except that they contain various plant nutrients. When a fertilizer (salt) is applied to soil, nearby water begins to move very gradually towards the area where the fertilizer has been applied. Salts and the fertilizer begin to diffuse or move away from the place where they had been applied. This dilutes the fertilizer and distributes it through a much larger area. If tender plant roots are close to the placement of a fertilizer, water is drawn from these roots, as well as surrounding soil. The more salt or fertilizer applied, the more water is drawn from nearby roots. As water is drawn from the roots, plant cells begin to dehydrate and collapse and the plant roots burn or dehydrate to a point where they cannot recover. If soil moisture is limited, most of the water drawn towards the salt will come from plant roots and the damage will be severe. Two rules should be kept in mind when applying fertilizer during hot weather when soil moisture is limited: 1) do not over apply nitrogen fertilizers and 2) make sure adequate moisture is present after applying fertilizers high in salts.

There are different methods of applying fertilizer depending on the formulation and the crop needs.

Broadcasting: A recommended rate of fertilizer is spread over the growing area and left to filter into the soil or incorporated into the soil with a rototiller or spade. Incorporation of mulching after fertilizer application will reduce the potential for fertilizer runoff and is more environmentally sound. Broadcasting is used over large garden areas or when time or labor is a limitation.

Banding: Narrow bands of fertilizer are applied in furrows 2 to 3 inches from the garden seeds and 1 to 2 inches deeper than the seeds or plants that are to be planted. Careless placement of the fertilizer band too close to the seeds will burn the roots of the seedlings. The best technique is to stretch a string where the seed row is to be planted. With a corner of a hoe, dig a furrow 3 inches deep, 3 inches to one side of, and parallel with the string. Spread the fertilizer in the furrow and cover with soil. Repeat the banding operation on the other side of the string, and then sow seeds underneath the string.

Banding is one way to satisfy the need of many plants (especially tomatoes) for phosphorus as the first roots develop. When fertilizers are broadcast and worked into the soil, much of the phosphorus is locked up by the soil and is not immediately available to the plant. By concentrating the phosphorus in the band, the plant is given what it needs even though much of the phosphorus stays locked up.

Starter solutions: Another way to satisfy the need for phosphorus when setting out transplants of tomatoes, eggplants, peppers or cabbage is through the use of a liquid

fertilizer high in phosphorus as a starter solution. As with all fertilizers and other chemicals, follow the directions on the label.

Side Dressing: Dry fertilizer is applied as a side dressing after plants are up and growing. Scatter fertilizer on both sides of the row 6 to 8 inches from the plants. Rake it into the soil and water thoroughly.

Foliar Feeding: Used when insufficient fertilizer was used before planting, a quick growth response is wanted, micronutrients (such as iron or zinc) are locked into the soil, or when the soil is too cold for the plants to extract or use the fertilizer applied to the soil. Foliar applied nutrients are absorbed and used by the plant quite rapidly. Absorption begins within minutes after application and with most nutrients; it is completed within 1 to 2 days.

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