Soil Fertility Notes
UCCE Soil Testing Workshop
11/15/23
Presenter: Arron Wilder

Soil testing – when to do it? Ideally, well before you plant your crop

- Nutrient availability, pH, microbial activity and diversity all change with soil temperature and moisture (seasonal effect).
- Get a representative sample
    - Composite samples vs. non-composite samples
- Collect samples where there is a management concern
- Baseline sampling is very important so you can track change over time
- Might be helpful to collect a control sample of unchanged land, too
- Determine from the soil analysis what the limiting factor is – in most cases, if something is limiting, growth will be less than ideal even if everything else is well balanced.
- Also look for high concentrations of nutrients or micronutrients that may affect growth negatively
- Soil temp, moisture and soil pH are great field indicators of nutrient availability.
    - Soil nutrient availability is driven by nutrient release from organic matter, so microbial activity is very important for nutrient delivery.
    - Soil pH is very important for the chemical availability of nutrients. At low pH, elements such as Mn and Al are available, which have negative impact on plant growth, while also being a sign of Ca and Mg depletion.

Plant assay – using different nutrients and nutrient applications to check on what is limiting.

Visual observations of nutrient deficiency:

- Plants yellowing
- Plants stunted
- Lack of vigor or growth slowed
- Fruits discolored, shrunken, swollen etc
- Wilting
- Low yield

Other:

- What soil analysis to get: full macro and micro nutrient analysis – A&L Western in Modesto has a nice report and low cost
- Caution on over-reliance on manuring or compost or organic matter
- Tillage vs. no-till? How does this factor in?
- Use of manure vs. compost?
- Is it possible to avoid liming soil if pH is low?

Notes on nutrients and amendments:

Nitrogen - NO_3^-, NH_4^+,
- cell growth
- Protein synthesis
- Cell wall formation
- Photosynthesis – adp and atp

Phosphorous – $H_2PO_4^-$, HPO_4^{2-} (orthophosphate)
- stem and trunk growth
- Adp and atp
- Respiration – oxidative phosphorilation

Potassium – nutrient transport
Cell communication

Other – Calcium - Ca^{2+}–
- Builds structure of cell walls in plant
- for pH adjustment in soil (to make other nutrients available)
- messenger for environmental cues across cell wall

Sulfur - SO_4^{2-} –
- essential to formation of enzymes in plant and roots
- builds proteins in plant

Magnesium – Mg^{2+}
- essential for photosynthesis (chlorophyll formation)

Organic sources/amendments

Nitrogen – Blood meal
Fish emulsion
Seaweed
Feathers
Bone meal

Manures – increasing by N levels
Horse
Rabbit
Cow
Sheep
Goat
Pig
Bats and birds (also high in P)

Phosphorous – Bone meal
Rock phosphate
Green sand

Potassium - Potash
Blood meal

Calcium - lime, gypsum, dolomite, feathers, bone meal

Sulfur – Organic matter (decomposes and releases S), manures

Magnesium - Dolomite

NPK ratios – 1:1:1 = 1% N, 1% P, 1%K (In 100 lb of compost with a NPK ratio of 1:1:1, you'd have 1 lb of each)