The Plant Doctor:
Plant Disease and Fertilization

Plants must have a proper growing medium for healthy growth. Most often the growing medium is soil. To support healthy plant growth, soil must have the moisture, structure, pH, mix of organic matter, and available nutrients to meet the plant's needs. A fertile soil is a well-blended mix of these. When any of these components is damaged or falls out of correct proportion, plant growth is affected. Most common problems result from imbalances in nutritional elements or improper pH.

Sixteen nutrients are essential to plant growth. They are designated as either macro or micronutrients, depending on the amount required for good plant growth. Three of the macronutrients, carbon, hydrogen, and oxygen, come from air and water. The other six, nitrogen, phosphorus, potassium, calcium, magnesium, and sulfur, come from the soil. Macronutrients are frequently called major elements because plants need lots of them.

Micronutrients, often called minor elements, include iron, manganese, zinc, copper, boron, molybdenum and chlorine. They come from the soil. Although plants need only small amounts of micronutrients, the micronutrients are as essential for plant growth as macronutrients.

A plant may also absorb nonessential minerals. Some of these may be toxic to it or to animals that may eat the plant.

The availability of many essential elements depends on soil pH. Lower-than- normal amounts of nutrients generally reduce growth and yield (flower or seed) of the plant. When the deficiency reaches a certain level, the plant develops acute (sudden) or chronic (over a period of time) symptoms. Deficient plants are susceptible to diseases.

Symptoms produced by deficiency of an element depend upon that element's role in plant growth. Usually, a deficiency produces several different symptoms. Some deficiencies produce similar symptoms; the combination of symptoms produced is unique but sometimes hard to notice. Many nutritional imbalances produce symptoms similar to those caused by pathogens, and the two problems are often confused.

The balance of a nutrient in relation to other nutrients influences disease development. Plants with balanced fertility are less susceptible to diseases, but plants with imbalanced nutrition may be predisposed to attacks by pathogenic organisms such as fungi or bacteria.

We know more about the influence of nitrogen on the development of diseases than we know about the influence of other elements. Too much nitrogen often causes more severe disease. For example, rice stem rot, verticillium and fusarium wilt of cotton and other plants, powdery mildew on small grains, cereal rusts, fire blight of apples and pears, and boll rot of cotton may be more damaging if you apply too much nitrogen. Susceptibility and incidence to grey mold and myrothecium incidence increase with increasing nitrogen in some greenhouse plants. On the other hand, Rust on perennial ryegrass is lower when plants are grown under high nitrogen fertilization.

It is not just the amount of nitrogen that is important; its form is also important, either nitrate or ammonium. One disease (foliar, wilts, or root rots) may be made worse by ammonium nitrogen, but another may be made worse by nitrate nitrogen.

Nitrogen levels should be balanced with potassium, since disease susceptibility generally increases with higher nitrogen-to-potassium ratios. Some diseases that are made worse by too much nitrogen may at least be partially reduced by increasing potassium. This is true in grey mold in tomato and in some bacterial stem rot. Likewise, Melting out, Leaf spot, Pythium blight, and Sclerotina dollar spot are greater under high nitrogen fertility. This effect can be offset for all but Sclerotina dollar spot by increasing phosphorus and potassium levels, bringing the fertility level more in balance.

As you can see, phosphorus and potassium fertilization must be kept in balance with nitrogen for the crop concerned. Deficient potassium levels play a major role in some diseases. Leaf lesion and root and crown rot caused by *Bipolaris* and Bermudagrass decline caused by *Gaeumannomyces* are worse in potassium deficient soils. Bermudagrass with a history of spring dead spot should be watched for potassium deficiencies so corrections can be made immediately. Adding phosphorus and potassium to the soil may even increase resistance to bacterial blight of cotton and cereal rusts.

Calcium enhances resistance to many diseases by hardening cell walls. Adequate calcium will increase resistance to bacterial blight in cotton and to bacterial spot on peaches and plums. Adequate calcium fertilization in wheat will reduce the amount of seedling blight from *Helminthosporium*. Calcium-deficient plants are more susceptible to infection by various pathogenic fungi such as Pythium blight and Fusarium blight. Calcium deficiencies, along with low or changing soil moisture, can cause blossom end rot of tomatoes and peppers.

Zinc deficiency is called Rosette on pecan trees and Little-leaf on peaches and apples. Boron can cause abnormalities of plants when in excess or when deficient. Boron deficiency can cause black heart disease in sugar beets. Turfgrass diseases are most influenced by calcium, nitrogen, potassium, and phosphorus. This is particularly true in sand-based greens.

Extremely alkaline soils may not be able to furnish one or more micronutrients. Iron, zinc, and manganese deficiencies often occur in alkaline soils. The severity of the condition will depend on the plant species and weather conditions. Iron chlorosis (yellowing) is a common nutritional problem in Mississippi. It is usually brought on by high soil pH. Plants afflicted with iron chlorosis often suffer from various leaf spot pathogens. Other diseases made worse by alkaline soils include soil pox or soil rot of sweet potatoes. Similarly, Irish potatoes will have no scab in soil with pH 5.2 or lower. Scab may become more prevalent as the pH increases. Adding acidifying material, such as sulfur, may help improve these conditions. On the other hand, Bermudagrass decline is worse in high pH rather than low pH.

Too much salt in the soil water may damage plants. The salts may concentrate from over fertilization or from chemical salts naturally occurring in the soil or water. The appearance of most plants grown in salty soils will be similar to plants grown on extremely dry soils. The plant will be stunted, leaves will be yellow, and they will often show dead tissue along the leaf margins and at the tips.

Soil organic matter furnishes nutrients for microorganisms and for the plant growth. Organic matter improves the water infiltration and retention in the soil, enabling it to retain water and air in desirable proportions. It may inhibit certain pathogenic organisms, but other pathogens may flourish. Disease will sometimes develop more where there is a lot of organic matter. Some diseases, such as verticillium wilt on cotton, thrive in wet soils that have had high applications of organic residues.

There is no general rule for using fertilizer to avoid plant diseases. You must consider each disease separately and manage fertility to fit the situation. The best practice is to assure enough of the nutrients and appropriate soil pH for the plant. You can know the correct adjustments to make by taking a soil sample and following the recommendations. Recommendations are based on many factors, including plant disease threats, and research is continuing to uncover more about specific fertilizer practices for disease control.

Some common symptoms of nutrient deficiencies in Mississippi

Nitrogen: Leaves are light green and lower leaves turn yellow or light brown. Stems may be thin and shortened.

Phosphorus: Leaves have a purple tint or are bluish green. Lower leaves may turn light brown. Stems may be thin and shortened.

Potassium: Thin stems, which may die-back in severe shortages. Older leaves may yellow, and the margins and tips may brown.

Calcium: New leaves are distorted with curled margins. They may have brown spotting.

Iron: Young leaves are yellow between the veins, but the veins remain dark green. Sometimes brown spots appear.

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