Basic Factors Affecting Plant Health at GCG

Soil Nutrition

The native soil at the Golden Community Garden was tested by the CSU Soil Testing Lab. They made the following recommendations to meet the basic needs of growing garden plants:

Available Nitrogen - Low
Add 2.5# of available Nitrogen per 1000 sq ft. each growing season. This is equivalent to 0.25 pounds for a 100 sq ft garden plot and 0.50 pounds for a 200 sq ft garden plot.

Soil Organic Matter - Low
Build soil organic matter to the recommended 3-5% that will support healthy plant growth.

The good news is that after three years of amending the soil and growing plants (plants add organic matter to the soil), we think that all of our plots meet or exceed.

pH – 8.0 – Alkaline. This is typical of Colorado and is higher than most plants would like. No action recommended except don't do anything that will further increase pH.

Other nutrients – adequate to support healthy plant growth.

Soil Moisture

Progress has been made on drainage with more to follow. However many plots still experience periods of soil saturation. When the soil is saturated, and there is free water, plant root systems can suffer damage. This condition is sometimes referred to as "wet feet". There are two major factors contributing to soil saturation at GCG.

Proximity to the native hard pan

Many plots have been elevated but some surfaces still remain in too close a proximity to the native hard pan level to allow for at least 1 foot of unsaturated root zone. We recommend that gardeners continue to add to the surfaces of their plots in areas where soil saturation is common until they have at least 1 foot of unsaturated root zone in which their plants can thrive. The Garden leadership plans to offer assistance in this area in 2012.

Over irrigation in impacted areas.

Working in concert with the native hard pan as well as plot elevations that are too low, over irrigation contributes to the condition of wet feet. Even if you are not over irrigating, excess water can move laterally for quite some distance along the surface of

the hard pan. Water then can wick up somewhat into the root zones of neighboring plots, and affect plantings in areas where the un-compacted soil is not deep enough.

Some timers were set to as much 40 minutes twice per day last year. Our irrigation specialist commented that no more than 8-10 minutes once or twice per day were required to supply adequate water for healthy plant growth at GCG.

In addition to wet feet, over irrigation can wash away valuable nutrients, especially Nitrogen. When these nutrients are washed away they typically end up being environmental pollutants rather than helpful plant nutrients.

Required Nutrients Basics

Nitrogen (N)

Most likely to need to be added regularly because it is quickly depleted by plants and microorganisms, and can also move away with draining water supplied through rain or over irrigation.

Phosphorus (P) and Potassium (K)

Along with N, these make up the so called Macronutrients, referred to as NPK. Macronutrients are so named because these are the elements that plants need the most of.

P and K are more fixed in the soil, and are pretty much only depleted by plants, so they are less likely to need amendment on a regular basis.

All commercial macronutrient fertilizers, whether organic or not, have three numbers on the label representing the percentage N-P-K contained therein. For example 20-10-10 means the fertilizer has 20%N by weight, 10%P by weight, and 10%K by weight.

These numbers help to calculate how much fertilizer to add to reach a fertility goal. We will discuss this in more detail below in the fertilizer calculator section.

Calcium (Ca) and Magnesium (Mg)

These macronutrients are less frequently required than N-P-K and are usually only needed for soils low in pH (acid soils). These nutrients are applied in the form of Limestone.

Iron (Fe), Zinc (Zn), Copper (Cu), and Manganese (Mn)

These are called micronutrients because plants only use a little of each. These are also fixed in the soil and are usually only added or applied to plants when they show symptoms of micronutrient deficiency.

High pH, also called alkalinity, can reduce plant uptake of the micronutrients. In Colorado it is not unusual to see Iron deficiency on certain plants in alkaline soils containing adequate Iron.

pH

There are three basic categories of soil pH.

Acid (< 6.6), Neutral (6.6-7.3), Alkaline (> 7.3)

Most crop plants like slightly acid to neutral soil pH.

Organic Matter

The predominant component of soils is mineral, weathered from rock.

Agricultural soils also need some organic matter in the range of 3-5%. More than this can be used but is not considered necessary for supporting optimum plant growth.

If a 100 square foot plot's soil contained no organic matter, 3% could be attained by adding about 120# of organic matter. CSU recommends adding organic matter derived from low nitrogen sources such as leaf mold or peat moss.

As mentioned above we think there is now adequate organic matter in the garden soils. Small yearly amounts could be beneficial. The best way to supply organic matter on an ongoing basis is to grow plants! The roots left in the ground will continue to contribute to the organic matter content and general soil structure.

Fertilizer calculator

To summarize, the Macronutrients N, P, and K are recommended at about 0.25 pounds per 100 square feet. All commercial fertilizers, including the compost we supply at GCG come with an analysis indicating the percentage of N, P, and/or K they contain. This can be used to calculate the amount of fertilizer needed for healthy plants.

Amount required = lbRequired*100 / (% Nutrient)

Example : the compost we use at the garden has a Nitrogen content of 1%. Using the recommended 0.25#N per 100 square feet :

Amount required = 0.25*100/ = 25 Pounds

25 pounds of compost can supply all of the N needed for healthy plant growth for one season.

Using Manure

Manures typically contain 2-7% available nitrogen so a little goes a long way. They are also a good source of Phosphorus and Potassium.

Using the fertilizer calculator above, approximately 4-12 pounds of manure per 100 square feet can supply enough nitrogen for an entire growing season.

It is not recommended to use raw manures on planted Vegetable gardens. The following excerpts are from the University of Maine Cooperative Extension Bulletin #2510, Guidelines for Using Manure on Vegetable Gardens :

Animal manure can contain bacteria such as *Listeria, Salmonella,* and *E. coli 0157:H7,* as well as roundworms and tapeworms. These tiny organisms are called pathogens because they may cause disease. Pathogens can pass from animal manure to humans through direct contact between contaminated manure and fresh fruit and vegetables.

To reduce the risk of disease transmission, food safety experts suggest that you follow these safe gardening practices:

- **Use composted manure.** Composting manure with your yard and garden waste helps reduce the risk of contaminating your garden vegetables with pathogens. Ensuring that your compost pile reaches a temperature of 140°F will further reduce the risk. Commercially processed manure, available in garden centers, should indicate on the package if it is pathogen-free.
- **Never use cat, dog, or pig manure in vegetable gardens or compost piles.** Parasites that may be in these types of manure are more likely to survive and infect people than those in other types of manure. It is also important to keep your pets out of your vegetable garden.
- **Use water that meets safe drinking standards to irrigate your vegetables.** This is most important within one month of harvest. If you use any water that is not drinkable (potable), such as water from old dug wells or rain barrels, to irrigate your garden, it is best to use drip (trickle) irrigation to both conserve water and minimize the contamination of leafy vegetables that can occur with overhead irrigation.

If you do intend to use raw manure as a soil amendment or fertilizer source on your garden, follow these guidelines:

- **Apply raw manure at least 120 days before harvesting a crop that has the potential for soil contact** (leafy greens, root crops, etc). The USDA National Organic Program (NOP) standards allow a 90-day period between manure application and harvest for crops that don't have direct contact potential with soil.
- **For gardeners in Maine (Colorado), the best time to apply raw manure to your garden may be in the fall after harvest**; incorporate it into the soil and plant a cover crop to hold nutrients over the winter. This should be done before October 1 for good cover crop establishment.

- **Never use raw manure as a sidedress to growing plants.** Manure that is incorporated and distributed throughout the soil has a much lower risk of passing pathogens to the growing crop.