Geochemical Analysis to Support Limited-Resource Urban Farms in Fort Worth:

The Tabor Farm Project

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Background and Motivation

- Urban Farms provides one solution to the widespread food insecurity issues in food desert areas like Southeast Fort Worth. Access to resources that would make the farms environmentally and economically sustainable are limited. One such resource is a comprehensive soil test to evaluate the soil properties needed to support optimal plant growth and minimal environmental degradation.

- As part of our class on geochemical analysis techniques we conducted various chemical soil tests to support the establishment of the Mount Tabor Urban Farm off East Berry Street. The farm is being establish in Fort Worth, TX as an effort to increase food security in the community.

Objectives

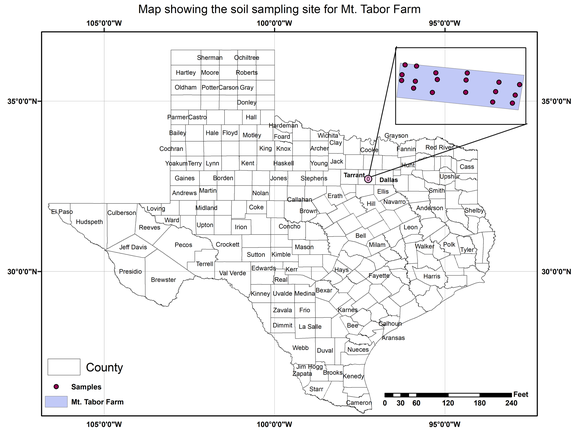
Our objective was to evaluate the chemical characteristics of soils at Mount Tabor Farm and make recommendations on changes needed (if any) for optimal growth of tomatoes. The questions we wish to address include the following:

1. Are the soil characteristics at Mount Tabor Farm suitable to grow tomatoes?
2. How much is the soil at Mt. Tabor Farm above/below the optimum conditions and how much is needed to bring it to the standard?

We applied chemical analysis methods to determine the soil pH/acidity, soil salinity/ electric conductivity, soil organic matter content, and macronutrient (Nitrate and Phosphorus) content needed for plant growth.

We are anticipating that our results will help produce tomatoes of good quality that will increase the opportunity for residents to get healthy and accessible food options.

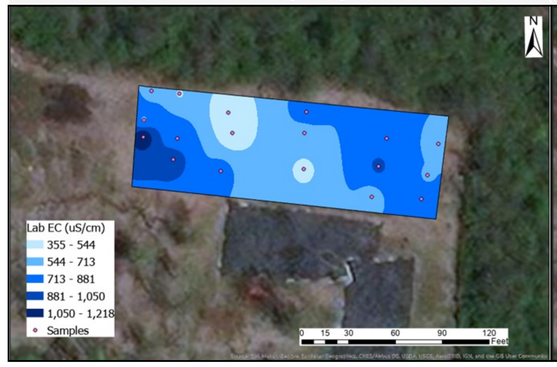
Study Site



Findings

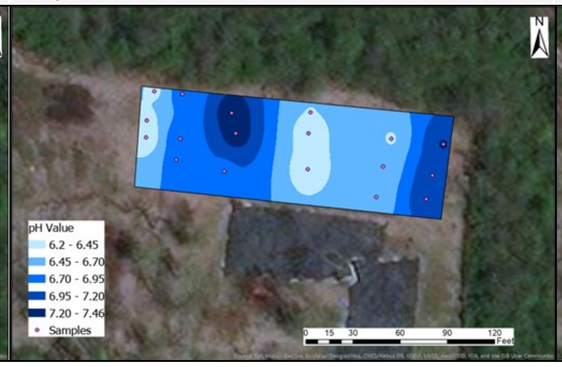
Soil Salinity

- Electrical conductivity (EC) is related to the salt content of soils.
- The optimum EC range is 0-2000 µS/cm, and ours averaged 723 µS/cm.
- Excess salt in the soil could be eliminated by adding organic matter or clay that absorb cations in the (CEC) sites where positively charged ions such as sodium ions are available for plant uptake.



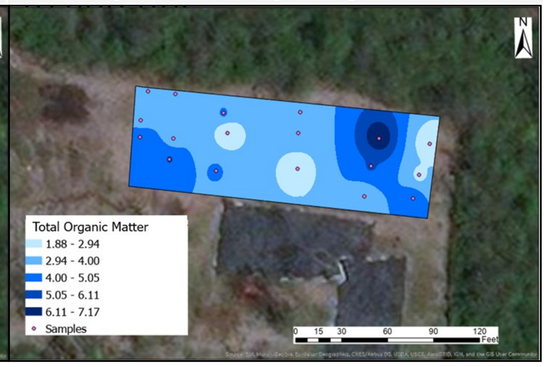
Soil Acidity

- Soil pH affects nutrient availability and enzyme action
- Tomatoes can grow between a pH 5 and 7, and are best at a slightly acidic medium (5.5)
- Add compost, manure, or organic soil to neutralize the pH in the areas it is highest.



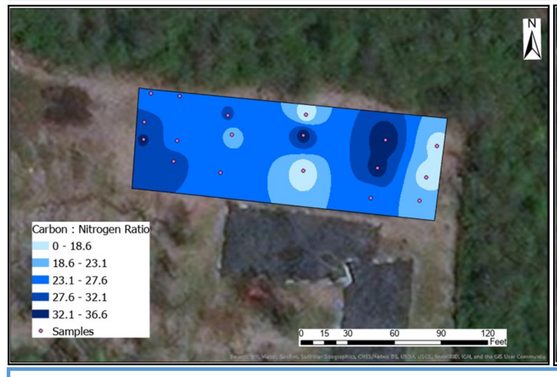
Soil Organic Matter

- The amount of labile organic matter impacts both the activity and mass of decomposers in soil.
- The most productive soil has 3-6% of total organic matter and the average LOI across the field was 3.7% .
- Add 2% compost (1.5 lbs/acre) to optimize organic matter content



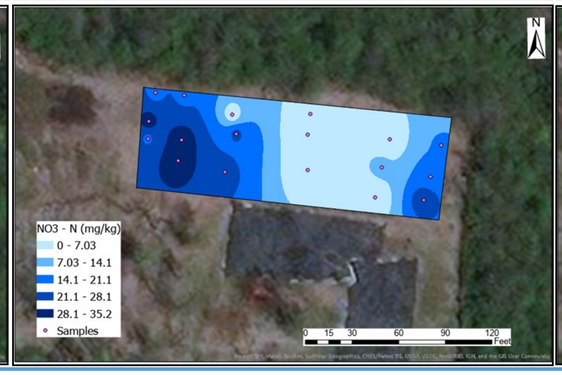
Carbon-Nitrogen Ratio

- A good balance of Carbon: Nitrogen provides readily available nutrients for soil microbes to feed
- The suitable ratio for tomatoes is 25-30:1
- The average C:N ratio of our site was roughly 25:1, and thus met the required conditions for crop growth



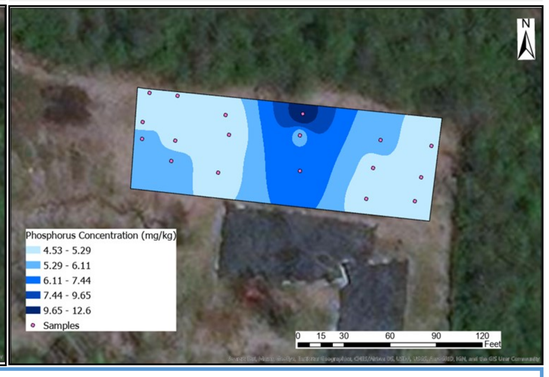
Nitrate-Nitrogen Distribution

- Nitrogen is a macronutrient important for plant structural development and food processing
- Nitrate levels varied across the field with an average concentration of 83.2 mg/kg of soil.
- Adding 35 lbs/acre of nitrate-nitrogen amendments aid in optimizing the nutrient conditions for favorable crop growth.



Phosphorous Distribution

- Phosphorus is an essential macronutrient responsible for cell development and energy production.
- The measured concentration of phosphorus across the field was generally low (5.55 mg/kg).
- Add at least 130 lbs/acre of phosphate amendments



Conclusions

Our results show there is soil variability across the site. The analysis of pH, EC, LOI, TGA, elemental analysis, and the amounts of nitrate and phosphate indicates that there is potential to use this site to plant tomatoes if the farmers make modifications to the soil. Since we were not able to connect the data from the EM38 to a computer when on site, we had to decide on a sampling plan without its map and data. This could be refined by first obtaining the EM38 information and then deciding on the sampling sites.