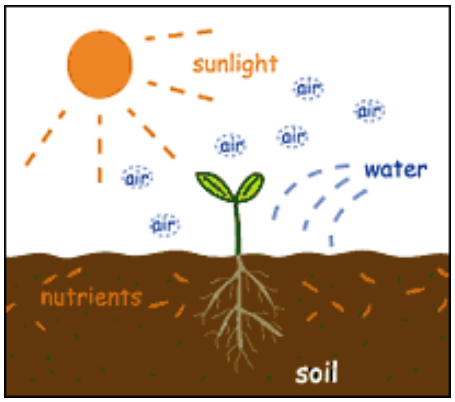
BASICS OF SOIL FERTILITY FOR URBAN (AND NON-URBAN) GROWERS

Erin Silva and Anne Pfeiffer
UW-Madison

PLANTS NEED…



SOILS: MORE THAN "JUST DIRT"

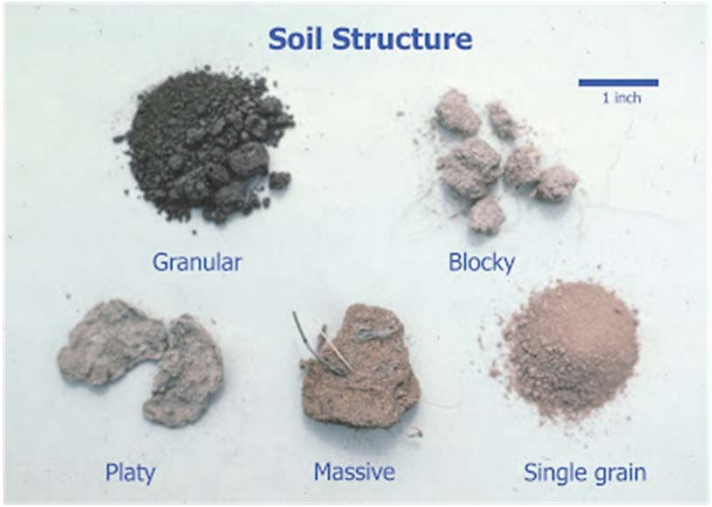
- Growing media for plants
  - Support
- Provide air and water to plants
- Supply nutrients
  - Plants need sufficient quantity but not too much
- Provide habitat for soil organisms

CHARACTERISTICS OF AN IDEAL SOIL

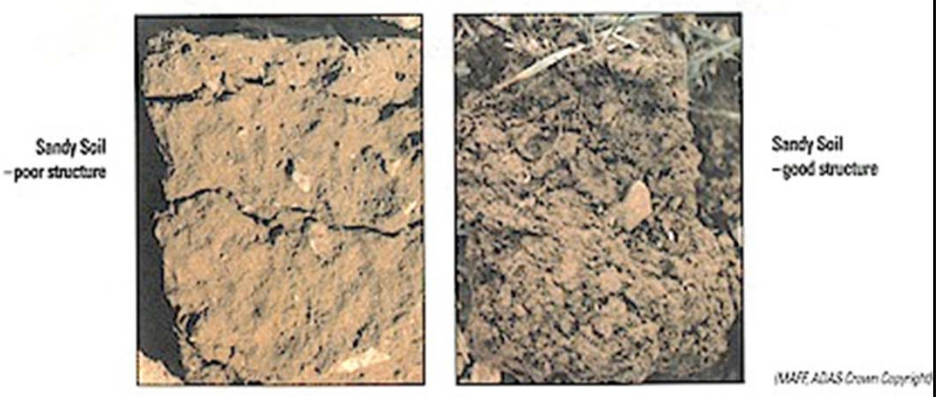
- What are characteristics of ideal soils?
  - Fertile
  - Deep
  - Well drained/aerated
  - High in organic matter
  - Friable
    - soil is easily worked

Role of Compost and Organic Matter

Compost and organic matter can help build soil structure



Benefit of Soil structure - tilth – root infiltration, water movement



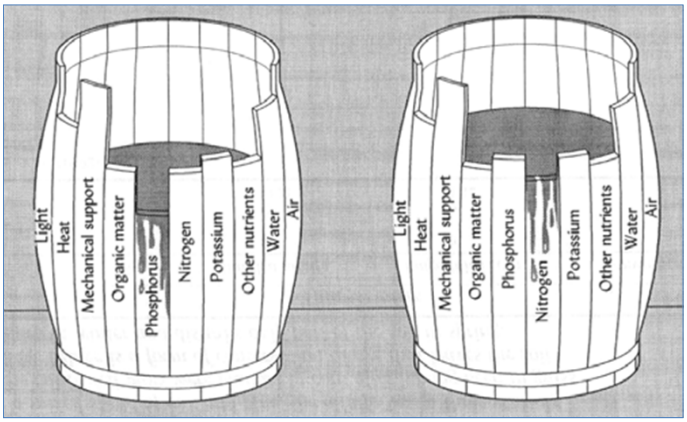
ESSENTIAL ELEMENTS FOR PLANT NUTRITION

- Required for the completion of the life cycle of the plant
- Depending on soil or field conditions, may need to be supplied by outside sources

16 Essential Elements

- C, H, and O are not considered minerals
- Macronutrients:
  - Primary macronutrients: N, P, and K
    - Needed in relatively large amounts
  - Secondary macronutrients: Ca, Mg, S
    - May be supplied in smaller quantities
- Micronutrients: Cl, Fe, B, Mn, Zn, Cu, Mo
  - Required in small amounts but still essential
  - Deficiencies lead to severe depression in growth, yield, and quality
- If any one is missing or low, plant productivity is limited

Elements Required in Plant Nutrition



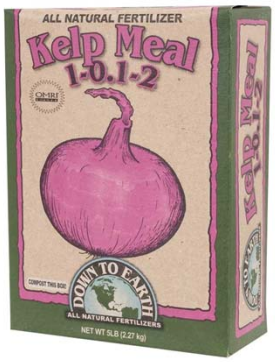
SUPPLYING FERTILITY

- Many organic options!

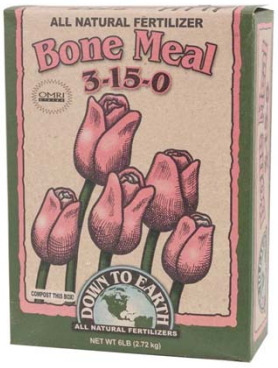
Guide to the Mineral Nutrient Value of Organic Materials Percent (%)				
Materials:	Nitrogen (%N)	Phosphorus (%P2O5)	Potassium (%K2O)	Relative Nutrient Availability
Bone Meal(raw)	2 to 6	15 to 27	0	Slow
Bone Meal(steamed)	0.7 to 4	10 to 34	0	Slow Med.
Cocoa Shell Meal	2.5	1	2.5	Slow
Compost(not fortified)	1.5 to 3.5	0.5 to 1	1 to 2	Slow
Cotton Seed Meal(dry)	6	2.5	1.7	Slow Med.
Dried Blood(dry)	12	1.5	0.57	Med. Rapid
Fish Meal(dry)	10	4	0	Slow
Manure(fresh)				
Cattle	0.25	0.15	0.25	Medium
Horse	0.3	0.15	0.5	Medium
Sheep	0.6	0.33	0.75	Medium
Swine	0.3	0.3	0.3	Medium
Poultry(50%water)	2	2	1	Med. Rapid
Mushroom Compost	.4 to.7	1	.5 to 1.5	Slow
Peat and Muck	1.5 to 3	.25 to .5	.5 to 1	Very Slow
Sawdust	4	2	4	Very Slow
Urea	42 to 5	0	0	Rapid
Wood Ashes*	0	1 to 2	3 to 7	Rapid
*** Wood ashes may raise pH**				
Cornell gardening resources A Guide to the Nutrient Value of Organic Materials, Ecogardening Factsheet #8, Spring 1993				

BLOOD MEAL - N

KELP MEAL - MICRONUTRIENTS



Bone Meal - P



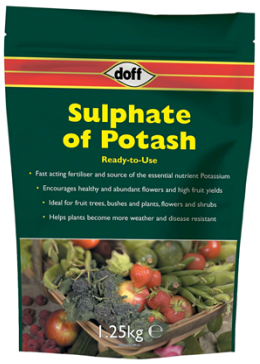
Seabird Guano - P

MIXTURE

SOYBEAN MEAL - N

LIQUID FISH

POTASSIUM



LEGUME COVER CROPS

- Supply N to subsequent crops
- Must be inoculated with appropriate Rhizobium bacteria

MORE ISN'T BETTER

- Too much of any nutrient can be negative
  - Poor fruit set
  - Run-off or leaching resulting in environmental pollution
  - Soil acidification through reaction with nitrogen
  - Salt burn

HOME COMPOSTING

WHAT IS COMPOST

- Stable humus (organic) material
- Produced when organic matter is broken down by bacteria and fungi
- Valuable soil amendment
- Pleasant smelling, "black gold"
- Nature's way of recycling!

WHY YOU SHOULD COMPOST

- Improves tilth of soil
- Protects and promotes health of your soil & plants
- May reduce need for fertilizers
- Saves you $$$ on soil amendments
- Keeps yard waste out of the landfill

WHAT SHOULD YOU COMPOST?

From your yard

- Leaves
- Grass clippings
- Weeds (pest and disease-free, no seeds)
- Trimmings and pulled annuals (see above)
- Small diameter twigs

WHAT MIGHT YOU COMPOST?

From your kitchen

- Eggshells
- Fruit and vegetable peelings
- Crushed crab or lobster shells
- Flower arrangements

WHAT YOU SHOULD NEVER COMPOST

- Noxious weeds (poison ivy, invasive plants…)
- Dog and cat feces, or cat litter
- Large diameter woody branches
- "Glossy" leaves

Also:

  - Insect-ridden plants
  - Plants that have gone to seed
  - Dairy products, meat, oils, or grease

OH, RATS!

- If you have a local "rodent problem", don't put food scraps in your compost at all
- There's no such thing as a rat-proof bin!

HOW DO YOU MAKE COMPOST?

To speed up the natural decomposition of organic matter, you can regulate:

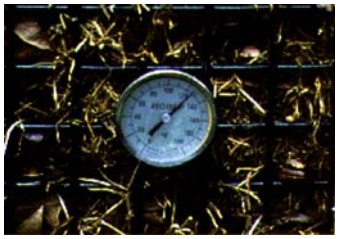
1. Moisture
2. Temperature
3. Air
4. Mix of ingredients

MOISTURE

- Water, in the right quantity, is needed for breakdown to occur
- Most sources describe the right moisture level as damp, like a wrung-out sponge
- Leave compost open to the rain
- Consider adding water, if necessary from

TEMPERATURE

- “Hot” piles are simply piles with high metabolic activity (= faster breakdown)
- “Cold” piles will do the job, just more slowly



To maintain a "hot" pile

- Pile must be > 27 cubic feet and < 125 cubic feet, a.k.a. a pile 3-5 feet high, wide and deep (ideal is approx. 4' x4' x4')
- For best results, shred materials to increase surface area for microbes to work
- Turn the pile – inside to outside – every two weeks or when the temp reaches 130-140 degrees

AIR

- Anaerobic conditions may result from
  - Tightly packed material, like grass clippings
  - Failure to turn pile
  - No coarse material
  - Pile in close contact with ground (hint: a wooden pallet is worth it's weight in compost!)
- Microbes cannot survive under anaerobic conditions

MIX OF INGREDIENTS

- To layer or not to layer…
- Greens and Browns, does it matter?
  - Greens are nitrogen-rich materials
    - Fresh grass clippings
    - Vegetable scraps
    - Fresh hay, weeds and plant waste
  - Browns are carbon-rich materials
    - Leaves
    - Sawdust (from untreated wood)
    - Wood chips
    - Straw

WHAT TYPE OF PILE?

TROUBLESHOOTING I

- My pile smells like ammonia
  - mix in dry browns
- My pile smells like rotten eggs
  - Aerate, add dry browns to pile if it is too wet
- My pile isn't heating up
  - Check for proper moisture content, air spaces, pile size, nitrogen (greens)
- My pile is TOO hot
  - Turn the pile

TROUBLESHOOTING II

- My pile is attracting rats
  - Don't add food scraps, or bury them deeply
- My pile isn't active at all
  - Check moisture throughout
  - Add nitrogen (grass clippings, coffee grounds…)
  - Shred material if possible

IS IT DONE YET???

- Proper composting takes time!
- Finished compost is earthy smelling, dark, and crumbly
- Finished compost will stay at or near the air temperature
- Expect hot piles to take several months; cold piles will take a year or more

USING YOUR COMPOST

- Flower and vegetable gardens
  - Mix 3 to 4 inches of compost through entire bed before planting
  - Top dress established plants with several inches compost
- Mulch
  - To eliminate weeds, protect soil, and keep roots moist
- Seeding new lawns
  - Till in 4 inches of compost
- Enriching established lawns
  - Rake an inch or so of compost over lawn in fall