Preparing soils for a hot, dry year

Overview of seminar

- Garden and landscape soil basics
  - Comparative plant-soil systems
  - Soil testing and interpreting results
  - Interference with soil function
- Pitfalls of amending soils
- Mulch types
- Mulch problems
- Garden management using coarse arborist wood chips

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 and interpretation

- Lab tests – only use a government or university lab that has expertise with garden and landscape soils
- 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

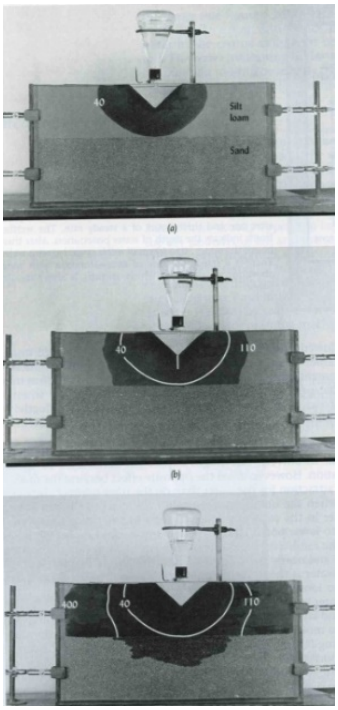
Interpreting lab results – compare natural vs. managed landscape

- Lab information that requires action
  - Excessive levels of nutrients can be toxic – identify source(s)
  - Soil OM – highly variable, important to understand and correlate with nutrient levels

- Lab information that requires no action
  - pH – it is what it is; do NOT attempt to change it except in limited volume areas
  - Low to optimal levels of nutrients (verify any actions with ground truthing [below])
  - Generic fertilizer recommendations – these are not made with sustainability as a goal
- 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 – eliminates pore space
  - Use of any sheet mulch (newspaper, cardboard, landscape fabric, plastic)

<u>Amending soils</u>

- Difference between amendment and mulching
- Incorrect system goal – annual crop production
- Results of amendment
  - Soil textural discontinuity
  - Hydrology disruption



Water enters fine-textured soil; vertical and horizontal movement both occur

Water contacts soil interface; vertical movement stops

Water enters coarse-textured soil only when gravitational pressure overcomes barrier

  - Soil subsidence
  - Nutrient overload

Mulches

Impacts of landscape mulches compared to bare urban soils

Characteristics	Living	Synthetic	Inorganic	Organic
Conserve soil moisture?	+/0/-	-	+	+
Reduce soil compaction and erosion?	+	+/0	+	+
Moderate soil temperature?	+	+/0/-	+/0/-	+
Provide nutrients?	+/-	-	0	+/0
Enhance plant growth?	+/0/-	0/-	+	+
Enhance beneficial soil organisms?	+	-	+	+
Control weeds?	+	-	+/-	+
Control insect pests?	+/0	0/-	+/0	+/0
Control disease?	+/0	0/-	+/0	+/0
Reduce pesticide use?	+	-	+/-	+
Relative cost?	$	$$ to $$$	$ to $$$	Free to $$
Availability?	N/LC	N/LC, HI	N/LC, HI	N/LC, HI, A/U/TS
Ease of replacement?	Moderate	Difficult	Easy	Easy

$ = low
$$ = moderate
$$$ = high

N/LC = nursery/landscape center
HI = home improvement store
A/U/TS = arborist/utilities/tree service

Acceptable mulches

- Living: Cover crops, ground covers
- Inorganic: Brick, decomposed granite, lava rock, stone pavers, tumbled glass
- Organic: Bark, coir, compost, leaves, nutshells, pine needles, straw, wood chips

Unacceptable mulches

- Synthetic mulches (geotextiles, plastic, rubber)
  - Not a permanent solution to weed control
  - Can damage health of landscape system
  - Sheet mulches reduce water and gas transport
  - Rubber mulches are flammable and may leach harmful chemicals
- Organic sheet mulches (cardboard, newspaper)
  - Can induce anaerobic conditions if used on wet, poorly drained soils
  - Will become hydrophobic if allowed to dry out
  - Can become pest havens for termites and rodents

Effectiveness of inorganic and organic mulches – numerous studies

- Weed control improves with mulch depth

- Permeability increases with mulch coarseness
- Greatest benefits and fewest drawbacks with deep, coarse mulches

Organic mulches can…

- provide a slow release of macro- and micro-nutrients
- improve soil structure by reducing compaction
- enhance establishment of trees and shrubs in low-maintenance landscapes
- enhance beneficial microbes and soil macrofauna biodiversity

Problems with fine-textured mulches

- Includes sawdust and compost
- Deep applications will lead to anaerobic soil conditions
- Often become compacted into impervious layers

Using compost as a mulch

- Use only if soil tests indicate generally low levels of nutrients
- If needed, use a thin layer of compost covered with an arborist wood chip mulch to prevent erosion and weed establishment (the “mulch sandwich”)

Arborist wood chips – the best choice

- Generated through chipping trees or parts of trees; they are NOT bark mulches (a poor choice)
- Many benefits, including unique ones
    - 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
- Ideal for weed control
    - Decrease nitrogen levels at mulch-soil interface
    - Reduce light needed by photodormant seeds
    - Reduce light availability to buried leaves and root crowns of weeds
    - Mulch depth is critical – when depths are less than 3” then weeds increase

Myths about arborist wood chips (AWC)

- “Wood chips leach nitrogen from the soil”
    - Wood chip mulches only affect nitrogen at the mulch-soil interface
    - Wood chip mulches do not cause nitrogen deficiency in soil beneath interface
    - High C:N ratio in wood chips prevents germination of weed seeds on interface
- “Wood chips made from diseased wood will infect plants”

Fungal pathogens and wood chips

- *Armillaria*, *Cytospora*, *Thyronectria* and *Verticillium* only survive on large pieces of wood
- There is a possibility of disease transfer if wood chips are incorporated into soil
- There is no evidence that pathogens in mulch can infect roots below the soil surface

Fungal communities in wood chips

- Fungal species in wood chips are generally decomposers, not pathogens
- In healthy (aerobic) soils, beneficial fungi out-compete pathogenic fungi
- Healthy plants are not susceptible to opportunistic pathogens

<u>Landscape and garden management advice for gardeners</u>

- 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
- Mulching
  - Do NOT place cardboard underneath AWC. No sheet mulches should ever be used
  - Begin AWC application before annual weeds are established (spring or fall)
  - Prune or mow perennial weeds at root crown; pulling destroys soil structure
  - Thick layers (6-8” for ornamental sites, 8-12” for restoration sites and aggressive weed control) of AWC are best for weed control and water conservation. Add more as needed to maintain 4” depth.

For more information:

Dr. Linda Chalker-Scott, WSU Professor and Extension Horticulturist
Email: lindacs@wsu.edu
URL: http://www.theinformedgardener.com (white papers on horticultural myths)
Blog: http//www.gardenprofessors.com
Books: http//www.sustainablelandscapesandgardens.com
Facebook page: http://www.facebook.com/TheGardenProfessors
Facebook group: https://www.facebook.com/groups/GardenProfessors/
Online Journal of the NACAA: https://www.nacaa.com/journal/index.php?search=Chalker&action=Search
Publications: https://www.researchgate.net/profile/Linda_Chalker-Scott/publications. This houses articles on many mulches, including arborist wood chips.
Washington State University Extension publications: http://gardening.wsu.edu/(peer-reviewed fact sheets on many topics of interest)/