UF IFAS Extension UNIVERSITY of FLORIDA

SL181-B

Tissue Testing and Interpretation for Florida Turfgrasses[1]

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Tissue analysis offers a precise estimate of a plant's nutritional status at the time of sampling. Nutrient deficiencies can be detected with tissue analysis before visual symptoms appear. Tissue analysis may provide information on the relative health of a plant and the relationships between essential macro- and micronutrients. Historical logs of tissue composition can be used to precisely calibrate a turfgrass fertilization program for optimum plant health and minimization of environmental impact. Tissue analysis, along with the visual appearance, can be used to diagnose deficiencies and improve the effectiveness of the fertilization program, especially for some micronutrients.

Tissue Sampling

Turfgrass clippings can be collected for tissue analysis during regular mowing. Clippings must be void of sand and fertilizer contamination. Clippings should not be collected immediately following fertilization, liming, top-dressing, pesticide application, or any other cultural practices that contaminate the tissue sample. Collect tissue samples from an area that is free of weed or disease infestation. Place about a handful of well-mixed clippings in a paper bag. Do not use a plastic bag because, due to the lack of aeration, the tissue may begin to ferment prior to drying.

If drying facilities are available, place the collected clippings in a drying oven set at 70°C (158°F) for 24 hours and then mail to an analytical laboratory of your choice. The UF/IFAS Extension Soil Testing Laboratory does not analyze bulk turfgrass tissue samples. If you do not have drying facilities, ship them, preferably overnight, to an analytical laboratory.

Turfgrass containing micronutrient or pesticide residue should not be used for testing. Washing clippings in a dilute soap solution is sufficient to remove most surface contaminants (Carrow and Duncan 2012). Place clippings in a 1 quart jar, add 5 drops of soap, agitate for 30 seconds, remove tissue, wash with tap water, and lay out the tissue to dry (Mccrimmon 1994). Washing samples for longer may cause some nutrients to leach out of the tissue. If you rinse one collection of clippings and not all, the nutritional analyses may not be comparable because the concentration of some nutrients, such as potassium (K), is mobile, and a portion of the K may be removed during washing. Unwashed samples may appear to have a higher concentration than washed samples, and there may appear to be a deficiency in the washed samples when, in fact, an adequate supply of K exists.

Interpretation of Tissue Analysis

At least five unique methods are used to interpret turfgrass tissue nutrient values. Four of these methods (critical nutrient range, diagnosis and recommendation integration system, compositional nutrient diagnosis, and Macy's concept) use yield to determine if a nutrient concentration

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is sufficient. Because obtaining maximum turfgrass yield is often not desirable, the use of these interpretations is questionable. However, if yield is of primary importance, then any of these methods of determining sufficiency ranges is useful (Table 1). The fifth method, referred to as 'reference ranges,' provides the range of nutrients that exist within 95% of healthy turfgrass populations (Shaddox et al. 2017). This method may be considered applicable to most turfgrasses because it utilizes turf quality as the primary metric rather than yield. Nutrient reference ranges for numerous turfgrass species and cultivars are currently being developed by UF/IFAS turfgrass faculty and will be published on http://edis.ifas.ufl.edu once they are complete.

Sufficient tissue nitrogen concentration can vary from a low of 1.5 percent for centipedegrass to a high of 5 percent for bermudagrass (Table 1). The sufficiency tissue concentration of other macro- and micronutrients may vary greatly among the turfgrass species and cultivars. These values represent the range over which a particular nutrient might vary across the different turfgrass species. They represent sufficiency ranges—levels below the range may indicate a deficiency and levels above the range may represent excessive fertilization or toxicity.

The sufficiency ranges in the table show the most current interpretation for nutrient concentrations in turfgrass tissue. If analytical test results are in the deficiency range or below the sufficiency range, an increase in fertilization for that nutrient may be required. A soil pH and salinity test can assist in determining the rate of required fertilization (see http://edis.ifas.ufl.edu/ss317). Alternatively, if tissue test results are above the sufficiency range, the fertilization program should be adjusted downward. If a change in fertilization is indicated, the adjustment should be reasonable. The intent is to find the correct nutrient management level that maintains turfgrass tissue nutrient concentrations within the optimum range and does not lead to over fertilization and possible adverse environmental and economic results.

Summary

If maximizing turfgrass yield is the objective, then turfgrass tissue analysis can be used to efficiently diagnose nutrient deficiencies and better manage nutrient applications. Until nutrient reference ranges are produced, the most reasonable option is to use current nutrient interpretations.

References

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Carrow, R.N. and R.R. Duncan. 2012. *Best management practices for saline and sodic turfgrass soils: assessment and reclamation.* CRC Press, Boca Raton.

Mccrimmon, J.N. 1994. "Comparison of washed and unwashed plant-tissue samples utilized to monitor the nutrient status of creeping bentgrass putting greens." *Commun. Soil. Sci. Plant Anal.* 25: 967–988. doi:Doi 10.1080/00103629409369092.

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Table 1. Nutrient ranges for warm-season turfgrass species.*

	Bermudagrass	Centipedegrass	Seashore Paspalum	St. Augustinegrass	Zoysiagrass
	---------- % ----------				
N	2.30–5.00	1.5–2.9	2.80–3.50	1.90–3.00	2.04–2.36
P	0.15–0.50	0.18–0.26	0.30–0.60	0.20–0.50	0.19–0.22
K	1.00–4.00	1.12–2.50	2.00–4.00	2.50–4.00	1.05–1.27
Ca	0.35–1.00	0.50–1.15	0.25–1.50	0.30–0.50	0.44–0.56
Mg	0.13–0.50	0.12–0.21	0.25–0.60	0.15–0.25	0.13–0.15
S	0.15–0.50	0.20–0.38	0.20–0.60	0.18–0.33	0.32–0.37
	---------- ppm ----------				
Fe	50–500	102–221	50–500	50–300	188–318
Mn	25–300	35–75	50–300	40–250	25–34
Zn	20–250	17–40	20–250	20–100	36–55
Cu	5–50	2–7	5–50	10–20	2–4
B	6–30	5–10	5–60	5–10	6–11
Mo	0.10–1.20	0.14–0.30	0.5–1.0	0.15–0.5	0.12–0.30

*Bryson et al. (2014)