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RESEARCH ARTICLE

Impact of Coffee Ground on Ammonia Concertation

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Abstract:

Farmers should wait one week after spreading the composts until the ammonium concentration decreases. If the base component is too high, the plants could not grow well. If the soil is too acidic, the plants cannot grow well. This study will reveal the optimal ratio of compost and coffee ground, base and acid, respectively. First, I prepared nine different ratios of compost, coffee ground, and potting soil. Then, five kidney beans were grown on each of the pots. Since kidney beans are easy to grow and grow fast, experiments were done with the kidney beans. All the other variables, including humidity, temperature, and lighting, were regulated. By measuring the soil pH, and the height and area of the leaves, the coffee and compost ratio was quantified. Results show that an optimal coffee ground, compost, and soil combination should be 30-40-30 percent by weight. Furthermore, this study improves the ease of managing farms using coffee grounds and prevents the waste of the excessive amount of coffee residues being dumped every day.

Keywords: Coffee ground, Compost, Kidney beans

Introduction

Compost is one of the foremost necessary factors for agriculture. Composts made up of associational feces should be sprayed before plants are nurtured or cultivated to form a setting where the soil is fertile. However, if the ammonia gas within the compost is preserved within the ground and is not drained well throughout this method, the soil becomes toxic for plants to grow. This method takes a couple of weeks for all ammonia gas to discharge. To attenuate the time required, coffee dregs are used. Coffee is one of the most common drinks in the world. Daily consumption of coffee is over 2.2 billion cups worldwide, and over 23 million loads

of coffee waste square measure created per annum [1]. Also, 99.8 % of beans are disposed as garbage, and only 0.2 % are used for coffee extraction [2].

Coffee grounds are usually used for farming because of the following characteristics:

1. Chemical elements act as a crucial ingredient for agriculture. Coffee grounds are high in chemical element concentration. Amino acid, which consists of chemical elements, affects plant growth; plant growth is hindered with no organic compounds or chemical elements.
2. Coffee grounds promote microbial production, increasing soil fertility and ion-exchange capability (CEC). Microorganisms facilitate plants to urge nutrients, which is extremely arduous to obtain with no external offerings. Soil fertility and CEC offer essential nutrients and nutrient ions to the soil.
3. Coffee ground has the proper quantity of significant metal and Na concentration, creating a secure ingredient for organic compost. Coffee grounds are wealthy in chemical elements, orthophosphoric acid, potassium, etc. required for plants to grow; therefore intermixture soil and low grounds during a magnitude relation of 9:1 will function as fertilizers with high organic content.

The potential of hydrogen(pH) measures how acidic/basic water is. It varies from zero to fourteen, with seven as a neutral state. pH less than seven indicates acid, and pH greater than seven indicates a base. Compost is a breakable mass of unsound organic matter made up of rotten material used in farming and agriculture. Compost is vital for organic farming, used instead of artificial fertilizer. Compost sometimes has the characteristics of a base. Because of the ammonia inside the compounds, the land should be left for a couple of weeks to remove the toxins due to ammonia. The ideal pH for a plant to grow is during a vary of pH five.5 to 7.

This work aims to investigate an optimum composition of a combination of compost, coffee ground, and soil in agricultural applications. In section II, the materials and methods of the current study are delineated. Section III discusses the results from experiments. A combination of adequate compost and an adequate coffee ground will produce optimum growth necessities for plants. Additionally, it's expected to reduce the amount of abandoned coffee grounds and reduce the time spent on toxin removal.

Material and methods

I. Experiment methods

A. Materials.

The coffee residue is obtained from Starbucks in Yongin-si, Seoul, South Korea. Nine plant pots (10X10X15 cm), Compost (danong, 749912830000031404), and potting soil (Eco-garden, LO1368384532_1368384533) are used to grow plants. Kidney beans are well known as fast-growing plants. Kidney beans can be grown in about two months, and observe the process of growing leaves as soon as possible. Kidney beans were grown for 15days of the experimental period. A total of 45 kidney bean seeds were raised, and two seeds per pot were planted with a different mixture of coffee ground, compost, and soil. I controlled three major components

in this study such as coffee residue, compost, and soil. I measured the PH value of each mixture using a pH meter (IS09001). The pH value of the mixture strongly depends on the volume ratio of the ammonium substance of compost and acids of coffee ground. The growth of kidney beans will vary according to the ratio of the volumes of the two substances. Aside from the independent variables-coffee residue and compost-all the other conditions should be the same for all nine pots: the amount of water to each pot is 70 ml and is given once every two days. I maintained the temperature about 26-29 degrees in Celcius and the humidity about 60 percent. Also, the amount of sunlight on all the pots is assumed to be similar since the pots are left outside by the window simultaneously. First, I fill out each pot with 90 g of soil. Then put each five kidney bean seeds in the pots. After being watered with 30 ml of water, the pots are covered with coffee residue and compost. The ratio is like the table below. The experiment will be done with all nine pots.

Table 1. Coffee-compost-soil ratio of each pot

Coffee-Compost-Soil (wt ratio)	No compost	Low compost	High compost
No coffee residue	0%-0%-100% wt.	0%-10%-90% wt.	0%-25%-75% wt.
Low coffee residue	10%-0%-90% wt.	9%-9%-82% wt.	8%-23%-69% wt.
High coffee residue	25%-0%-75% wt.	23%-8%-69% wt.	20%-20%-60% wt.

If soil and dry coffee grounds are mixed at a ratio of 9:1, plants will grow well. Originally, coffee should be left for 2 to 3 days to remove acidic ingredients, but I intended to neutralize the basicity of fertilizer by leaving the acid ingredients intact. At this time, I wanted to adjust the amount of coffee and compare the amount when not mixed at all, when mixed in an appropriate amount, and when mixed in excess. Therefore, the ratio of soil to coffee was adjusted to 9:0, 9:1, and 9:3, and the ratio of soil to compost was varied with the same ratio. The experiment will be conducted for 15 days. Growth of the kidney beans and pH of the soil will be measured every two days also. pH will be measured by the IS09001 pH meter. Plant growth is measured by the average height of the five beans stalks and the average length and width of the largest and smallest leaf in the pot. Height of the kidney beans will be measured below. Starting from the soil surface, height will be measured till the end of the stalk. All figures were recorded according to significant figures rounded to decimal places.

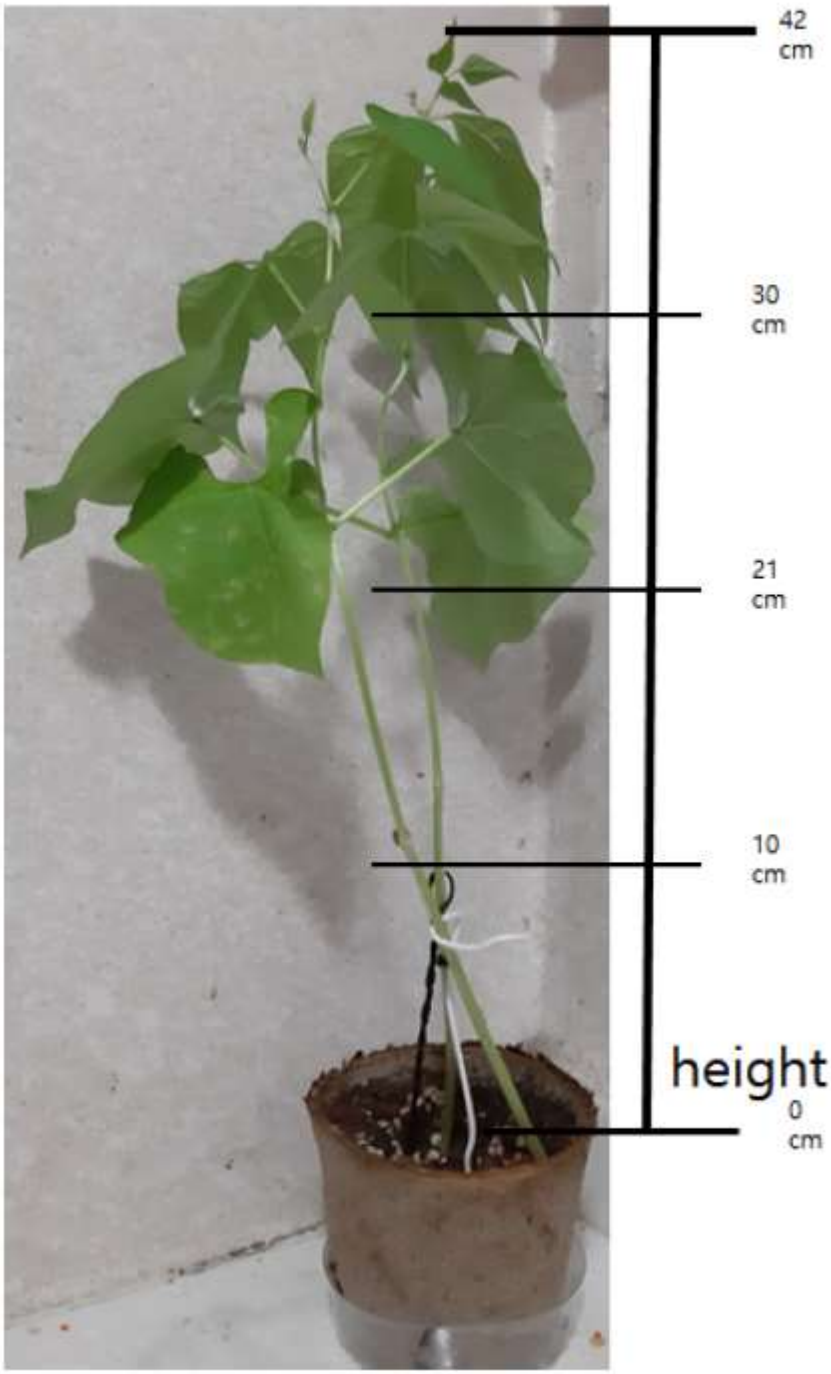

Figure 1. height measurement.

Results

Temporal change in pH

Initial pH of the soil was 7. Ph of the compost is 7.5 and the pH of the coffee residue is 5.5.

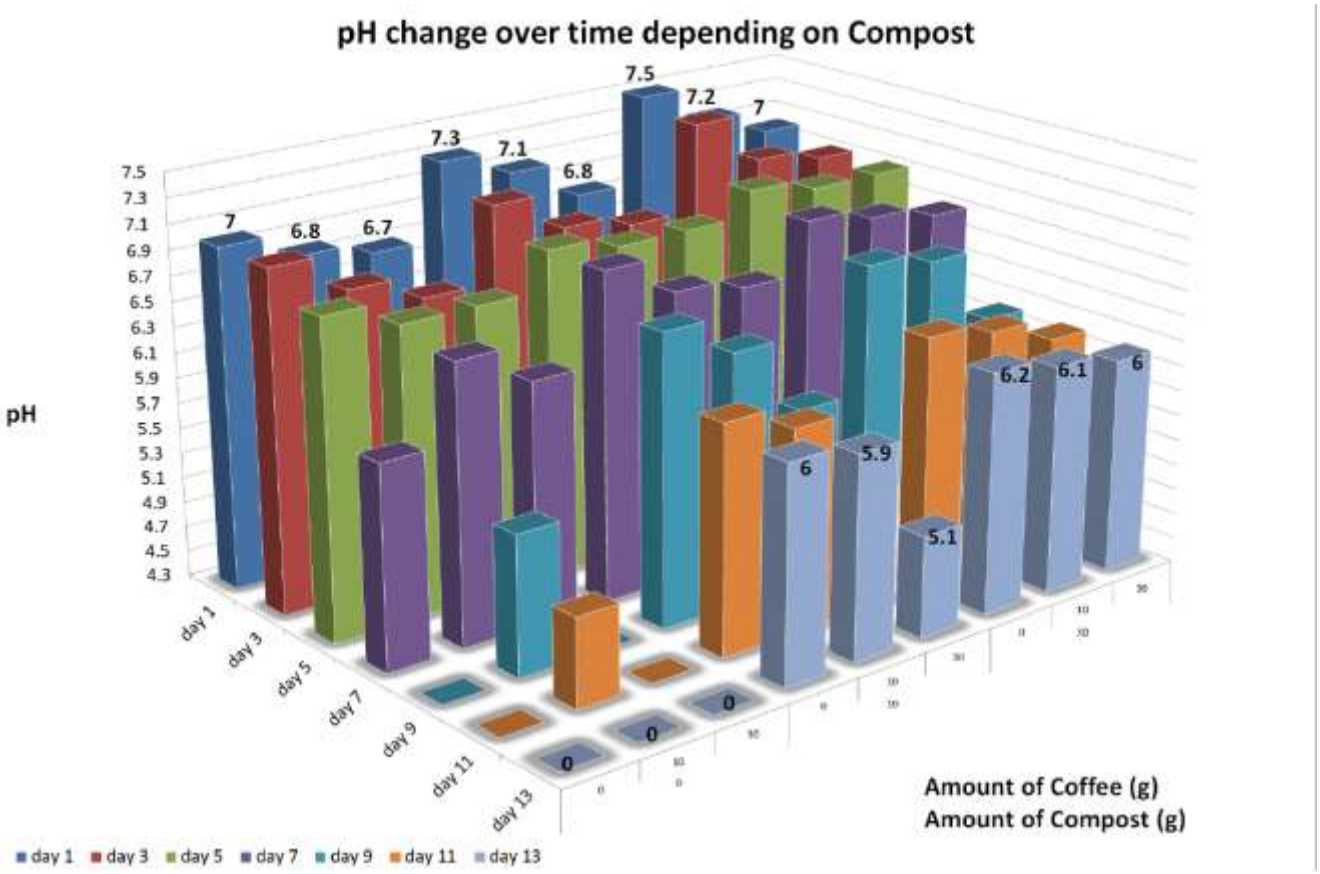

Figure 2. pH change over time depending on compost

When kidney beans died, the figure was marked as zero starting from that day. When the graph is drawn based on the amount of added compost, it can be seen that the pH of the soil is lower as the amount of fertilizer is small and the amount of coffee is higher. Looking at the initial pH, when the amount of compost was 0, the maximum pH was 7, and the minimum was 6.7. The pH was highest when the amount of added coffee was 0, and the pH was lowest when coffee was added to 30. As days went by, the pH dropped rapidly, and by day 9, the potted coffee of 0 and 30 died, and by day 11, the remaining potted coffee of 10 died, and all the pots with zero compost died. When the amount of compost was 10, the pH was lower as the amount of added coffee was increased, and the initial pH was up to 7.3 and at least 6.8. By Day13, the order of high and low pH did not change, but the pH of the pot with zero coffee was 6, and the pot with 10 was 5.9, and 30 was 5.1, indicating a significant difference depending on the amount of coffee. Similarly, when the amount of compost was 30, the higher the amount of coffee, the lower the pH, and the initial pH was up to 7.5, and the minimum was 7. By Day 13, the order of high and low pH did not change, but the pH of the pot with zero coffee was 6.2, and the pot with 30 was 6. On average, during the 13days growing period,

the pH decreases by 1.2. In addition, considering that the ideal pH for kidney beans to grow is 5.5 to 7, it can be seen that a certain amount of basic compost is recommended to neutralize the acidity of coffee. The reason why pots containing zero compost do not grow well is that there is no substance to prevent acidity. When compost is added by zero, it is impossible to cope with a phenomenon in which pH is rapidly lowered due to nitrification occurring as plants grow. Plants cannot withstand the lowered pH leading to the death of kidney beans. A pot with ten compost and 30 coffee is the only one whose pH drops below 5.5 because the amount of coffee is larger than that of fertilizers, so the acidity is higher than that of basic. Therefore, it can be seen that to use coffee and compost for farming, the amount of compost must be higher than coffee.

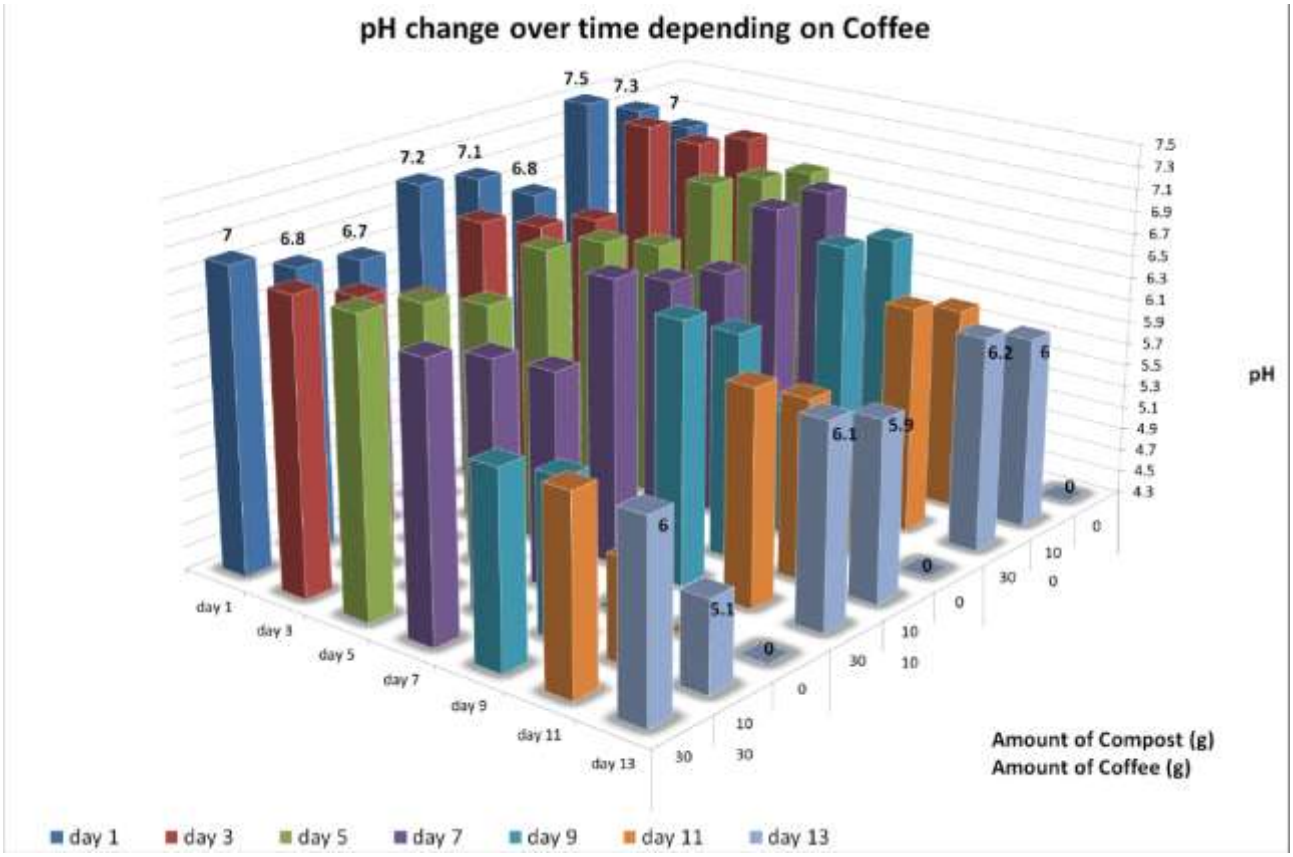

Figure 3. pH change over time depending on coffee ground/scrap/waste

When the graph is drawn based on the amount of coffee added, it can be seen that the pH of the soil is lower as the amount of coffee is larger and the amount of compost is smaller. Looking at the initial pH, when coffee is zero, the pH is the highest on average at up to 7.5 and at least 7. And when the coffee is 30, the pot has the lowest pH on average, with a maximum of 7 and a minimum of 6.7. As days passed, the pH gradually decreased due to the natural nitrification that occurs as plants grow. And starting on day 11, kidney beans in three pots die, all of which contain no compost. When coffee was contained as much as 0, the pH was higher as the amount of compost initially increased, and this order was maintained even when day 13. The more compost, the higher the pH. In the case of 10 coffee and 30 compost, the higher the amount of compost, the higher the pH, and this order was maintained until day 13. The more compost, the higher the pH. When Figure

2 and Figure 3 are combined, it can be seen that more effective differences can be seen in the graph drawn based on compost. When compost is 10 or 30, using coffee scraps less than compost can lead to practical agriculture. Since each other's acids and bases neutralize each other and provide additional nutrients, it can lead to the ideal soil condition for plants to grow.

Change of height

Initial height of all the kidney beans were zero centimeters.

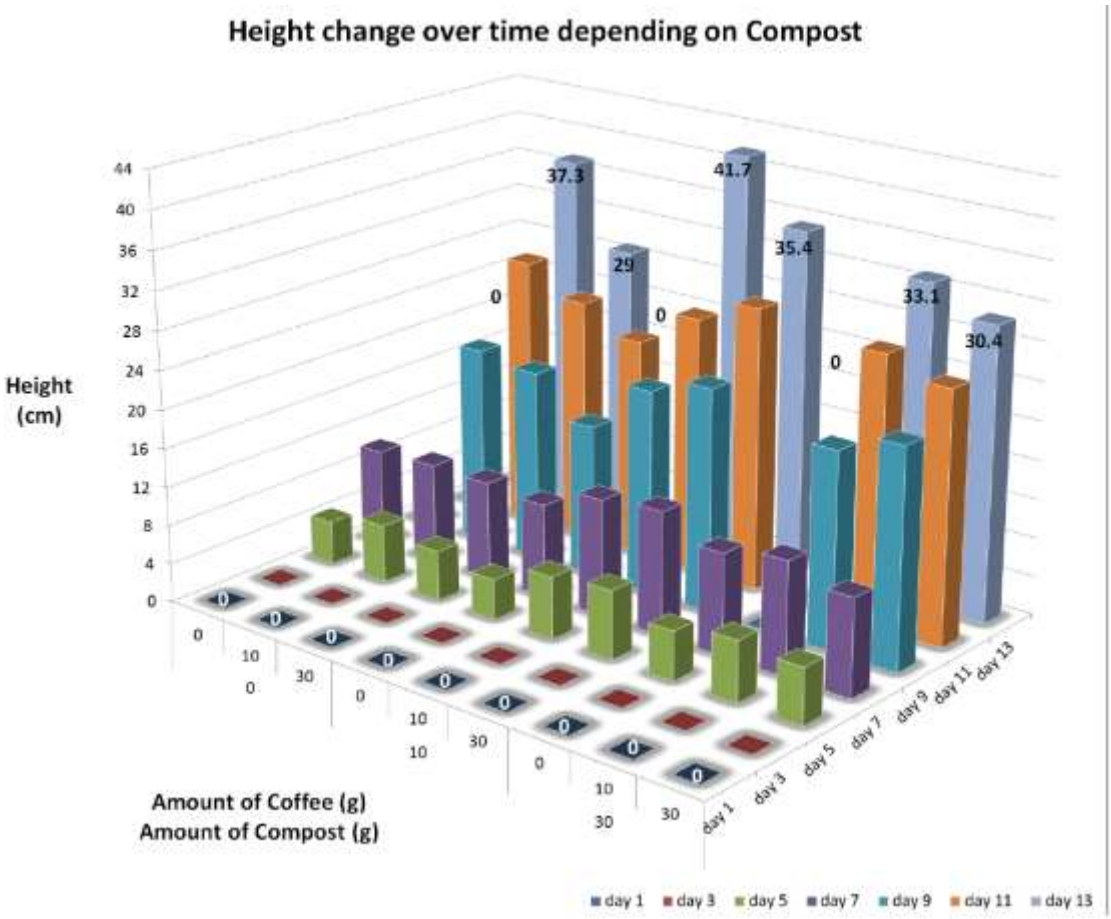

Figure 4. Height change over time depending on compost

If you draw a graph about the height of kidney beans based on compost, it appears as above. When kidney beans died, the figure was marked as zero starting from that day. It showed the best growth when the compost content was 10, followed by the fertilizer content of 0 and 30. It can be seen that pots with a compost content of 10 grow higher on average than other pots. When compost is zero, it does not neutralize the acidity of coffee, which adversely affects the growth of plants, and when it is 30, it is found that it affects the growth of plants with strong toxicity and basicity. Regardless of the compost content, the coffee content of 10 grew higher than that of 30. If the compost content was 0, the pot containing 10 coffee was about 8 cm higher than 30, and if the compost content was 10, the height difference was 6 cm, and if the compost was 30, the height difference was about 3 cm. Through this, it can be seen this.

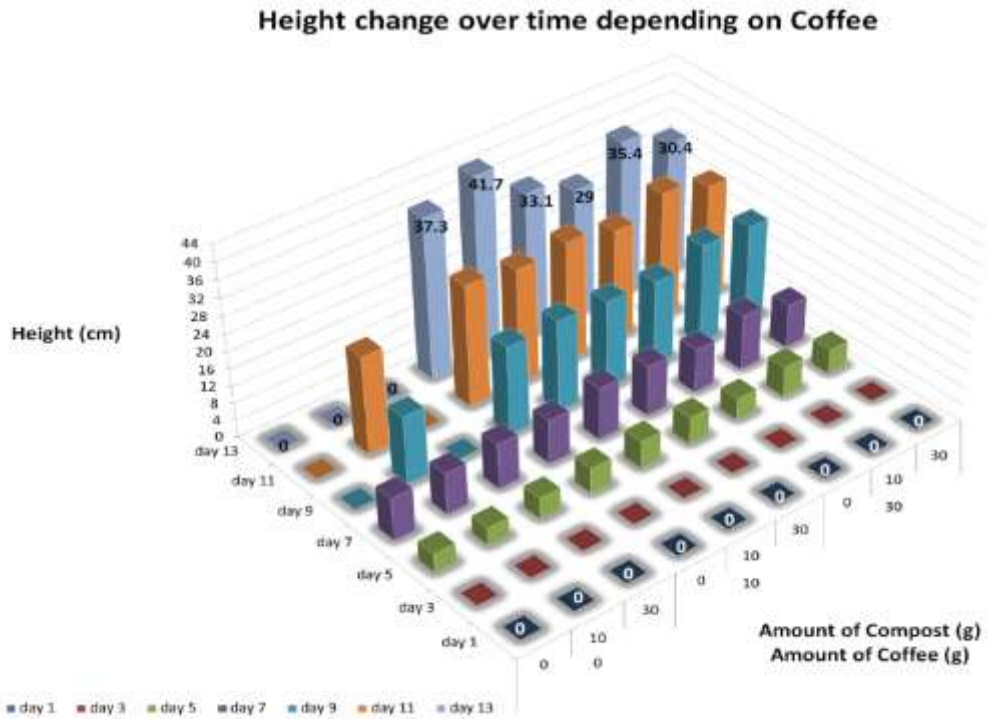

Figure 5. Height change over time depending on coffee

If you draw a graph based on coffee, it is as above. Likewise, when kidney beans die, the figure was marked as zero starting from that day. If the coffee content is 0, it can be seen that all of them died during the experiment. It can be seen that coffee did not neutralize toxins due to the basicity of compost, adversely affecting plant growth. In addition, it can be seen that kidney beans grew larger on average than when the coffee content was 10 or 30, which is due to the acidity in coffee. At 10, the acidity in coffee is an appropriate amount to neutralize the basicity of the compost, but at 30, it can be seen that the acidity in coffee is excessive and rather adversely affects plants. It can be seen that coffee grows the highest, especially when the ratio of fertilizer to coffee is 1:1 because coffee and compost neutralize each other, eliminate ingredients that adversely affect plants, and leave only good ingredients. Through his, it can be seen that the ideal soil: fertilizer: coffee for plants to grow is 9:1:1.

Conclusion and discussion

Compost is one of the most important factors for agriculture. Composts made from animal feces must be sprayed before plants are nurtured or cultivated to create an environment where the soil can be fertile. However, if the ammonia gas inside the fertilizer is preserved in the ground and is not drained well during this process, the soil becomes too toxic for plants to grow.

Coffee grounds are often used for farming due to the following characteristics. First, the coffee residue is high in nitrogen concentration. Nitrogen acts as an essential ingredient for agriculture. Amino acid, composed of nitrogen, positively affects plant growth; without amino acid or nitrogen, plant growth can be hindered.

Therefore, the ideal ratio of compost and coffee, which are factors that help plant growth, could be found through this experiment. To neutralize each other and leave only essential ingredients, the amount of fertilizer must be the same or

greater than the amount of coffee, and the ideal case is when the ratio is 1:1. In addition, it was possible to prove that the ratio of coffee to soil was the most appropriate at 1:9. Therefore, the ideal soil, coffee, and fertilizer ratio when growing plants is 9:1:1.

The acid and base cause a neutralization reaction, keeping the pH of the soil between pH 5.5 and pH 7 is the ideal degree for plants to live. This study will help reduce waiting time and promote plant growth if soil and coffee are matched by 9:1 for future farming and fertilizer equal to the number of coffee scraps. By this, farmers could gain more effective plant growth, and the waste of coffee ground will decrease. Future studies will include more tests with different soil, coffee and compost ratios. Also, experiments to identify the effect of each chemical composition in coffee grounds will be effective for growing plants.

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