Soil and Fertilizers 101

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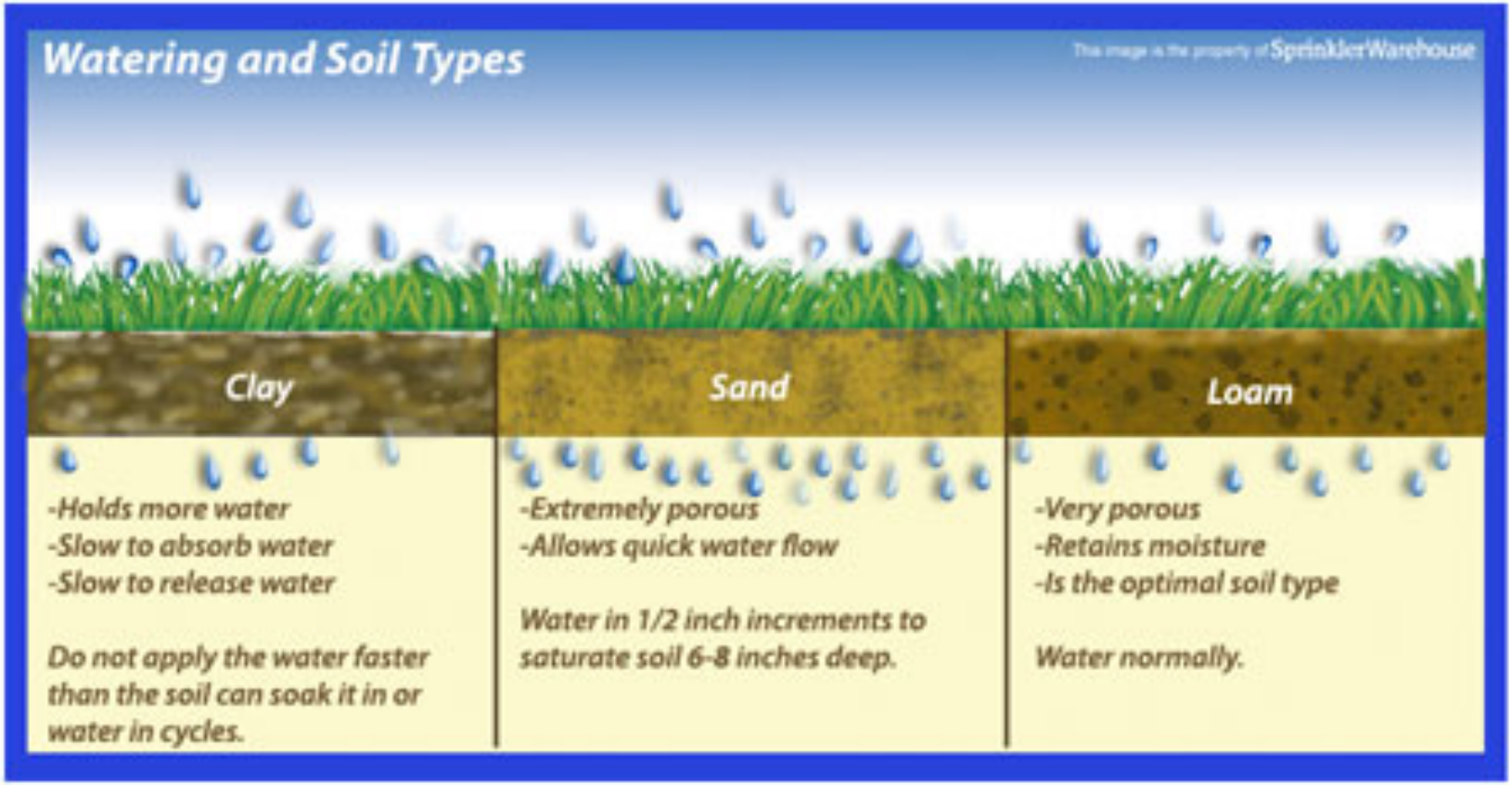
Soil and Fertilizers 101

- Agenda
  - What is Soil?
    - Types
    - Components
    - Structure/Texture
    - pH
  - Fertilizers
    - Ingredients
    - Fertilizer Math
    - When to fertilizer

Soil Types

- 3 Basic Soil Types
  - Clay
  - Sand
  - Loam
- Soil type determines watering

Watering


Watering and Soil Types
This image is the property of SprinklerWarehouse
Clay
Sand
Loam
-Holds more water
-Slow to absorb water
-Slow to release water
Do not apply the water faster than the soil can soak it in or water in cycles.
-Extremely porous
-Allows quick water flow
Water in 1/2 inch increments to saturate soil 6-8 inches deep.
-Very porous
-Retains moisture
-Is the optimal soil type
Water normally.

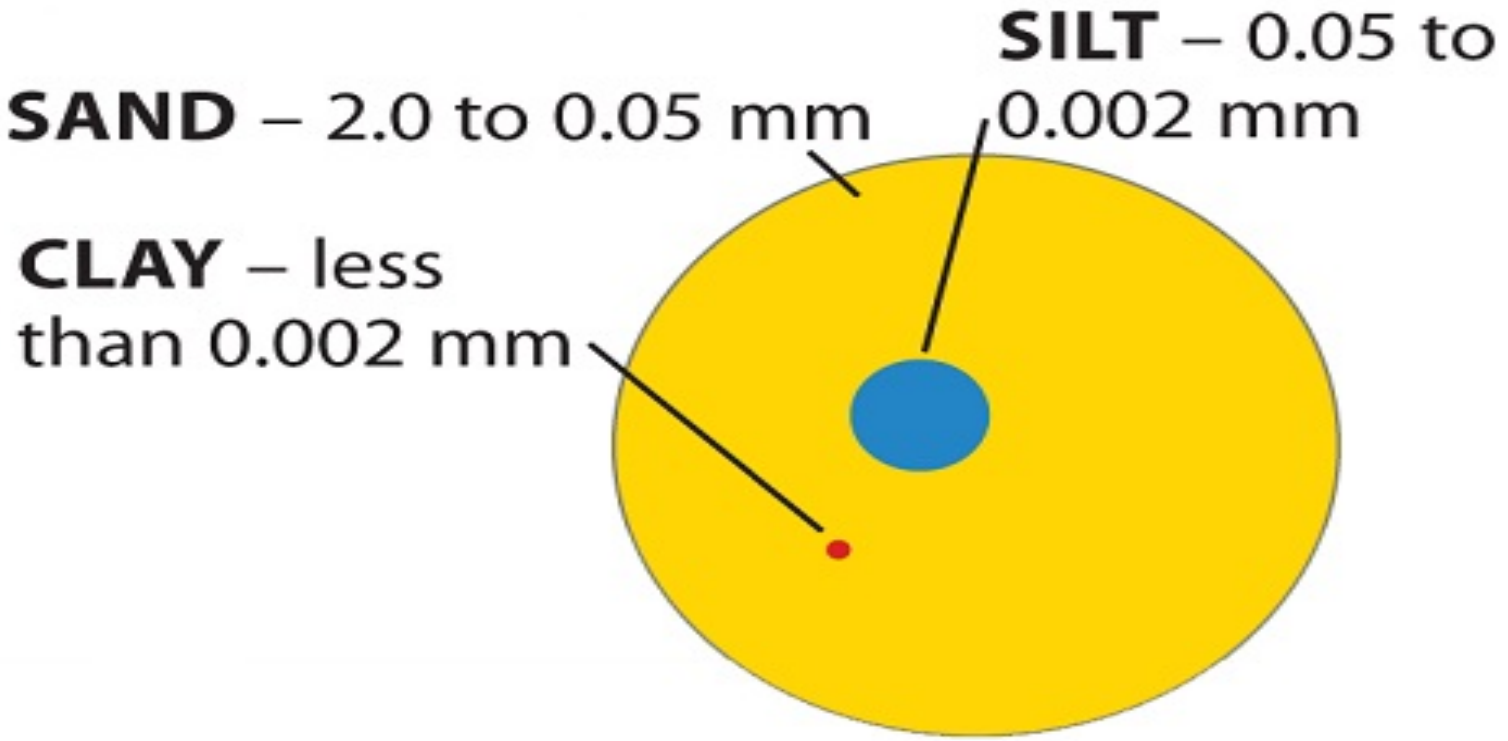
What is Soil?

- Soil is made up of varying ratios of components
  - Sand
  - Silt
  - Clay
  - Organic Matter
  - Air
    - Microorganism
- Percentage of each determines structure
- Composition of each components varies by sources

Importance of Soil Components

- Components of soil determine
  - Structure (texture)
  - pH (Acidity/Alkalinity)
  - Nutrients (Fertility)
  - Buffering Capacity (Resistance to change – Stability)

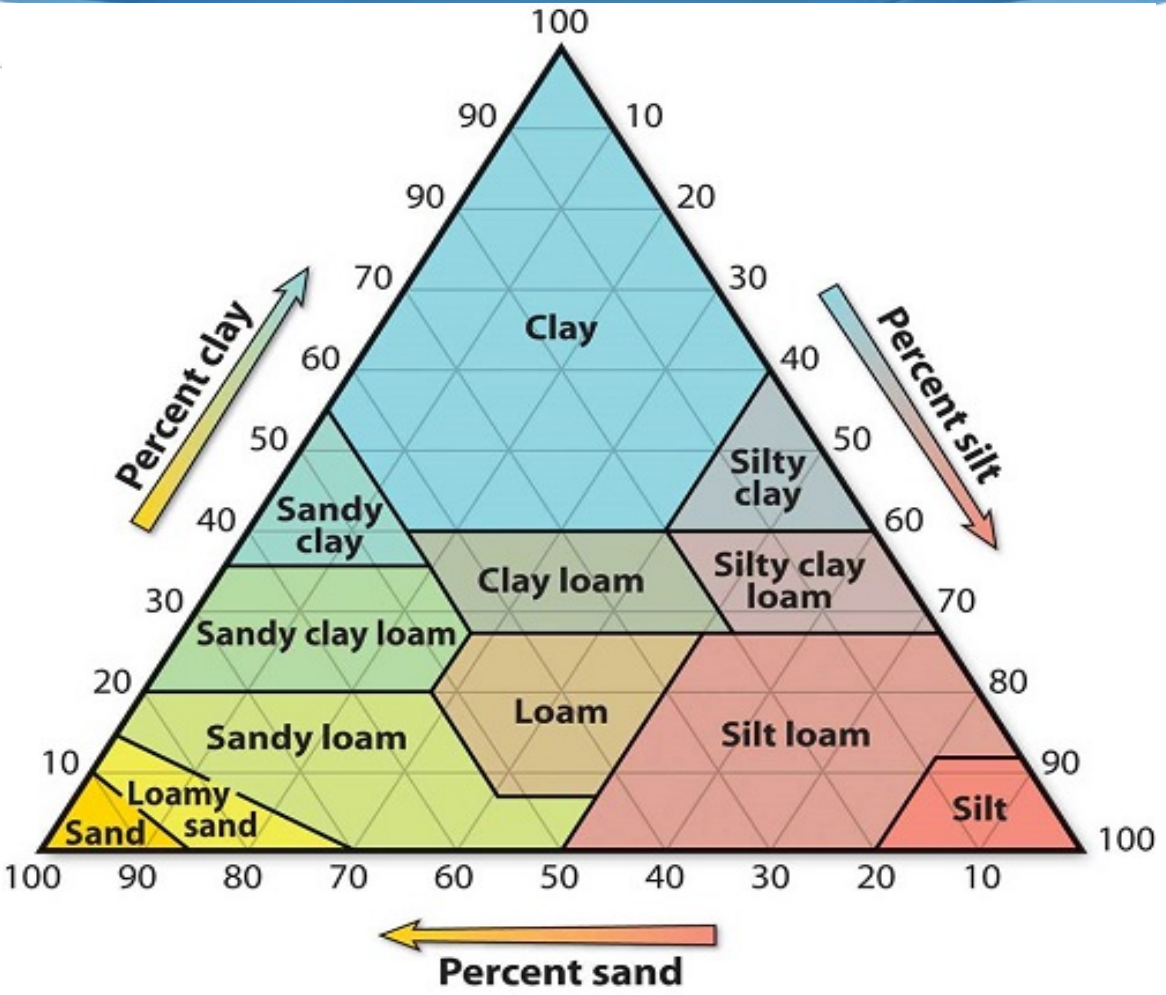
Relative Size of Soil Components



What is Structure?

- Structure/Texture is determined by how individual soil granules clump or bind together and aggregate
- Aggregates Influence
  - Arrangement of pore between granules
  - Flow of air and water and nutrients
  - Root space (easy of rose root penetration)

Texture Triangle

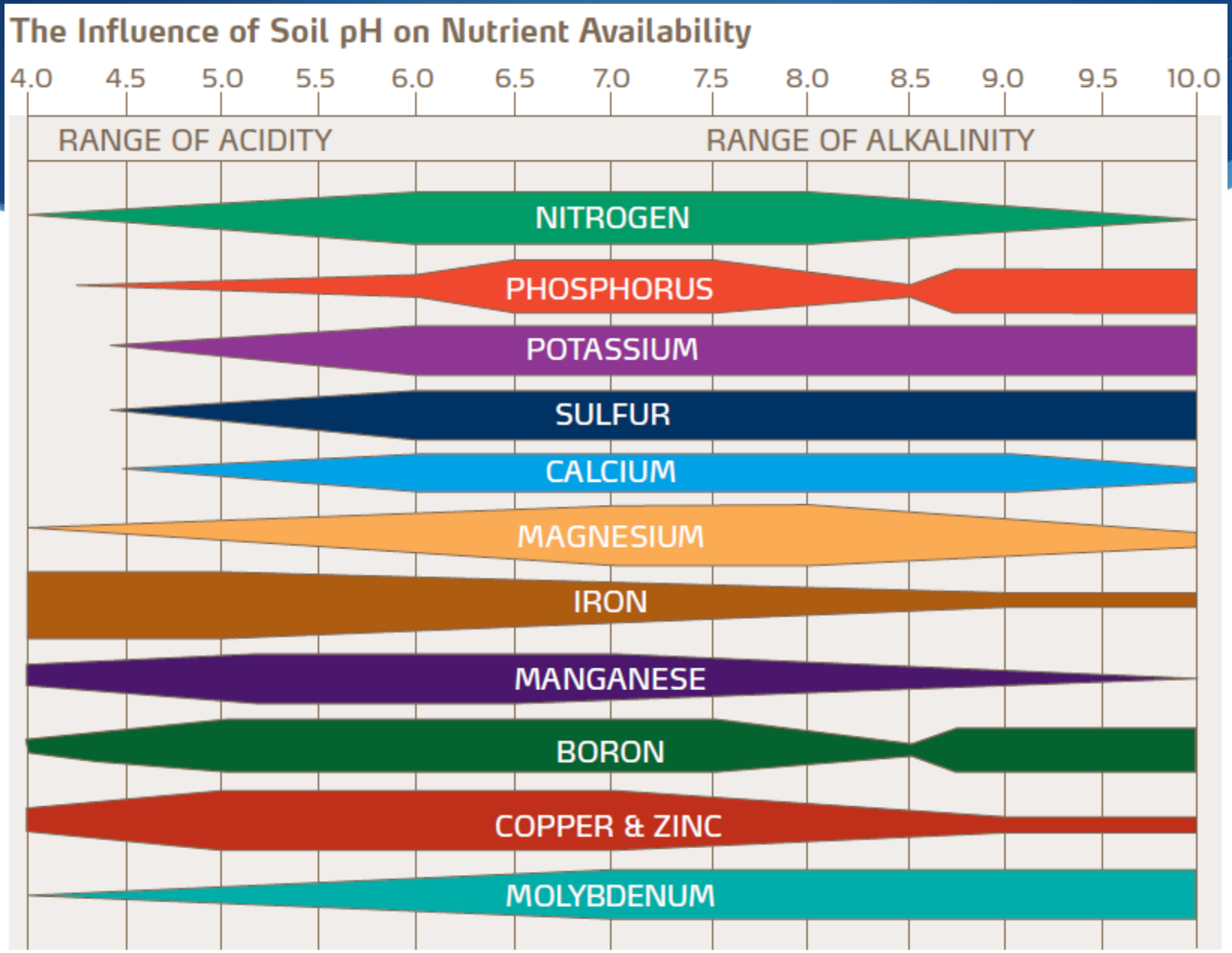


Microorganisms

- Microorganisms critical to soil fertility and plant growth
  - Fungi
  - Bacteria
    - Aid in nutrient uptake/exchange
- Excess use of pesticides will harm microorganisms
  - Do not spray insecticides and fungicides on soil

What is pH?

- Inverse log of 1 over the Hydrogen ion concentration
  - Relative acidity or alkalinity of a material
- Measured on scale of 0-14
  - pH 2 – lemon juice (Acid)
  - pH 7 – pure water (Neutral)
  - pH 11 – ammonia (Alkaline)
- Difference between steps is 10X
- Determines nutrient availability


The Influence of Soil pH on Nutrient Availability
4.0
4.5
5.0
5.5
6.0
6.5
7.0
7.5
8.0
8.5
9.0
9.5
10.0
RANGE OF ACIDITY
RANGE OF ALKALINITY
NITROGEN
PHOSPHORUS
POTASSIUM
SULFUR
CALCIUM
MAGNESIUM
IRON
MANGANESE
BORON
COPPER & ZINC
MOLYBDENUM

How to Change pH

- Changing pH is a slow process (make take several seasons)
- To raise pH
  - Add Lime
- To lower pH
  - Add organic matter
  - Add garden sulfur

Soil Test

- BEFORE MAKING ANY pH CHANGES

GET A SOIL TEST!

OR CONDUCT YOUR OWN TEST!

pH Meters

University of Minnesota Soil Testing Laboratory

LAWN, GARDEN AND LANDSCAPE
SOIL ANALYSIS REQUEST SHEET

Report No.

Send this information sheet with **ONE (1)** soil sample

MAIL SOIL TEST REPORT TO: | **OPTIONAL REFERENCE:**

Name _____

Address _____

City, State, Zip _____

Phone _____

Soil Location: County _____

Check for $ _____ enclosed

_____

_____

_____

_____

Please provide a name for this sample, consisting of no more than 4 numbers and/or letters.
Indicate this name on the sample container and record it here.

_____

The report you receive will use this name to identify your sample.

Fertilizer Recommendations Requested for: (check only one)

Lawn

- ☐ (101) Before seeding or sodding
- ☐ (102) Existing lawn

Gardens

- ☐ (110) Vegetable Garden
- ☐ (111) Flower Garden

Fruit

- ☐ (112) Tree Fruits
- ☐ (113) Small Fruits
- ☐ (114) Blueberries

Tree and Shrubs

- ☐ (115) Broadleaf
- ☐ (116) Evergreen
- ☐ (117) Azalea & Rhododendron

For Grass Only

Is grass watered regularly?

- ☐ Yes
- ☐ No

Are clippings removed?

- ☐ Yes
- ☐ No

Check Tests Requested

- ☐ **Regular Test,** $17.00 - includes total organic matter, phosphorus, potassium, pH - lime requirement, and estimated texture
- ☐ **Soluble salts**, $7 - testing for excessive salts
- ☐ **Lead test**, $16 - (separate sample required)

*Additional tests, primarily of interest to land care professionals

- ☐ Sulfur $7
- ☐ Nitrate $8
- ☐ Boron $7
- ☐ Calcium/Magnesium $7
- ☐ Iron, Zinc, Copper, and Manganese $12

Be advised - The Soil Testing Laboratory does not provide interpretation for trace element tests.

Test provided by the University of Minnesota Soil Testing Laboratory are intended to aid in evaluating the fertility status and chemical condition of your soil. Based on these test results and the type of plants to be grown, you will receive fertilizer recommendations calculated to provide adequate levels of phosphorus and potassium for healthy plant growth, without adversely affecting the environment.

Problems with plants may be caused by factors other than soil fertility, e.g., disease, insects, insufficient light, soil moisture or compaction, or climatic conditions. An evaluation of soil fertility and pH is an important *first step* in diagnosing problems. If soil fertility is not found to be a problem, the other factors affecting plant growth should be evaluated to determine possible causes. Your County Extension Educator or Master Gardener can help if you need more information to diagnose your problem.

Because nitrogen is extremely mobile in soils, nitrogen recommendations are based on plant requirements and soil organic matter levels as determined by the laboratory.

*Trace element tests are generally not recommended for lawn and garden samples. Research has shown that most soils in Minnesota contain adequate levels for plant growth. Trace element tests may be useful to some lane care professionals dealing with special problems.

See next page or reverse side of this form for soil sampling information and mailing instructions

HOW TO TAKE A SOIL SAMPLE

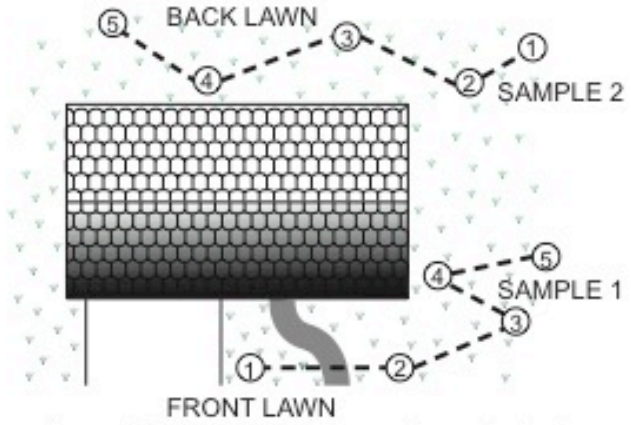
The quality of your results depends largely on the quality of your sample. To obtain a good soil sample, follow the directions below.

WHEN

Soil samples may be collected whenever soil conditions permit. When submitting your samples to the laboratory, check our website (**soiltest.cfans.umn.edu/**) for current turnaround times and more information.

WHERE

- If the area is fairly level and the soil appears to be uniform, collect one composite (mixed) sample.
- If your lawn or garden has large areas which differ in fertility, take one sample from each area. For example, you may want to sample the front lawn and the back lawn separately (see diagram).



- Do not combine soil from the lawn area and a garden in the same composite sample.
- Area of special concern (under trees, near buildings, trouble spots) should be represented by separate samples.

HOW

Use a garden trowel, spade, sampling tube or soil auger. **Scrape away or discard any surface mat of grass or litter.** Sample the lawn or garden area to the sampling depth indicated below.

1) existing grass - sample 0-3"
2) new grass - sample 0-6"
3) gardens - sample 0-6"

- Place the soil sample in a clean bucket or pan.
- Repeat sampling in several random locations within the chosen area. Mix soil well to make ONE composite sample for the entire area, and send or bring **2-3 CUPS** of the composite sample to the lab. Use a clean, leak-proof container (e.g. disposable food storage bag or tub) and place the container inside a sturdy mailer or shipping package. Please keep your paperwork outside of the soil container, but DO place the form(s) and payment inside the sealed mailer or shipping package.
- Label the sample container with your name, address and sample identification (**max = 4 characters**). Fill out the other side of this form completely, and *keep a record of your sample identification*.
- **Soluble salts test**: This test should be requested if:
  1) "black dirt" has been hauled in and poor growth is observed,
  2) there is possible damage from salt used on streets and sidewalks, **or** *excess application of fertilizer*,
  3) the grass looks burned even when adequate water is present,
  4) the soil is poorly drained and located in the south central or western part of the state.
- **Lead test**: Select only if lead contamination is suspected.

HOW TO SUBMIT SAMPLES

Soil samples may be delivered in person to Room 135 Crops Research Building, University of Minnesota (see map below), or mail to:

Soil Testing and Research Analytical Laboratory
University of Minnesota
135 Crops Research Building
1902 Dudley Avenue
St. Paul, MN 55108

Hours: Mon-Fri 8:00am - 4:30pm
Website: http://soiltest.cfans.umn.edu/
Phone: (612) 625-3101

Enclose form and full payment for each sample to be tested. You may send one check to cover the cost of multiple samples. Make checks payable to the University of Minnesota. **Do not send cash**. The University of Minnesota will not be responsible for cash sent through the mail. The sender pays postage.

Fertilizers

- What is a fertilizer?
  - A substance added to soil to increase fertility and thus increase or sustain plant growth and health.
- Main components of Fertilizers
  - N = Nitrogen (expressed as ammoniacal or urea nitrogen)
  - P = Phosphorus (expressed as P_2O_5)
  - K = Potassium (expressed as K_2O)

Minor Elements

- Calcium –Ca
  - Strengthens cell walls and promotes early growth
- Magnesium –Mg
  - Promotes Chlorophyll formation and disease resistance
- Sulfur – S
  - Raw material for amino acids thus protein formation

Micronutrients

- Zinc –stem growth and bud formation
- Iron – chlorophyll formation, sugar burning enzymes, aids nitrogen fixation
- Manganese – chlorophyll, enzymes, cellular respiration, nitrogen metabolism
- Copper – Enzyme activation, stem development, pigment formation
- Boron – aid sugars move from cell to cell, starch formation, cell division, flower formation and pollination

Micronutrients

- Molybdenum – nitrogen fixation and use in plant, required for amino acid production that stimulates growth and vigor
- Carbon, Hydrogen, Oxygen – carbohydrate production – plant life

Fertilizer Math

- Why is this important?
  - Apply proper amounts of N-P-K to garden
  - Basis is Soil test results
  - Can save you money
  - Avoids over fertilization
- Calculate N-P-K based on a fictional soil test

Fertilizer Math

- Data
  - Soil tests says apply 2 lb Nitrogen per 1000 sq ft.
  - Fertilizer bag reads 11-15-11
  - Fertilizer bag weighs 20 lb
- Question – How much of 20 lb bag to apply?

Fertilizer Math

- First Calculate Nitrogen
- Nitrogen is calculated as elemental nitrogen so:
- Multiply 11% N X 20 lb = 2.2 lb N
- 2 lb recommended /2.2 lb in bag =91% of bag – I would apply the entire bag.

Fertilizer Math

- Phosphorus is expressed as P_2O_5
- Same fertilizer 11-15-11 (20 lb Bag)
- Test recommends 3 lb Phosphorus applied to 1000 sq. ft.
- Must first determine % P in P_2O_5 – I will forgo this P = 43.7%
- So =15% X 20 lb = 3 lb of P_2O_5 per bag
- Now 3lb x .437 = 1.3 lb P per bag
- Therefore need 2.3 bags

Fertilizer Math

- K is expressed as K_2O
- As with Phosphorus must calculate % K = 83%
- Same fertilizer, 2.5 lb per 1000 Sq. Ft.
- So: 15% of 20 lb bag = 3 lb of K_2O
- 3 lb X .83 = 2.49lb – Use one bag

When to Fertilize?

- Soil temperature is above 50^{o}F
- After you have watered and roses have had time to absorb water
- First application at leaf bud break – May 1st
- Last application of Nitrogen fertilizer – August 15th.
- In between will depend on soil type and watering pattern

Tidbits

- One or two applications of an organic fertilizer
  - Fish Emulsion
  - Kelp Emulsion
  - Alfalfa meal/tea
  - MooPoo Tea
- I usually apply Alfalfa meal upon uncovering roses and again July 1st.
- Fish or Kelp Emulsion or Teas in Mid July

Further Information

- My Personal Rose related blog
  - www.northernrosarian.com
- Email addresses
  - maplerosedoc@gmail.com
  - jim@northernrosarian.com
- Minnesotarosesociety.org
- Minnesotarosesociety.org/blog

QUESTIONS