*Solving the Soil: A Case Study*

***In this lesson, students will be able to***:

- Read a soil test printout of 12 plots on the Northeast Urban Farm
- Connect the soil test number to the appropriate location on the Northeast Urban Farm and make observations about the soil and growing environments
- Determine which of the 12 plots would be best for growing field production pumpkins
- Describe the fertility and pH needs of the field production pumpkins
- Calculate the fertility needs of the field production pumpkins in pounds per acre (lbs./ac)
- Write a soil prescription to amend the soil
- Optional – explore Web Soil Survey on the same site to understand additional soil characteristics

***Materials Needed***:

Printout of the Northeast Urban Farm soil test
Access to a computer with internet access

**Time to Complete**

Activity 1 = 45 minutes
Activity 2 (optional) = 20 minutes


**Image 1 – Urban Farm Map**

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## *Introduction*

**Soil nutrition** is affected by the 17 essential elements needed for plant growth, pH, soil temperature, and soil moisture. The 17 essential elements can be analyzed by a lab and viewed with a soil test report. This lesson will focus on amending the soil nutrients and/or the pH (temporarily; long-term changes require the formation of new soil). This will allow the desired crops to have access to the amount of each element needed for successful growth and yield.

## *Essential Elements*

Plants use 17 essential elements to successfully complete their life cycle. These elements play a vital role in growth and reproduction.

| | | | | | | |
|---|---|---|---|---|---|---|
| Carbon | Life element | Plant Structures | | Chlorine | Micronutrient | Root Growth, Shoot Growth |
| Hydrogen | Life element | pH Regulation, Water Retention | | Iron | Micronutrient | Chlorophyll Maintenance |
| Oxygen | Life element | Respiration; Plant Structures | | Manganese | Micronutrient | Chlorophyll Synthesis |
| Nitrogen | Fertilizer element/ Primary Macronutrient | Plant Growth; Cell Formation | | Molybdenum | Micronutrient | Nitrogen Fixation, Protein Synthesis |
| Phosphorous | Fertilizer element/ Primary Macronutrient | Photosynthesis, Root Growth, Seed Germination | | Zinc | Micronutrient | Auxin Formation, Starch Formation |
| Potassium | Fertilizer element/ Primary Macronutrient | Disease & Drought Resistance, Vigor | | Nickel | Micronutrient | Seed Development |
| Magnesium | Secondary Macronutrient | Component of Chlorophyll | | Boron | Micronutrient | Flowering and Fruiting, Cell Division |
| Sulfur | Secondary Macronutrient | Odor and Flavor, | | Copper | Micronutrient | Chlorophyll Synthesis, Respiration |
| Calcium | Secondary Macronutrient | Structural Support, Cell Wall Structure | | | | |

**Life elements** are those elements that make up nearly all life on earth. Carbon (C), Hydrogen (H), and Oxygen (O) are the basis of all living organisms. Plants use these elements in respiration, photosynthesis, and transpiration.

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The **fertilizer elements** are three of the six macronutrients. Fertilizer elements are the nutrients required in the greatest quantities by most plants. Nitrogen (N), Phosphorus (P), and Potassium (K) are used by the plant for growth and stress resistance. **Macronutrients** are those elements needed in "large" quantities by plants. The secondary macronutrients, Magnesium (Mg), Sulfur (S), and Calcium (Ca), are used by plants to increase colors, flavors, and the strength of stems and other tissues.

**Micronutrients** are elements that plants use in very small quantities. The micronutrients, Chloride (Cl), Iron (Fe), Manganese (Mn), Molybdenum (Mo), Zinc (Zn), Nickel (Ni), Boron (B), and Copper (Cu), might only be used for small portions of the plant's life cycle.

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*Soil pH*

Soil pH can affect the availability of the essential elements. The pH scale runs from 0.0 to 14.0. From 0.0 to 6.9 the pH scale is acidic, at 7.0 the scale is neutral, and from 7.1 to 14.0 the pH scale is alkaline.

As seen in the graphic below, nutrients can be limited by the pH of the soil. In the image, where the element bands are broad, that means the element is available to plants. When the band is narrow, that means the pH limits the amount of the element that plants can use, even if that element is present in the soil.

Typically, the pH range from 5.5 to 8.0 is considered "adequate" for most plants.

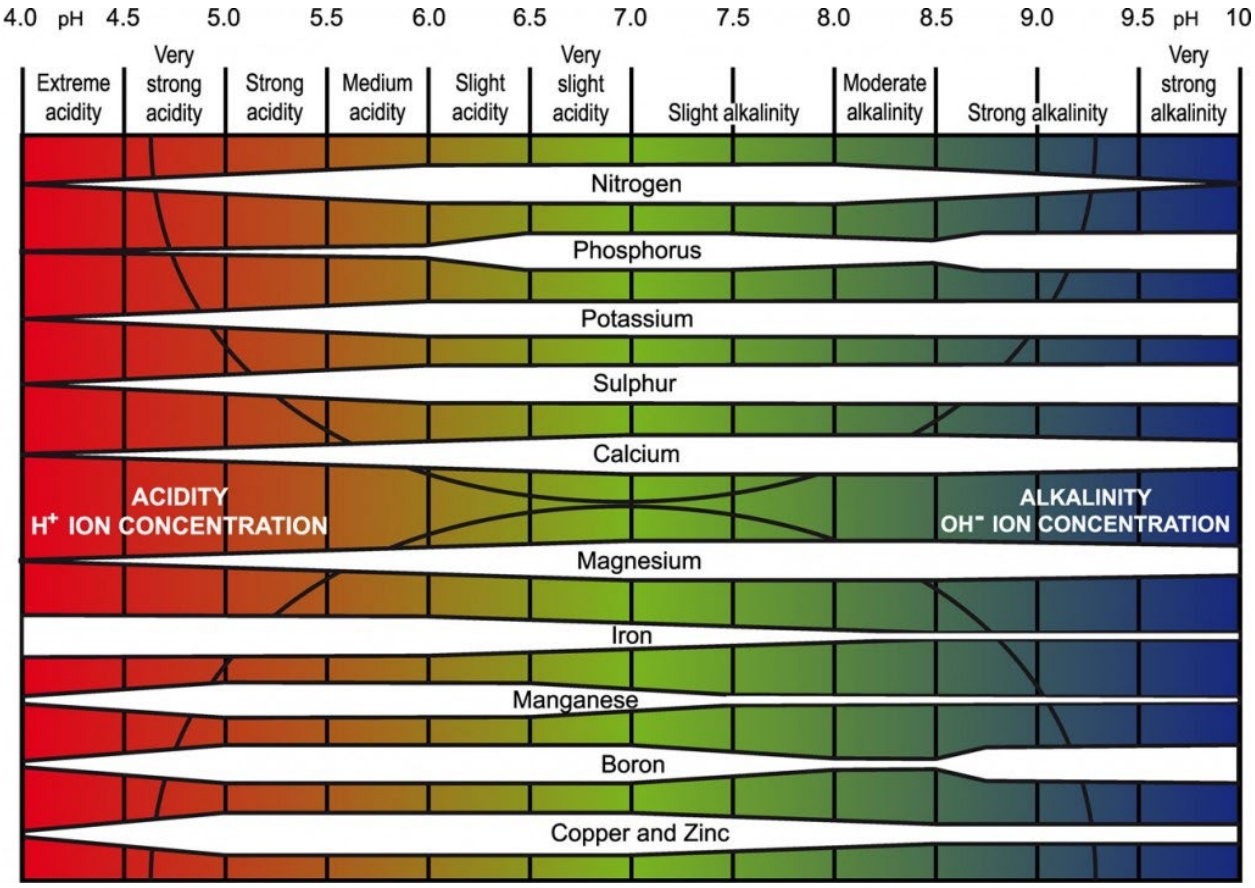


**Image 2 – Soil Nutrient Availability Based on Soil pH** https://www.pda.org.uk/

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*Activity*

This activity will explore potential nutrient changes to the growing environment within each of the 12 plots on the Northeast Community College Urban Farm.

Use the Urban Farm Map on page one of this lesson and the **Urban Farm Soil Sample 2022** document to help guide your decisions in making nutrient adjustments for potentially growing **pumpkins** in each of the 12 plots.

**Plot 1**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot 2**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot 3**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot 4**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

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**Plot 5**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot 6**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot 7**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot 8**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

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**Plot 9**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot 10**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot 11**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

**Notes:**

**Plot12**

**pH**

Increase Decrease No Change

**Nitrogen**

Increase Decrease No Change

**Phosphorous**

Increase Decrease No Change

**Potassium**

Increase Decrease No Change

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**Discussion:**

**Why is it important to do regular soil testing?**

**What nutrient challenges did you note on the Urban Farm?**

**Which plots were best for growing with minimal inputs?**

**Which plots were undesirable for growing pumpkins?**

**What does this information tell us about soil health and Urban Ag?**

**If the soil is not adequate for growing pumpkins, what other ideas might you have for producing an Ag product on this site?**

## *Activity Add-ons*

*Visit Web Soil Survey (https://websoilsurvey.nrcs.usda.gov/app/) to investigate the soil types and other information about the site. The location is found slightly north and east of the Northeast Community College campus at 801 E Benjamin Ave. The legal description of the Urban Farm is* N2NW4SW4 of 13-24N-1W.

*Investigate the soil test further by learning about and reporting on CEC, Carbon to Nitrogen (C:N) ratio, Magnesium, Calcium, and Iron.*

## *Reflection*

What did you already know when we started this activity?

What did you learn from this activity?

How will this activity help you grow plants?

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