Amending Desert Garden Soil

Feeding the Soil that Feeds your Plants
Feeding the Soil?

Feed the soil organic matter thereby feeding soil microorganisms, which then provide nutrients for plants.
Overview

- Soil basics: texture & structure
- Local desert soil characteristics
- Plant / soil nutrient cycle
- Organic material & soil biology
- Role of microorganisms
- Amending the soil that you have
- Drought proofing desert garden soil
Soil Formation

The breakdown of rocks by:

- Wind erosion
- Rain & water erosion
- Freezing & thawing
- Root penetration
- Biochemical activity

Lichen on rocks >
Function of Soil

• Physical anchor for plants

• Medium for root growth

• Reservoir for water & air

• Location for microorganisms, plant nutrients and carbon in the form of humus.
Soil Texture

Inorganic (mineral) components:

• **Sand** – largest particle
• **Silt** – smaller particle
• **Clay** – smallest particle
Ideal soil Components

AN IDEAL SOIL

Mineral 45%

Organic Matter 5%

Water 25%

Air 25%
Soil Structure

- How sand, silt & clay particles interact
- Particle aggregation
- Air & water spaces
- Organic matter
Soil Color

• Light colored soils get darker with the addition of organic material as it is transformed to *humus*.
Humus is the stable end product of organic material transformed by microorganisms.
What Soil Do You have?

• Soil shake > texture

• Laboratory soil test > organic matter, mineral nutrients, pH, sodium, carbon : nitrogen ratio

• Establish a baseline, then work with what you have.

• Keep notes on your soil endeavors.
What texture do you have?

Organic matter
Floats on top
Soil Organic Matter

Organic component in soil:

• Microorganisms
• Humus
• Root & plant residue
• Decomposing plant & animal litter
• Worms
• Insects
• Ideal amount: 2 – 10%
Life in the Soil

Soil Food Web:

- Animals – manure
- Plant & animal residues
- Insects
- Worms
- Beneficial microorganisms: bacteria, fungi
Organic Matter Composition in Soil

- Living organisms: <5%
- Fresh residue: <10%
- Stabilized organic matter (humus): 33% - 50%
- Decomposing organic matter (active fraction): 33% - 50%
Soil Structure

- Air: 25%
- Water: 25%
- Mineral Particles: 45%
- Organic Matter: 5%
  - Organisms: 10%
  - Roots: 10%
  - Humus: 80%
Natural Plant Nutrients Recycling

Photosynthesis

Nutrient Cycle

- Plant Growth
- Water and air penetrate soil
- Dead leaves (and other plant and animal matter)
- Minerals and other nutrients released into soil
- Decomposers break down organic matter
- Rocky subsoil

Respiration

Plant growth

Plant residues

Mineral nutrients

Photo by S. Marzoni
Nutrient exchange at the Root Zone by Microorganisms
Nutrient Exchange Sites at Root Zone: clay & humus particles

Diagrammatic scheme showing how root hair takes in nutrients from exchangeable ions on a clay crystal and on humus, and from soil.
Nutrient Binding & Release in the root zone

CEC: Cation Exchange Capacity
Beneficial Fungi in Root Zone
Mycorrhizal Fungi

• Transport nutrients to plant roots, eg. Phosphorus.

• Produce *glomalin* sticky substance that enhances soil particle aggregation.
Red Worms Make Humus in Soil
Natural Nutrient Recycling
Issues in the Desert

- **Climate:** intense sun, wind, low rain fall often lead to desiccation of organic material so that it decomposes slowly.

- **Answer:** organize organic material in a way that maintains moisture and air flow= Home Composting

- Add organic mulches on top of amended garden soil – straw, leaves, coffee, corn cobs, grass clippings, nut shells, wood shavings & chips, compost
Home Composting

• Recycles & transforms organic material to make humus.
Adding Compost to Desert Soil

- Allows for aggregation and *water retention* in sandy soil.
- Decreases compaction in heavy clay.
- Improves soil resilience from compaction.
- Provides dormant & living beneficial microorganisms & nutrition for them.
Adding Compost Cont.

- Improves soil structure by improving aggregation of particles – important for sandy soil.

- Adds, holds and releases plant nutrients. \( \text{N-P-K} = 1-1-1 \)

- Moderates soil erosion by improving water absorption.

- Helps buffer soil pH – toward neutral

- Moderates soil temperature
ABQ area soils: texture & structure issues

- Sand, silt, clay variations
- Caliche
- Sandy loam
- Clay loam
- Loam – equal parts: sand, silt & clay
ABQ area soils – Issues:

- pH – alkaline soil & water
- Salts
- Low soil organic matter - possibly
- Erosion
Soil pH

• Measure of the soil solution’s acidity & alkalinity.

• Influenced by both acid & base forming ions in soil.

• Desert soil: low precipitation = decreased leaching of base cations = high base saturation = alkalinity.
Soil pH

The pH scale ranges from 1 to 14, with 7 being neutral. Values below 7 are considered acidic, and values above 7 are considered alkaline.

- **1** to **3**: Increasingly acidic
- **4** to **6**: Neutral
- **7** to **11**: Increasingly alkaline
- **12** to **14**: Increasingly alkaline
Soil pH / Nutrients

pH 8: cations are tightly bound to soil not easily exchangeable
Iron Deficiency - Chlorosis

Veins remain Green

Mild chlorosis  Severe chlorosis / yellowing
Desert Soil pH - What to Do:

• Add organic material as a buffer moving pH toward neutral. Humus helps increase nutrient availability to plants.

• Choose appropriate plants for your soil’s pH

• Extreme cases may require elemental sulfur

• Cannot permanently change a soil’s pH
pH Amendments

- Added compost – moves pH toward neutral.
- Ironite: Iron is already in the soil.
- Sulphur: Sometimes useful. Soil test first.
- Chelated iron – soil & foliar
- Lime: no - alkaline
- Wood ash: no - alkaline
- Call Extension Office for assistance
Caliche – Hard Pan

Deposit of calcium carbonate
Caliche

• Restricts water drainage and root penetration.
• Avoid planting over it – if you can.
• Garden above it with raised beds.
• Penetrate with an augur.
Salts

- Naturally occurring

- Low precipitation so they are not leached downward then become concentrated near / surface

- May restrict water absorption by roots.

- Leach by deep soil irrigation.

- Salts are also in water.

- Manures contain salt: placement, moderation & dilution

- Chemical fertilizers are salts.

- Soil test for diagnosis
Salt “burn” on Leaf
Sandy Desert Soil

• Porosity- poor aggregation > increased drainage

• Alkaline – may restrict nutrient exchange

• Low SOM – low microorganism activity

• Compost – improves water absorption, reduces drainage, improves particle aggregation, buffers pH and improves soil life
Clay Desert Soil

• Sticky & easily compacts when wet and hardens as it dries – bricks & pots

• May hold water too long – smothers roots

• Good nutrient exchange capability

• Compost decreases compaction by improving particle aggregation in clay
Water Erosion of Desert Soil
Improving desert garden soil

• Keep a garden notebook.

• Be patient & persevere.

• Consider home composting.

• Amend with organic material regularly, then add mulch.

• Select appropriate plants for your soil.

• Till lightly, only as necessary.
Improving desert garden soil cont.

- Consider cover / green manure plants
- Rotate crops from season to season.
- Avoid garden soil compaction.
- Allow roots & plant residue to overwinter.
- Add composting worms.
- Maintain moisture in all seasons – mulch!
- Shade soil as necessary.
Trees & Shrubs

Amend the top soil not in the hole.

Native Soil – No Amendments

Girdled Roots > > >
Amending soil with Compost

Make holes with spade.

1 cu. ft. of compost will cover 140 sq. ft.
To a 1” depth.
Then add composting worms if you wish
Then water & add mulch over winter
MULCHING Preserves Soil Moisture

STRAW

LEAVES

NEEDLES
Organic Mulches

CARDBOARD & PAPER
Add Compost to a Hole
Green Manure / Cover Crops

Seaweed mulch is used to smother the cover crop. The bed on the right shows a ‘green manure’ cover crop before the mulch is applied.
Cover Crop add organic material to soil
Raised Garden Beds

• Override compacted / poor soil.

• Help avoid soil compaction.

• Provide easy access to plants.

• Eases management of soil & plants.

• Eases evaporation & water management.
Raised Beds

• Mulches well contained.
• Easy to provide shade.
• May be elevated – no bending over.
• Red worms may be added.
• Pre cut kits available.
Shading soil to decrease evaporation
Shading Soil to decrease Evaporation
Shading
Sheet mulching / composting

Sheet mulching is a method used to create a new garden bed by laying out layers of materials such as grass clippings, newspapers, cardboard, and compost. Water is then applied to the layers to help with the decomposition process. This method helps to retain moisture, suppress weeds, and add organic matter to the soil.
Sheet mulching / composting

Leaves

Manure

Newspaper
Olla clay pot irrigators
Clay Pot Irrigation
Drought Proofing Desert Soil

• Manage evaporation from sun, wind, high air temps.
• Amend the soil with organics - regularly
• Cover amendments with organic mulches.
• Shade the mulch and the soil.
• Water the soil under the mulch.
• Water appropriately.
Home Composting Workshop
March 28, 2015

Free Registration Required

Composting Workshop
Learn how to compost your food and yard waste, an easy and fun way to recycle and to build healthy soil in your yard and garden. The classes will cover the science, art, methods, choices, and benefits of various home composting methods.

Saturday, March 28, 2015
The classes are free and open to all.
You may register for one, two, or all three classes. Registration is required.

9:00 am to 12:00 pm
Home Composting Basics and Soil Amending

1:30 pm to 3:00 pm
Composting With Worms (Vermicomposting)

3:30 pm to 4:30 pm
Bucket Composting With the Bokashi Method

At Sandoval County Extension Service Classroom
811 Camino del Pueblo, Old County Courthouse, Bernalillo, NM
To register send email to register@nmcomposters.org or call 505-867-2582.

Presented by Bernalillo County Extension Master Composters in collaboration with Sandoval County Master Gardeners.

nmcomposters.org
sandovalmastergardeners.org
Questions & Discussion

WHERE FOOD BEGINS