Landscape soil tests – getting the right tests and interpreting them correctly

Increasingly we recognize the important of soil testing before prescribing use of fertilizers, but all soil tests are not created equally: agricultural soil metrics are not appropriate for use in landscapes. Moreover, we can correlate relevant soil test data with careful site observations to learn more about what constitutes sustainable levels of organic matter and nutrient levels. Learning how to interpret soil tests by ground-truthing with site conditions allows arborists and landscape managers to understand how rhizospheres are currently functioning and what, if anything, should be added.

Overview of seminar

- Plant-soil systems, goals, and appropriate management
- Soil testing methods and criteria
- Interpreting results
- Ground-truthing
- Landscape management advice for clients

Plant-soil systems, goals, and appropriate management

Comparative criteria	Intensive annual agriculture	Home vegetable garden	Ornamental landscape
Plant life cycle	Annuals	Annuals/perennials	Woody plants/perennials
Planting scheme	Monoculture	Polyculture	Permanent landscape
Biomass removal	High	Moderate	Low
Soil disturbance	High	Moderate	Low
Nutrient inputs	High	Moderate	Low
Disease pressure	High	Moderate	Low
Pest pressure	High	Moderate	Low
Biodiversity	Low	Moderate	High
System goal	Maximize yield	Crops for personal use	Sustainability

Soil testing methods and criteria

- **Test a standard for your area (i.e., natural conditions) in addition to site of interest**
- DYI tests
  - Texture (https://youtu.be/0tRQUPDRiDU)
    - Sandy soils – little nutrient retention, high oxygen levels and rapid drainage
    - Silty soils – little nutrient retention, lower oxygen levels and slower drainage
    - Clay soils – high nutrient retention, lowest oxygen levels and slowest drainage
  - Compaction – requires simple lab equipment (Chalker-Scott, 2009)
  - Drainage – conduct a percolation test (Chalker-Scott, 2009)
- Lab tests
  - Choose a lab that has a demonstrated capacity to address nonagricultural soils (.edu and .gov)
  - Soil sampling
    - Methods – collect several samples, pool, mix, and sample
    - Frequency – baseline is critical; frequency depends on test results
  - Tests to request in addition to standard nutrients
    - Organic matter (required)
    - Heavy metals (if contamination is a concern)
    - Soluble salts (if saline soils are a concern – e.g., deicing salts, arid conditions)

Interpreting lab results – compare natural vs. managed landscape

- Lab information that requires action – **compare to standard**
  - Excessive levels of nutrients can be toxic – identify source(s)
  - Soil OM – highly variable, important to understand and correlate with nutrient levels
  - CEC if lower than 5 meq/100 g; over 15 is common in rich OM soils; Ca, Mg, K, H, Al
  - Non-essential heavy metals – may guide safety recommendations for managing soils
  - Soluble salts – where deicers are used and in naturally arid regions
- Lab information that requires no action - **compare to standard**
  - pH – it is what it is; do NOT attempt to change it
  - Low to optimal levels of nutrients (verify any actions with ground truthing [below])
  - Base saturation – "ideal" base saturation is a myth
  - Generic fertilizer recommendations – these are not made with sustainability as a goal
  - Humus/humic acid levels – these are lab artifacts and don't exist in nature
- Common problems
  - Excessive levels of macronutrients, especially P, Mg, Ca, K
  - Excessive OM relative to what's normal in standard area soils, particularly when nutrients are in toxic ranges

Ground-truthing

- Consider confounding factors that interfere with normal soil function and restrict air and water movement
  - Layered soils (e.g., landscape fill used as "topsoil") – creates perched water table
  - Amended soils – creates textural barriers
  - Drainage "improvements" (e.g., French drains) – creates perched water table
  - Compaction
  - Use of any sheet mulch (newspaper, cardboard, landscape fabric, plastic)
- Evidence of deficiencies - **compare to standard**
  - Foliar symptoms for most or all plants, not just one or two trees
  - Check test results for nutrient toxicities, especially P

Landscape management advice for clients

- Data-based landscape management
  - Have at least one soil test to determine baseline nutrient levels and %OM
  - Select plants that will tolerate site soil type and conditions
  - Roots need nutrients, water, and **oxygen**. Avoid anything that reduces availability of these factors
- Soil amendment
  - You cannot change the character of your soil with amendments but you will create problems
  - Amendments create textural discontinuities that reduce water, oxygen, and root movement
  - Layered soils will create perched water tables
- Nutrient sources
  - Do not add fertilizers or rich organic matter unless you have confirmed nutrient deficiencies
  - If tests indicate nutrient toxicities, do not add compost or other rich organic matter
  - If specific nutrients are needed, only add those nutrients to the soil surface and cover with arborist wood chips
- Mulching
  - No sheet mulches should ever be used on landscape soils

- Arborist wood chip mulches (maintained at a depth of at least 4") are superior landscape mulches
  - Provide a sustainable level of nutrient availability and prevent nutrient leaching
  - Build soil organic matter slowly and sustainably
  - Improve water and oxygen movement in soil
  - Reduce evaporation
  - Prevent soil erosion and compaction
  - Enhance beneficial microbes, especially mycorrhizae
  - Reduce weeds

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