Understanding a Plant Tissue Analysis

TURF **TIPS**

A plant tissue analysis offers a precise measurement of the nutritional status of a plant at the time the sample was collected – a snapshot in time. This information allows a manager to determine if a specific nutrient is lacking, before a deficiency symptom becomes apparent. It also provides information on the relative health of the turf grass and interrelationships between all essential plant nutrients. When tissue testing is used in conjunction with a soil analysis, it can provide information on which nutrient levels are most critical, and how best to correct them. For example, if pH is at a critical level, a foliar application of an iron compound might be preferable to a soil application.

Because a tissue analysis is not predictive, collecting multiple samples throughout the growing season is recommended. This will allow the charting of plant nutrients, and can help you determine when a specific nutrient should be applied. At the very least, it can be used to better prepare a fertilizer plan for the next growing season. In the case of manganese for example, a soil analysis is a weak tool for evaluating actual needs. In this situation, if a tissue sample was tracked over the growing season as low, then the chances of getting a positive response to manganese next year will be high.

Keep in mind that a plant analysis can be only as good as the sample that is collected. In most situations, samples are taken from the clippings during regular mowing cycles. While this type of sampling will work, it is important that samples be devoid of fertilizer, lime and sand contamination. It is suggested to wait a minimum of two weeks after an actual application before samples are collected. For more specific information on how to collect an appropriate sample, please refer to the plant sampling instructions on the web, *www.agsourcelaboratories.com*.

On each report, a sufficiency range is printed for each essential nutrient. To interpret a tissue report, compare the result of a specific nutrient to the nutrient's sufficiency range. If the comparison is in the optimum or high range, then the uptake for that specific nutrient is in adequate supply (at that point in time). An illustration of this would be potassium levels for Bentgrass greens. The optimum range for potassium is 2.2 to 3.5 percent. If the value printed on your report is 3.7%, you would interpret potassium as adequate. For your convenience AgSource Laboratories provides a graphic display of how data compares to the optimum range.

Optimum Nutrient Ranges for Various Turf Grasses

	Bentgrass	Bermuda Grass	Bluegrass	Fescue Grass	Bahiagrass
Nitrogen %	4.0 – 5.0	2.5 – 3.5	4.0 – 4.5	3.4 – 4.5	1.5 – 2.5
Phosphorus %	0.3 – 0.6	0.2 – 0.5	0.3 – 0.5	0.3 – 0.5	0.2 – 0.5
Potassium %	2.2 – 3.5	1.0 – 3.0	2.5 – 3.5	2.6 – 4.0	1.0 – 3.0
Magnesium %	0.2 – 0.4	0.2 – 0.5	0.2 – 0.5	0.2 – 0.3	0.2 – 0.5
Calcium %	0.2 – 0.8	0.5 – 1.0	0.4 – 0.8	0.4 – 0.8	0.5 – 1.0
Sulfur %	0.2 – 1.0	0.2 – 0.5	0.2 – 0.4	0.2 – 0.4	0.2 – 0.5
Zinc ppm	20 – 70	20 – 125	40 – 60	40 – 60	20 – 125
Manganese ppm	25 – 100	25 – 100	30 – 200	30 – 200	25 – 100
Copper ppm	5 – 15	5 – 30	14 – 30	5 – 20	5 – 30
Iron ppm	30 – 300	20 – 250	50 – 300	50 – 300	20 – 250
Boron ppm	3 – 20	5 – 20	5-15	5-15	5 – 20

Mineral nutrients are classified as major, secondary and minor elements. This classification describes the relative amounts of each element present in plants. It is not intended to reflect its importance. No one essential nutrient is more or less important than any other. All essential elements are necessary for proper turf grass growth; major and secondary elements are just needed in greater quantities than minor elements.

Following is a list of essential elements and the special role each plays in plant nutrition.

Nitrogen is an essential part of all living matter. Compounds containing nitrogen make up about half of the substances in plant cells. It is the basis for amino acids, which combine to form proteins. Nitrogen is associated with vegetative growth and density of turf, as well as its deep green color. Nitrogen deficiency is noticed in turf that has turned a light green or yellow - the blades start dying at the tip until the entire leaf is necrotic. When deficiency occurs, it is first noticed on the older blades, since nitrogen is easily moved from the older to the newer growth.

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Phosphorus is the key nutrient in seedling development as it contributes so much to initial root and seed formation. It provides the plant with a mechanism for using and transforming energy. Phosphorus aids in the transformation of sugars and starches, as well as nutrient movement within the plant. Deficiency symptoms appear as dull green with a purple shade; leaf blades are narrower and have a tendency to roll. The reddish tinge or purple color is an indication that the plant has ample food supplies (sugars) but not enough energy to convert it into proteins. Phosphorus is mobile in tissue, so older blades are the first to be affected.

Potassium is required by the plant in relatively large quantities. Plant tissue may contain up to four to five percent. Its role is that of a regulator of plant processes because 46 enzymes require potassium to function properly. Contrary to some statements, it is not directly used in cell wall or plant strength development. A likely function is that it affects the shape of enzyme proteins, which has a direct effect on enzyme functionality. Some of the 46 enzymes affect carbohydrate form and storage, while others regulate the use of nitrogen in its role of reforming proteins. Potassium is a mobile nutrient; as a result, deficiency symptoms will appear first on older tissue; resulting in leaf tip burn and a gradual thinning of the turf stand. A light chlorosis (yellow color) may also be apparent.

Calcium is an important constituent of plant cell walls. It is the cement that binds the adjacent cells together, giving rigidity to the plant. It is also essential for root development and may serve to neutralize some toxic compounds present in the plant. Calcium is immobile in the plant, meaning that it is not transported from one plant part to another. As a result, deficiency symptoms will be detected in the newer leaf blades as deformed, chlorotic and eventually necrotic leaves. In addition, root growth and development are also affected. The end results are slow growth and patchy dead spots of turf.

Sulfur is an integral part of certain amino acids, proteins and chlorophyll. As both nitrogen and sulfur are associated with chlorophyll, deficiency symptoms resemble each other. The difference is that sulfur will not produce the firing of the leaf tip back to the leaf collar. Instead, because sulfur is immobile, younger leaves will exhibit a light-green color, eventually turning brown and curling up. Deficiencies are almost always associated with soils low in organic matter.

Zinc is used primarily as a catalyst for oxidation processes in cells and for the utilization of carbohydrates. These processes regulate energy production of chlorophyll, formation of auxin (growth hormone) and promote the absorption of water. Zinc is a non-mobile compound, so deficiency symptoms will appear in new leaf blades, first as chlorosis, eventually progressing to necrosis. Because zinc is involved with growth hormones, deficient plants may exhibit a rosetting effect on new tissue.

Magnesium is an integral part of the chlorophyll molecule, which means it is essential for the process of photosynthesis. It also serves as a catalyst for several enzyme reactions essential for the phosphorus energy transfer. Magnesium is mobile in plant tissue; deficiencies will develop in the older tissue and move to the young immature leaves. Because chlorophyll is affected, symptoms will begin as pale green leaves and advance to interveinal chlorosis from the edge to center of the leaf.

Manganese, as with most of the micro-nutrients, is mainly used as a catalyst (it is needed to activate a chemical process). Its use is in the oxidation of carbohydrates into carbon dioxide and water (plant respiration). Other enzymatic processes affected include the metabolism of nutrients and synthesis of chlorophyll. Manganese is immobile; deficiency will first appear in the youngest leaves. Deficiency symptoms appear as graying blotches near the base of the leaf blade, progressing to a yellow, and then to a bright yellow-orange color.

Copper increases oxidase activity to influence metabolic reactions, including the formation of iron porphyrin, needed for chlorophyll. Essentially, it is needed for the formation of chlorophyll, but is not part of the chlorophyll molecule. Severe deficiencies for copper are extremely rare, but will appear as yellowing of the youngest leaf blades.

Iron also acts as a catalyst, and is essential for the formation of the chlorophyll molecule. In addition, it is an activating element in enzymes known as coenzymes. This coenzyme is used as an oxygen carrier for plant respiration. Iron is mainly immobile, so chlorotic mottling will appear on the youngest leaf tissue.

Boron's function in plant development is not fully understood, but is recognized to be involved with protein metabolism, water regulation, and the plant's energy producing mechanism (ATP). In addition, it is essential for proper development of apical growing points (active cell division). Deficiency symptoms are varied, but are usually described as stunted and misshaped/distorted plants. Symptoms also include leaf tip dieback and necrosis of the entire leaf.