

**GRADE LEVEL:** Grade 7  
**AGE LEVEL:** 12-13 Years Old  
**SUBJECT:** Science 7 Integration in Organic Agriculture  
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**LEARNING COMPETENCY:** Investigate properties of acidic and basic mixtures using natural indicators.

**TIME FRAME:** 1day

**LEARNING OBJECTIVES:**

**Subject Matter Objectives:**

By end of the session, students should be able to: Determine the soil pH level using the pH paper or pH meter or natural indicator;

**Organic Agriculture Objectives:**

Differentiate the soil pH from organic and non-organic soil.

**SUBJECT MATTER:**

<b>Topic:</b>	Science Grade 7:	ACIDS AND BASES
	Organic Agriculture:	Soil pH level

**MAIN CONCEPTS AND SKILLS**

- An **acid** (from the Latin *acidus/ acēre* meaning *sour*<sup>[1]</sup>) is a chemical substance whose aqueous solutions are characterized by a sour taste, the ability to turn blue litmus red, and the ability to react with bases and certain metals (like calcium) to form salts. Aqueous solutions of acids have a pH of less than 7. Non-aqueous acids are usually formed when an anion reacts with one or more positively charged hydrogen cations. Chemicals or substances having the property of an acid are said to be **acidic**. ([http://en.wikipedia.org/wiki/Base\\_\(chemistry\)](http://en.wikipedia.org/wiki/Base_(chemistry)))
- **Base** is a substance that, in aqueous solution, slippery to the touch, taste bitter, change the color of indicators (e.g., turn red litmus paper blue), react with acids to form salts, and promote certain chemical reactions (base catalysis). Examples of bases are the hydroxides of the alkali and alkaline earth metals (NaOH, Ca(OH)<sub>2</sub>, etc.). ([http://en.wikipedia.org/wiki/Base\\_\(chemistry\)](http://en.wikipedia.org/wiki/Base_(chemistry)))
- The **pH** is a measure of acidity or basicity. to distinguish acidic from basic mixtures. It is through the use of the pH scale, which extends from 0 to 14. The pH scale was proposed by the Danish biochemist S.P.L. Sorensen. In this scale, a sample with pH 7 is *neutral*. An **acidic mixture** has a pH that is less than 7. A **basic mixture** has a pH that is greater than 7. In general, the lower the pH, the more acidic the mixture and the higher the pH, the more basic is the mixture.

- A **pH indicator** is a dye that changes into a different color depending on whether it is in acid or in base. There are many indicators that come from plant sources. Each indicator dye has one color in an acidic mixture and a different color in a basic mixture. A common indicator is *litmus*, a dye taken from the lichen plant. Litmus turns red in acidic mixtures and becomes blue in basic mixtures. Determining the acidic or basic nature of sample maybe use the color scheme for eggplant or *camote* ; Strongly acidic: red to pale red, Weakly acidic: blue, Weakly basic: green, Strongly basic: yellow.
- **Inorganic soil particles** Inorganic soil particles are irrelevant to plants in terms of support and growth. So we exclude from our thinking those particles that are too large for plants to interact directly with. So glacial erratic boulders, rocks, gravel, pebbles are all excluded here..[http://en.wikipedia.org/wiki/Soil\\_organic\\_matter](http://en.wikipedia.org/wiki/Soil_organic_matter))
- **Soil organic matter (SOM)** is the organic matter component of soil, consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by soil organisms.
- **EFFECTS OF SOIL pH ON CROP GROWTH** - Most soil used for vegetable cultivation become gradually more acidic as calcium is lost due to leaching by rainwater and irrigation. The process is further accelerated by the use of nitrogenous fertilizers' such as ammonium nitrate and ammonium sulphate. Vegetables vary in their tolerance to soil acidity. Acidic soil often causes the stunting and yellowing of leaves, resulting in the decrease in growth and yield of crops as the pH levels falls. Additionally, plants grown in adverse pH conditions may be more prone to disease and fungal attack. In general, the most favorable pH range for vegetable is between 5.5 to 6.5 in mineral soil and 5.0 to 6.0 in organic soil.
- **EFFECTS OF SOIL pH ON AVAILABLE NUTRIENTS-** The availability of plant nutrients is considerably affected by soil pH. Calcium, potassium, magnesium and sodium are alkaline elements, which are lost with increasing acidity whereas phosphorous is more available in acidic soil conditions. Acidity can also induce deficiencies of micronutrients such as molybdenum, copper and boron, although a deficiency in the latter is more commonly seen in alkaline soils where over-liming has occurred. Other minor elements which may be deficient due to low solubility in high pH includes manganese and iron, the deficiency of which produces a chlorotic condition commonly seen in the young leaves of brassica plants.

#### **MATERIALS NEEDED:**

- Litmus paper (pH paper) or pH meter or Plant Indicator solution (ready-made or improvised like camote tops indicator) before doing this lesson the teacher may conduct a test if plant pH indicator maybe used;
- soil sample (vermi cast and soil with applied inorganic fertilizer).
- student's worksheet

#### **LEARNING ACTIVITIES**

**Prerequisite:**

- Performed making of natural indicator (using camote tops).
- Differentiated acids and bases with its characteristics.
- Determined common household solutions using pH meter or natural plant indicator.

**Review/Motivation**

- Differentiate acids and bases.
- What are the step in making natural plant indicator?

**ACTIVITY:**

- Color Range,pH Scale! See attached activity sheet. (appendex 1)

**ANALYSIS:**

1. Do you think there is a need to know the soil pH level? Why?
2. What is the significance of soil pH level? How to measure soil pH level?
3. Is there a difference of soil pH between organic and non-organic soil?
4. What are the possible causes why soil acidity increase?
5. What causes soil acidity? And what are the effects to crops and other available nutrients?

**ABSTRACTION:**

**Directions:** Read and understand the statement carefully, write agree if the statement is true and write disagree if the statement is false.

Pre-test (Agree or disagree)		Post-test (Agree or disagree)
	Organic matter component of soil, consisting of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by soil organisms.	
	Inorganic soil particles are relevant to plants in terms of support and growth.	
	Most soil used for vegetable cultivation become gradually more acidic as calcium is lost due to leaching by rainwater and irrigation.	
	Acidic soil often causes the stunting and yellowing of leaves, resulting in the decrease in growth and yield of crops as the pH levels falls.	

	The availability of plant nutrients is not affected by soil pH.	
	Chemicals or substances having the property of an acid are said to be acidic.	
	A higher pH level means a higher acidity.	
	Farmers need to know the pH of their soil since plants will only grow in a narrow pH range.	
	The pH also does not affect how much nutrients from the soil become available to plants.	
	Most plants in the Philippines grow in acidic soils. Some plants grow best in almost neutral and other plants require basic soil.	

### APPLICATION

- Why some plants did not grow well in some areas?  
*(The pH of soil is very important. Some plants grow well in acidic soil while others prefer basic soil. Farmers need to know the pH of their soil since plants will only grow in a narrow pH range. The pH also affects how much nutrients from the soil become available to plants.)*

### ASSESSMENT

Direction: List at least five plants grow well in acidic soil, five plants grow well in basic soil and five plants grow well in neutral soil.

Plants grow well in acidic soil	Plants grow well in basic soil	Plants grow well in neutral soil

### AGREEMENT

- Make a research of what fruits and vegetables grows in acidic and basic soil.

### Bibliography

Brady, J.E. & Senese, F. (2004). *Chemistry: Matter and its changes*, 4th edition. River Street Hoboken, NJ: John Wiley & Sons, Inc

Philippines. Department of Education. (2004). Chemistry: Science and technology textbook for 3rd year. (Revised ed.). Quezon City: Author

Learning Materials from Grade 7 Science and Organic Agriculture  
 ..([http://en.wikipedia.org/wiki/Soil\\_organic\\_matter](http://en.wikipedia.org/wiki/Soil_organic_matter))

### Activity 1 (Appendix 1)

#### Color Range, pH Scale!

Objective:

In this activity, students can able to determine the soil pH level using the pH paper or pH meter or plant indicator.

Materials Needed:

- Soil samples (organic soil, inorganic soil)
- Soil pH kit or plant indicator
- students activity sheet

Procedure:

- Use the following soil pH kit (man-made plant indicator) to determine the pH of the soil samples.
- Present your results in table 1 below.
- Interpret your results using the color changes of natural or plant indicator given.

The natural or plant indicator shows the following color changes.

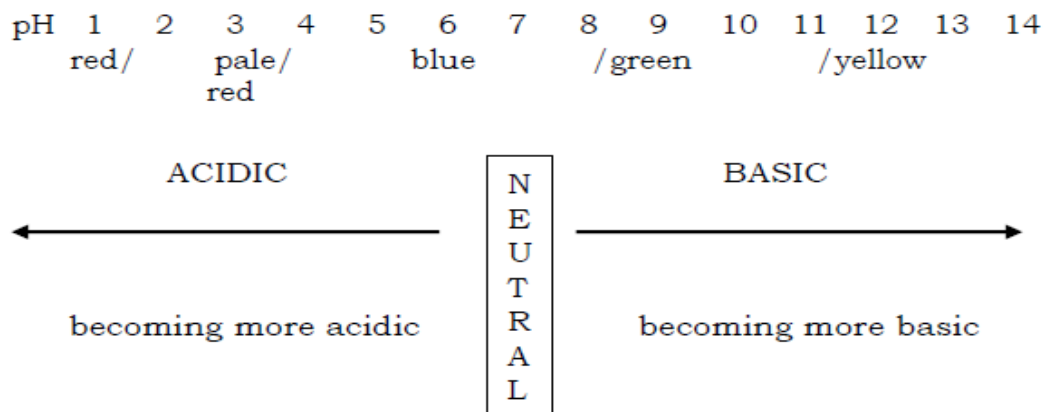


Table 1

Sample (organic, non-organic)	Color of the sample before being applied with improvised natural pH indicator or litmus paper	Color of the sample after being applied with improvised natural pH indicator or litmus paper (red/pale/red/blue	pH of the sample based on the results after being applied with improvised natural pH indicator or litmus paper

		/green/yellow)	(acidic, basic, neutral)
Vermi cast (organic soil)			
Soil with inorganic fertilizer (non-organic soil)			

Questions:

- Is there a difference of soil pH between organic and non-organic soil? Explain your answer.
- Do you think there is a need to know the soil pH level? Why?
  - How to measure soil pH level?