

The Effect of plants on the PH of the Soil

Fajer Mohammad Alzamanan
Dana abdulaziz Althumairi
Dana Mohammad Almalki

Dhahran 1st HighSchool
Dhahran, Saudi Arabia

Teacher: Maha Alqahtani
March 2020

ABSTRACT

In this study we are investigating the effect of different kinds of planets on the PH of the soil. Since the PH of the soil is very important for the planet to grow strong and healthy, we assumed that there would be a mutual effect between them, thus, the planets could change the soil PH. The effect of nine kinds of plants differs from one to another during the period of this study.

1. Introduction:

The PH is a measurement that used to determine weather the water or the water-based solution is acid or basic. It has a scale from 0-14, the numbers (starting from 0) range from acid to normal and the highest edge show the basic state. The PH is the concentration of hydrogen ions, where the lowest PH means a higher concentration of hydrogen ions and vise versa. Since the PH is a logarithmic scale, each time we go up one point in the scale, the acidity will be 10 times less, which means the concentration of the hydrogen ions is ten times less too. The PH also is one of the characteristics of the soil that affects plants directly; it has an impact on the nutrients that plants need. Moreover, it influences the pesticides and the organic matter decomposition [1].

The soil PH is traceable by measuring the PH of the soil solution's acidity and alkalinity (basic). As a part of the soil characteristics, we can describe the soil as acid or normal or basic. As shown in Figure (1) there are different kinds of soil in different PH measurement, also it shows some examples of common solutions that have corresponding PH.

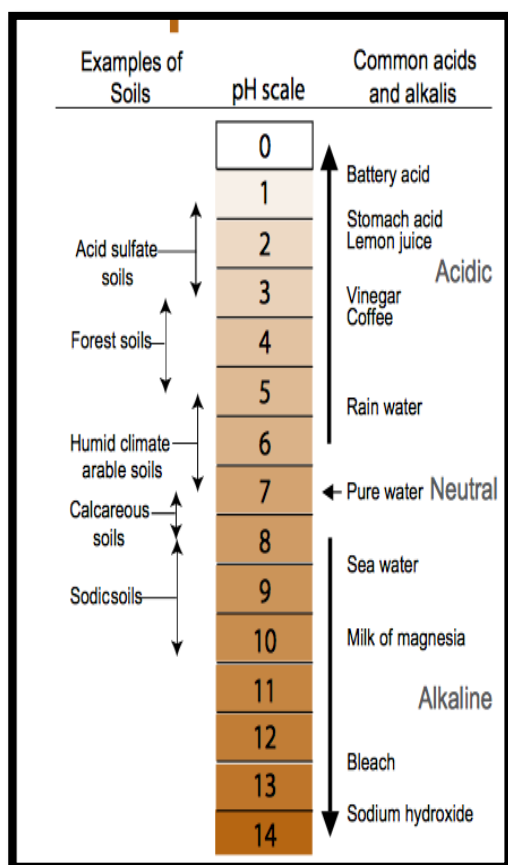


Figure (1): the PH scale and some examples of soil that has the same PH [1]

Every plant has a preferred PH, which helps the plant to grow healthy. Having the suitable PH is the key to growing a healthy plant because it plays a major role in absorbing the nutrition that plants need. The wrong PH will not kill the plants in most cases; however, it will affect the growth of the plants negatively.

Although there are few plants that may prefer to grow in acid or alkaline soil, the optimum PH for most planet ranges from 5.5 to 7.0 [2]. In this optimum PH most nutrients are available to plants. In lower PH, the nutrients will leach out more quickly than the optimum range [2].

One of problem that could face the plants is the acidic soil that results because of the nature of the soil, or some of the people wrong activities. Acidic rainwater that results because of the pollution may also increase the acidity of the soil. Because the acidity will affect the microorganisms that help in the nitrification and denitrification process that provide the needed nitrogen to plants, the optimum PH is crucial to the plants [3].

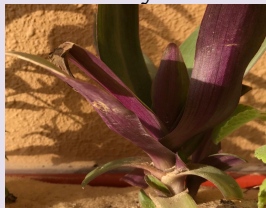
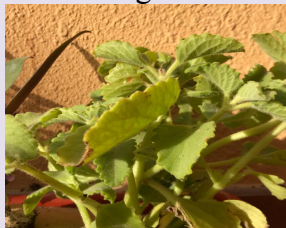
2. Research Question and Hypothesis:

Plants for us is more than the main producers of food and oxygen, it also more than the lung of the globe. For us, plants are the most important creatures in this planet. Plants are the creatures that spread the positive energy as they spread the oxygen without saying any word. We have a deep appreciation for plants, and we are eager to know more about them. As we were looking for an area to investigate in plants, we notice that many researches focus on how the PH of the soil may affect the plants. Thus, we think of the opposite side and we asked, if all the factors are controlled, do the plants affect the PH of the soil? When this question popped, we suggested that the plants could have an impact on the soil PH after planting them.

2. Materials and Methods:

To test our hypothesis and to answer our research question we planned to do the following steps:

1- We planted 9 plants (3 plants to each researcher). The chosen plants were as following:

Fajer Mohammad Alzamanan	Dana Abdulaziz Althumairi	Dana Mohammad Almalki
1- Flaming Katy 	1- Bluemink 	1- Boatlily 
2- Garden Onion 	2- Polka dot plant 	3- Zonal geranium 
4- Garlic 	3- Springer's asparagus fern 	4- Horse Mint 

(Table 1: chosen plants, we used picture this [4] to identify them)

- 2- We put the plants in the same soil to control all the factors such as soil temperature; humidity, air pressure and we watered them with the same water.
- 3- We collaborated with Globe team in our school to measure all the constants factors every day for the period of our study, which was (one month) using the atmosphere and soil protocols measurements.
- 4- We chose the kind of plant as our independent variables, and the soil PH as our dependent variable.

- 5- For the period of one month, we measured the soil PH every day in order to trace any change that could results from the plants (with a generous help and training from globe team).
- 6- We recorded all the data that we collected in a table in order to graphically present the data we got and to draw the results.

4. Data Summary and Analysis:

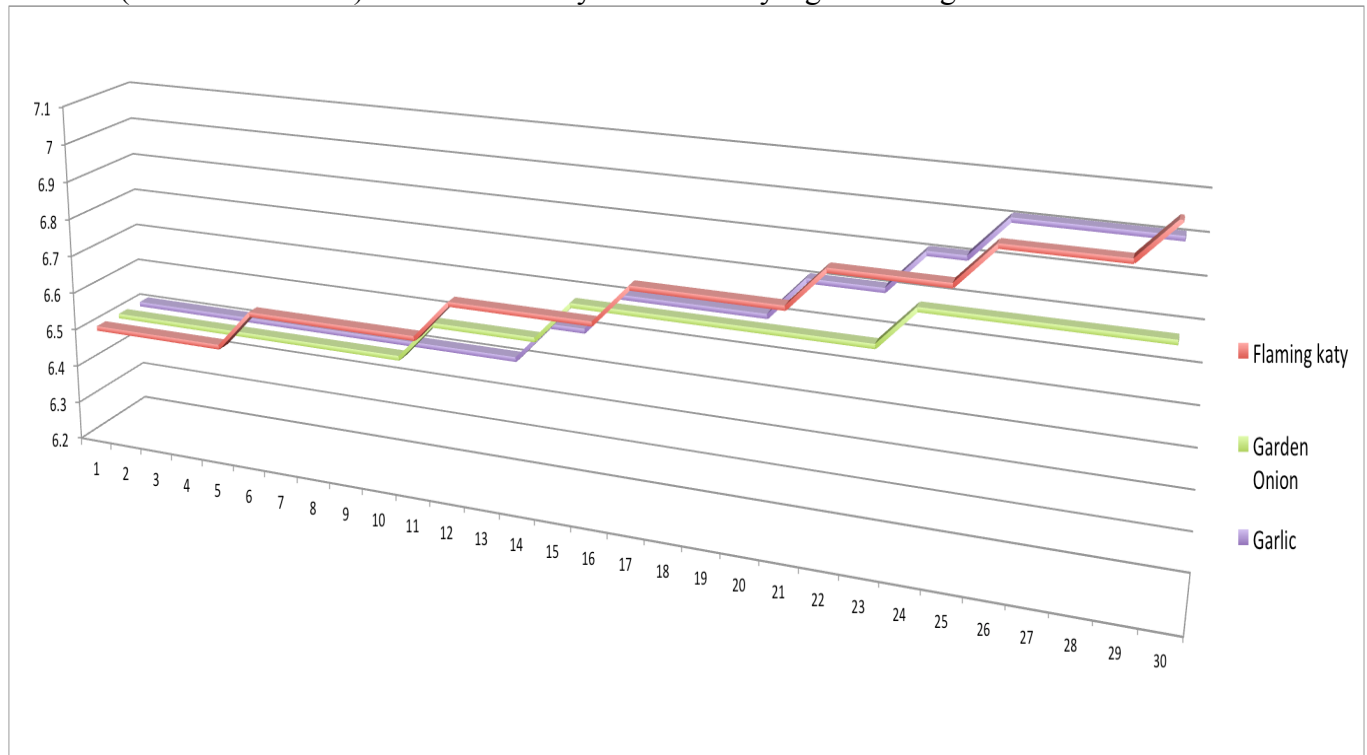
We collected many data for each plant for the period of one month (from the 4th of February until the 4th of March); the following table presents the data we got during our study:

Springer's asparagus fern	Polka dot plant				Bluemink				Garlic				Garden Onion				Flaming katy			
	P	H	T	PH	P	H	T	PH	P	H	T	PH	P	H	T	PH	P	H	T	PH
	1021	45%	18	6.5	1021	45%	18	6.5	1021	45%	18	6.5	1021	45%	18	6.5	1021	45%	18	6.5
	1020	47%	19	6.5	1020	47%	19	6.5	1020	47%	19	6.5	1020	47%	19	6.5	1020	47%	19	6.5
1020	48%	21	6.5	1020	48%	21	6.5	1020	48%	21	6.5	1020	48%	21	6.5	1020	48%	21	6.5	3
1018	41%	23	6.5	1018	41%	23	6.5	1018	41%	23	6.5	1018	41%	23	6.5	1018	41%	23	6.5	4
1015	47%	24	6.5	1015	47%	24	6.6	1015	47%	24	6.5	1015	47%	24	6.5	1015	47%	24	6.5	5
1017	66%	19	6.5	1017	66%	19	6.6	1017	66%	19	6.5	1017	66%	19	6.5	1017	66%	19	6.6	6
1018	56%	19	6.5	1018	56%	19	6.6	1018	56%	19	6.5	1018	56%	19	6.5	1018	56%	19	6.6	7
1022	44%	16	6.5	1022	44%	16	6.6	1022	44%	16	6.5	1022	44%	16	6.5	1022	44%	16	6.6	8
1029	38%	11	6.5	1029	38%	11	6.7	1029	38%	11	6.5	1029	38%	11	6.5	1029	38%	11	6.6	9
1028	46%	16	6.5	1028	46%	16	6.7	1028	46%	16	6.5	1028	46%	16	6.5	1028	46%	16	6.6	10
1024	44%	19	6.5	1024	44%	19	6.7	1024	44%	19	6.5	1024	44%	19	6.6	1024	44%	19	6.6	11
1021	46%	21	6.5	1021	46%	21	6.8	1021	46%	21	6.5	1021	46%	21	6.6	1021	46%	21	6.7	12
1018	44%	21	6.5	1018	44%	21	6.8	1018	44%	21	6.5	1018	44%	21	6.6	1018	44%	21	6.7	13
1017	53%	21	6.5	1017	53%	21	6.8	1017	53%	21	6.6	1017	53%	21	6.6	1017	53%	21	6.7	14
1018	45%	23	6.5	1018	45%	23	6.8	1018	45%	23	6.6	1018	45%	23	6.7	1018	45%	23	6.7	15
1014	41%	23	6.5	1014	41%	23	6.9	1014	41%	23	6.7	1014	41%	23	6.7	1014	41%	23	6.7	16
1011	46%	25	6.5	1011	46%	25	6.9	1011	46%	25	6.7	1011	46%	25	6.7	1011	46%	25	6.8	17
1017	53%	21	6.5	1017	53%	21	6.9	1017	53%	21	6.7	1017	53%	21	6.7	1017	53%	21	6.8	18
1020	52%	21	6.5	1020	52%	21	6.9	1020	52%	21	6.7	1020	52%	21	6.7	1020	52%	21	6.8	19
1019	55%	23	6.5	1019	55%	23	7.0	1019	55%	23	6.7	1019	55%	23	6.7	1019	55%	23	6.8	20
1016	49%	24	6.5	1016	49%	24	7.0	1016	49%	24	6.8	1016	49%	24	6.7	1016	49%	24	6.8	21
1012	59%	25	6.5	1012	59%	25	7.0	1012	59%	25	6.8	1012	59%	25	6.7	1012	59%	25	6.9	22
1016	38%	22	6.5	1016	38%	22	7.0	1016	38%	22	6.8	1016	38%	22	6.7	1016	38%	22	6.9	23
1020	34%	21	6.5	1020	34%	21	7.0	1020	34%	21	6.9	1020	34%	21	6.8	1020	34%	21	6.9	24
1018	46%	22	6.5	1018	46%	22	7.1	1018	46%	22	6.9	1018	46%	22	6.8	1018	46%	22	6.9	25
1019	44%	23	6.5	1019	44%	23	7.1	1019	44%	23	7.0	1019	44%	23	6.8	1019	44%	23	7.0	26
1012	42%	24	6.5	1012	42%	24	7.2	1012	42%	24	7.0	1012	42%	24	6.8	1012	42%	24	7.0	27
1018	46%	21	6.5	1018	46%	21	7.2	1018	46%	21	7.0	1018	46%	21	6.8	1018	46%	21	7.0	28
1020	47%	21	6.5	1020	47%	21	7.3	1020	47%	21	7.0	1020	47%	21	6.8	1020	47%	21	7.0	29
1020	47%	21	6.5	1020	47%	21	7.3	1020	47%	21	7.0	1020	47%	21	6.8	1020	47%	21	7.1	30

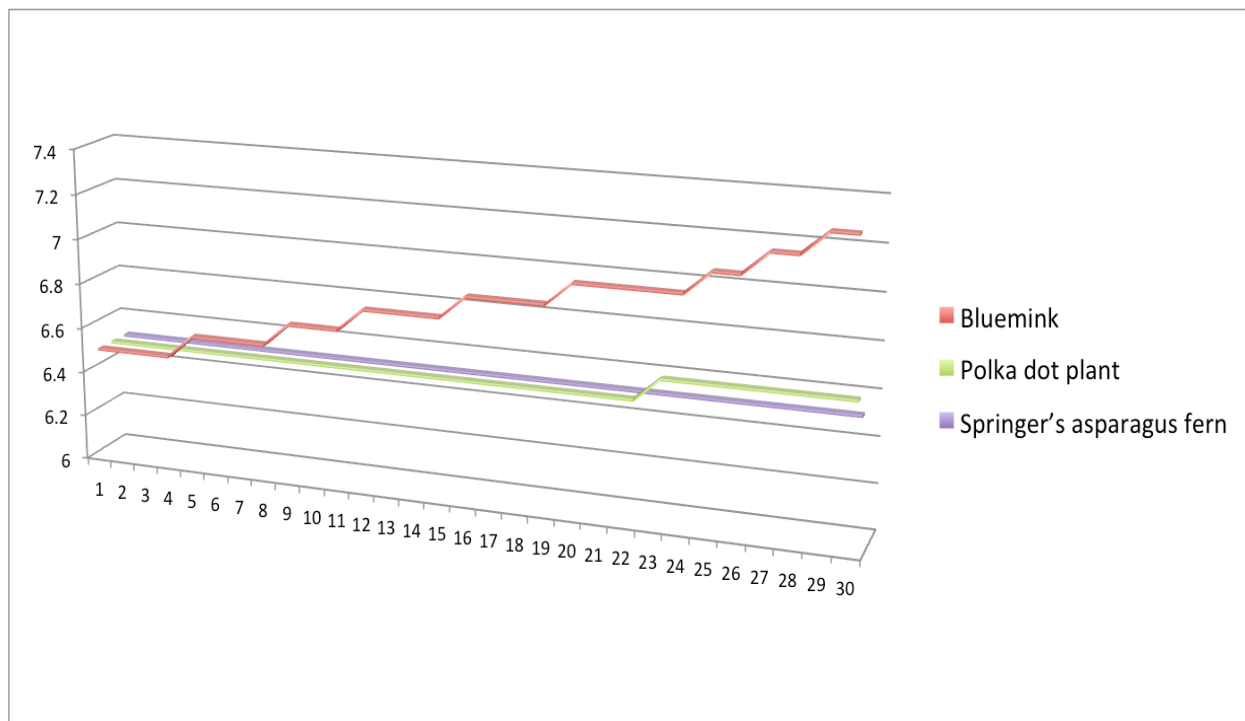
Horse Mint	Boatily			Zonal geranium			Boatily		
	PH			PH			PH		
	T			T			T		
	H			H			H		
Zonal geranium	P			P			P		
	PH			PH			PH		
	T			T			T		
	H			H			H		
Boatily	P			P			P		
	PH			PH			PH		
	T			T			T		
	H			H			H		

Table (2): the collected Data during one month (30 days); T= soil temperature, H= humidity and P= air pressure.

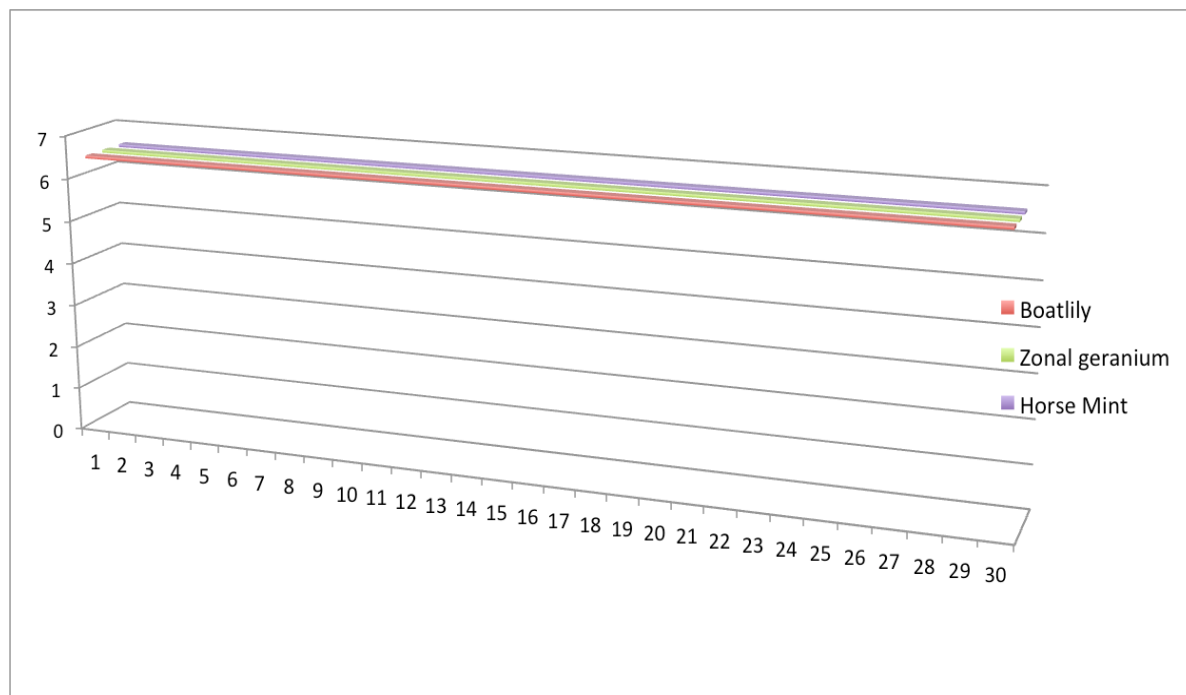
A graph of the relationship between the independent variables (the kind of plants) and the dependent variable (the PH of the soil) will show clearly if there is any sign of change in the PH.



Graph (1): This graph presents the change in the PH during the period of one month in Fajer's plants.



Graph (2): This graph presents how the PH changes differ from one plant to another during during the period of one month in Dana Althumairi's plants.



Graph (3): This graph presents there is no changes in the PH during the period of one month in Dana Almalki's plants.

5. Results, Conclusions, and Discussion:

The results (as shown in the graphs (1),(2)and (3)) and in the table(2), show that there are some plants that changed the soil PH after some days. On the other hand, there are some plants that did not have any impact on the soil PH. In Fajer's plants, the soil PH changed differently. At the beginning, Fajer suggested that this study and the results from it could help farmers in their agricultural crops, which will have a positive impact on the society specially the organic agriculture, that the researchers of this study support and encourage. Thus, Fajer suggested Onion and Garlic. As we can see in the graph and table, the onion and garlic changed the soil PH after one month and increased the alkaline of the soil.

Dana Althumairi's plants also reacted in different ways. One of them did not have any impact on the soil PH, where as the other one has more significant impact on the soil PH. The third one changed the soil PH slightly.

Dana Almalki's plants did not have any impact on the soil PH. However, Dana Almalki noticed some thing very interesting that were the changes on the measurements of the soil PH in the nighttime. Dana almalki's got the chance (some times) to take some measurements during the nighttime, and the soil PH was higher at night than the measurement in the next day. These differences raised the question; dose the temperature or the sunlight have affect on the soil PH?. Therefore, we looked for answer, so we contacted Mr. Mohammed Mansour who is a chemist from King Fahad University Of Petroleum and Minerals (KFUPM) and he answered, " Since the PH is the hydrogen ions activity, as temperatures changes, activity change as well, and that explains why the PH differs. Besides, temperature has an effect on the activity of living organisms and in the decomposition process no matter how much it is, and eventually that has impact on the hydrogen activation (soil PH)"

In conclusion, our results state that some plants matched with our hypothesis and make changes in the soil PH. Moreover, other plants did not make any changes. For further studies we could enlarge our study to investigate Families of plants instead of one plant. Or we could investigate the changes on the soil PH from day to night.

6. References:

- 1- A. McCauley, C. Jones, and J. Jacobsen, "Soil pH and organic matter," in *Nutrient Management Module*, vol. 8, Montana State University Extension, Bozeman, Mont, USA, 2009.
- 2- <http://pss.uvm.edu/ppp/pubs/oh34.htm>
- 3- Robson, A. (2012). *Soil Acidity and Plant Growth*. Elsevier Science. Retrieved from <https://books.google.com.sa/books?id=KL8gWPuOET0C>
- 4- Picture This app (<https://apps.apple.com/us/app/picturethis-plant-identifier/id1252497129>)

Additional badges:

1- cooperation:

The researchers cooperated with the GLOBE family in the school to do measurements and to collect the atmosphere and soil PH data daily using Atmosphere protocols, and soil protocols.

2-communication with a STEM specialist:

The researchers communicated Mr. Mohammed Mansour who is a chemist from King Fahad University Of Petroleum and Minerals (KFUPM), to answer some of their questions.

3- Society Impact:

This study was promoted by their appreciation to plants and their eager to help farmers to enhance their crops in order to give the society healthy organics goods.

4- Exploring STEM professions:

This study is related to some scientific profession such as ecologist and Botanist.