BIOLOGY II

Fast Plant Experiment (2008)

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1. INTRODUCTION

All living organism or things have the capabilities and tendencies to grow, germinate or reproduce. However, the rate at which these living things develop or grow very well depends on certain conditions and these conditions can be categorized as biological, physical, chemical, environmental, etc. the environmental as well as chemical conditions include among others temperature, light, acidity (pH), weather season, humidity, soil type ,nutrients, etc . For instance, the growth or development of living thing such as human being can develop well under all the above conditions and these conditions sometimes become impediment to their growth when they are either being over or under used/exposed to these conditions.

Plants grow (the main subject matter for this experiment) very well under such conditions such as good soil, enough nutrients, moderate temperature, average acidity level of the soil, lighting condition, etc. Because we have different kind of plants and each plant does well under different condition individually, therefore the rate at which it grows fruitfully depend on the amount it has been exposed to the conditions. Thus, certain conditions might be suitable for plant A but not plant B, and vice versa but they will all grow well depending on the amount of the conditions they have been exposed to.

The Wisconsin fast plants which was the main plant used in the experiment is a type of crucifer (a large group of plants that includes mustard, radish, cabbage, and more) that have been bred and selected to have a uniform, short flowering time (14 days) and grow well under in a small indoor space, with little soil, under artificial lights. These Fast Plants are rapid-cycling Brassica

rapa plants that bred by Dr. Paul Williams bred as a research tool that could be used for improving disease resistance of cruciferous plants (a large group of plants that includes mustard, radish, cabbage, broccoli, kohlrabi, and more).

Therefore, the fundamental purpose of this experiment was to design and conduct research on how certain conditions affect the growth and development of plants by using controlled and experimental variables to investigate the hypothesis.

2. MATERIAL USED

The following materials below were used in this experiment;

a. Small quantity of Soil
b. 1 plastic water tray with lid
c. 1 pack of wicks
d. 1 plastic Ruler
e. Water
f. 16 Wisconsin Fast Plant Seeds
g. 1 Felt Water mat (or paper towel)
h. Salt
h. 1 anti-alga square
j. Sand

3. METHODLOGY

The experiment consisted of four sets of experimental planter pods with a set of four individual planters inside. These plants were to be compared to 16 individuals control plants.

The experiment setup consisted of a plastic container with a cover. This will serve as water reservoir to illuminate the need for constant watering. The cover has a rectangular hole cut towards one end to serve as an opening for inserting a large wick that will feed water to the Styrofoam planter on top. The planter was divided into eight sections with four individual wells for plants on each. Each hole had a smaller wick pulled through it so that about an inch will hang

out. After this, each planter was filled roughly half way with soil with a fertilizer pellet put into each one. After this the pods were filled with soil two seeds of Brassica rapa were placed into each planter. At this time the experimental factors were introduced to the soil. It was determined that two groups of planters would have the experimental factors mixed into the soil. One group had a teaspoon of road salt mixed directly into the soil while another had sand pulled directly from a nearby street to the other. The other experimental groups were planted exactly as the control groups. The remaining two experimental groups had the sand and salt variables introduced to a week later. The planters were labeled to with the experimental group with sand in the soil labeled group 4, the experimental group with salt in the soil labeled group 3, the soil with sand on the top labeled group 2 and finally the group with the salt on top labeled group 1

After all the preparation has been completed the plants were placed in a classroom where they are constantly lighten by a set of florescent lights.

After a week the two experimental groups that have not had anything introduced to them are altered. Each remaining group either had a tablespoon of salt or sand placed directly onto of the soil. Each planter is checked to see if any plants have grown, and since the experiment is to see the effect that these two elements have on plant growth no plants are transplanted into these pods. If any individual planters have more than one plant the other one is removed. The smallest plant in each planter was the one that was removed. The first measurements for the experiment were taken this day.

Until the end of the experiment, 2 sets of measurements and data were taken per week. The data recorded consist of the number of plants per pod, the height of all the plants in each pod, the number of leaves and flowers per plant. At the end of the data collecting the average height,

flower and leaf count were calculated for each day that the measurements taken and analysis made to investigate the hypothesis.

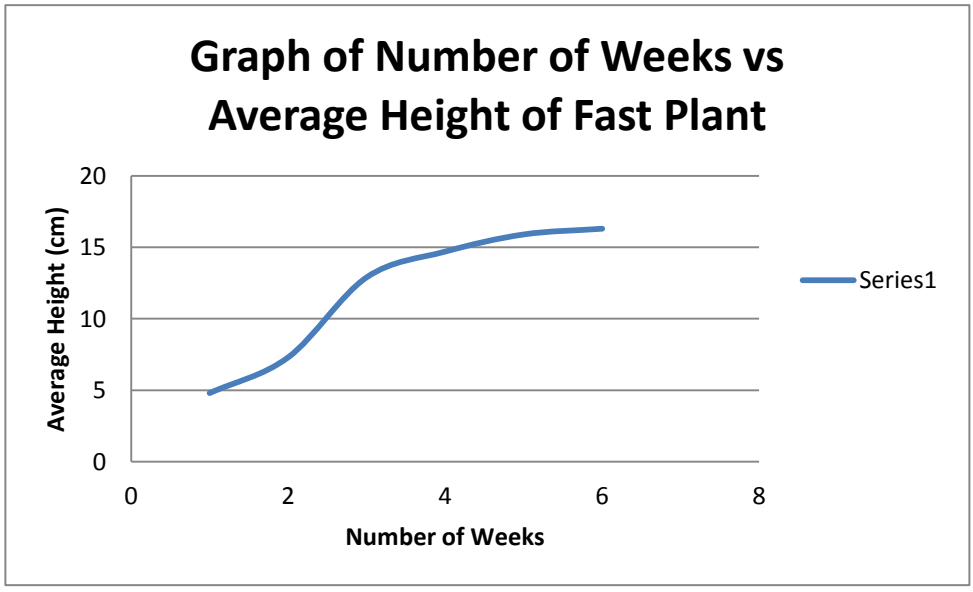
4. DATA ANALYSIS AND RESULTS

4.1: Control Group

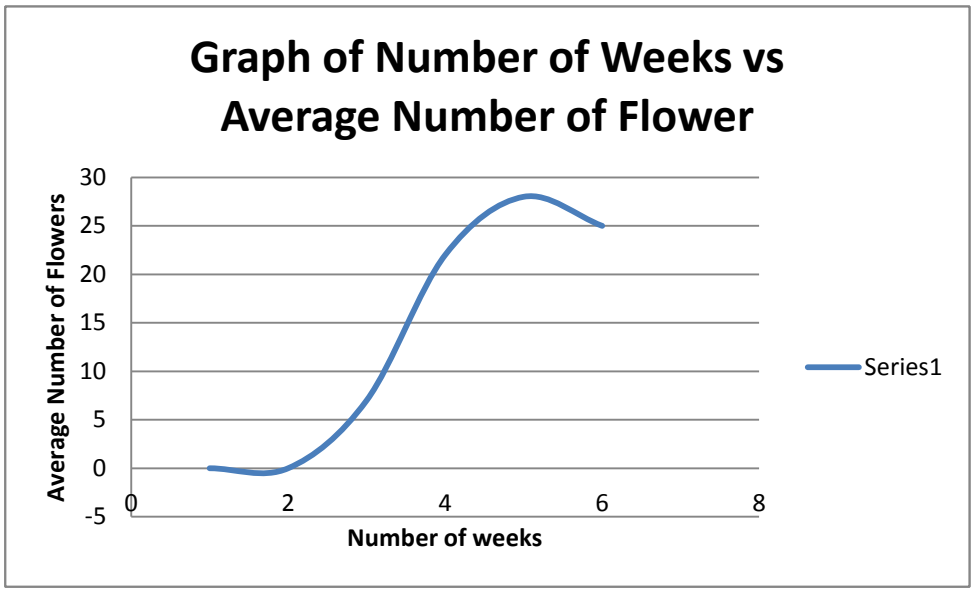
Table 1: Average Control Variable

Number of Weeks	***Average Number of Plants***	***Average Height***	***Average Number of Flowers***	***Average Number of Leaves***
1st Week	16	4.8	0	17
2nd	16	7.3	0	27
3rd	16	12.9	7	38
4th	16	14.7	22	39
5th	16	15.9	28	47
6th	15	16.3.	25	51

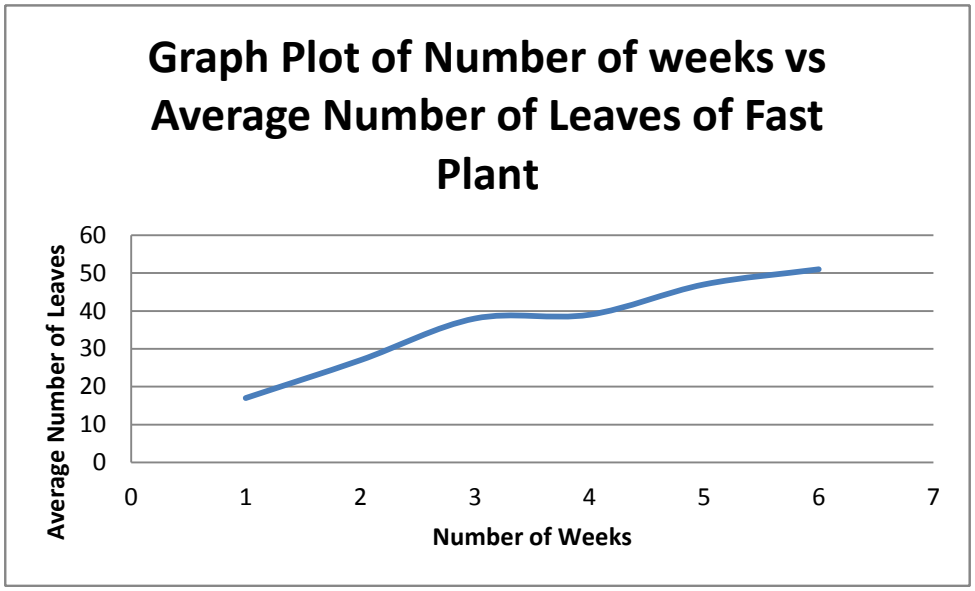
Graph 1: Number of Weeks vs Average Height



Graph 2: Number of Weeks vs Average Number of Flowers



Graph 3: Number of Weeks vs Average Number of Leaves

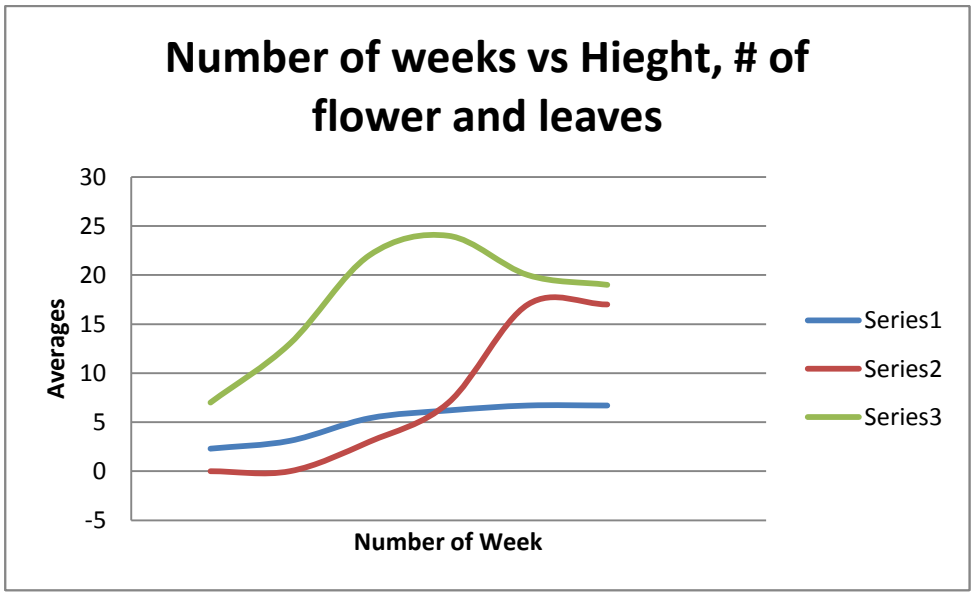


4.2: Experimental Variables
Experimental Group 1: Salt and Soil mixed at the beginning
Experimental Group 2: Sand and Soil mixed at the beginning.
Experimental Group 3: Salt added to the soil after the 1st Week.
Experimental Group 4: Sand added to the soil after the 1st Week

Table 2: Experimental Group 2 (Sand and Soil mixed at the beginning).

Number of Weeks	*Average Number of Plants*	*Average Height(cm)*	*Average Number of Flowers*	*Average Number of Leaves*
1st Week	4	2.3	0	7
2nd	4	3.1	0	13
3rd	4	5.4	3	22
4th	4	6.2	7	24
5th	4	6.7	17	20
6th	4	6.7	17	19

Graph 4: Number of Weeks vs Average Height for Experimental group2

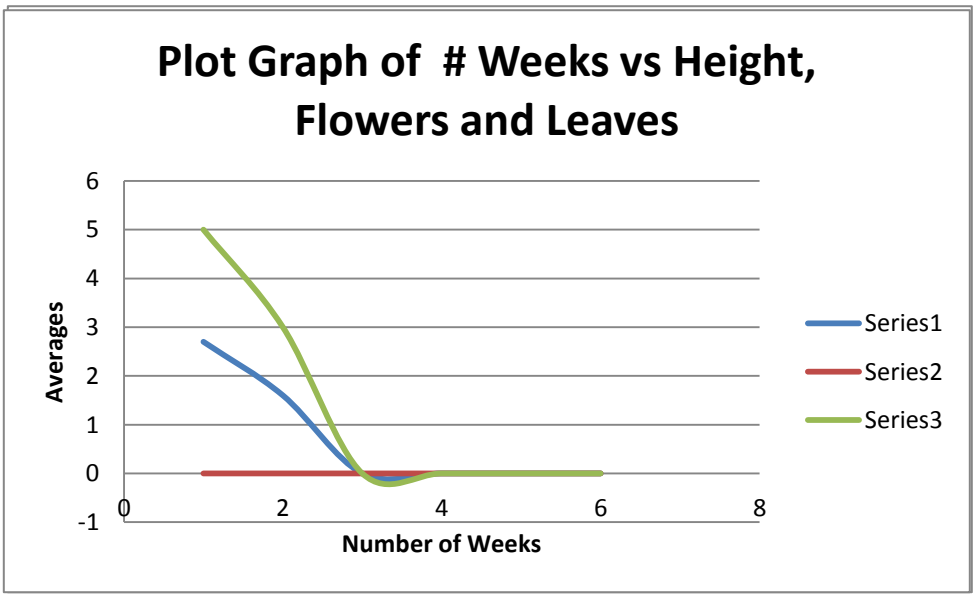


NOTE: ***Line Blue = Average Height***
Line Red = # of Flowers
Line Green = # of Leaves

Table 3: Experimental Group 3 (Salt added to the soil after the 1st Week).

Number of Weeks	*Average Number of Plants*	*Average Height(cm)*	*Average Number of Flowers*	*Average Number of Leaves*
1st Week	5	2.7	0	5
2nd	2	1.6	0	3
3rd	0	0	0	0
4th	0	0	0	0
5th	0	0	0	0
6th	0	0	0	0

Graph 5: Number of Weeks vs Average Height for Experimental group3

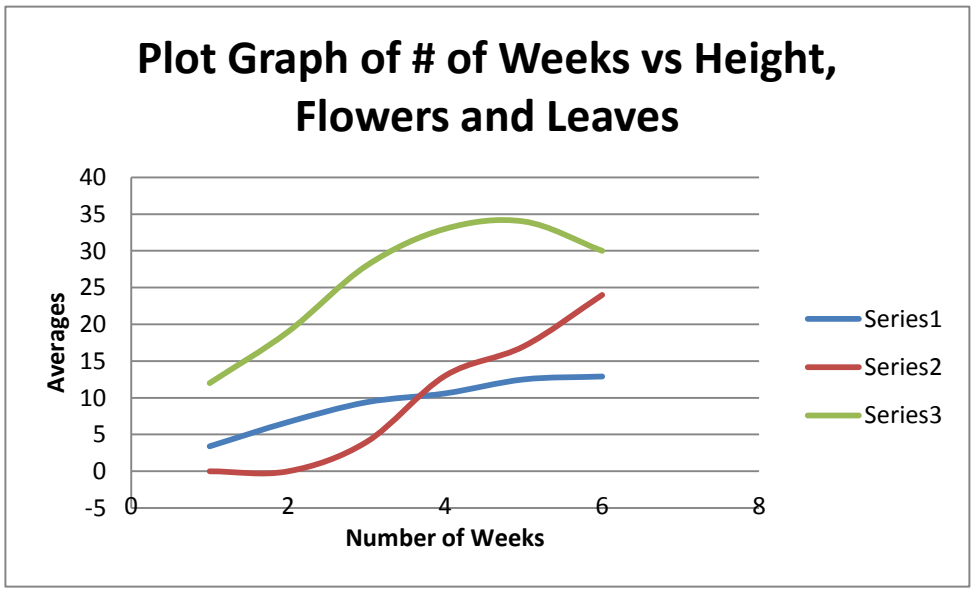


NOTE: ***Line Blue = Average Height***
Line Red = # of Flowers
Line Green = # of Leaves

Table 4: Experimental Group 4 (Sand and Soil mixed after 1st Week).

Number of Weeks	*Average Number of Plants*	*Average Height(cm)*	*Average Number of Flowers*	*Average Number of Leaves*
1st Week	7	3.4	0	12
2nd	7	6.7	0	19
3rd	7	9.4	4	28
4th	7	10.6	13	33
5th	7	12.5	17	34
6th	7	12.9	24	30

Graph 6: Number of Weeks vs Average Height for Experimental group4

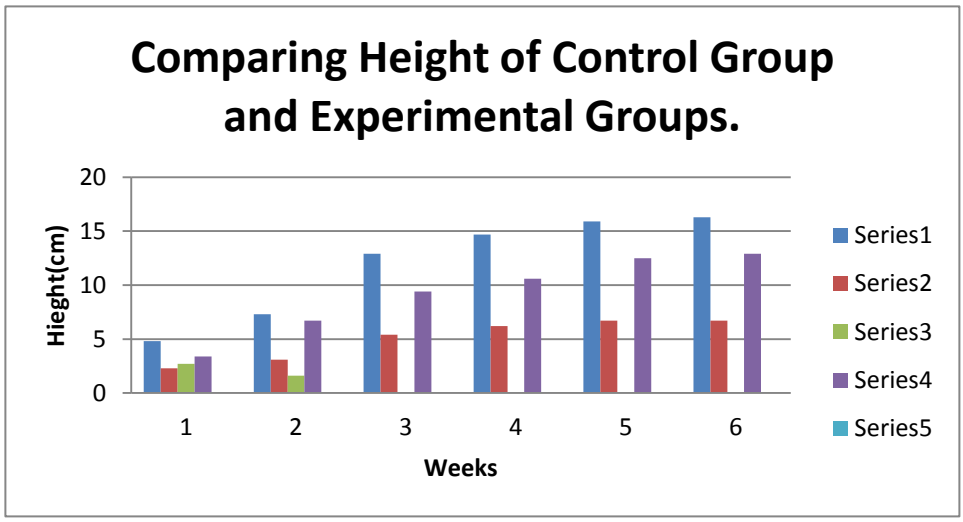


NOTE: ***Line Blue = Average Height***
Line Red = # of Flowers
Line Green = # of Leaves

NOTE: Fast plants did not grow at all in the Experimental group 1.

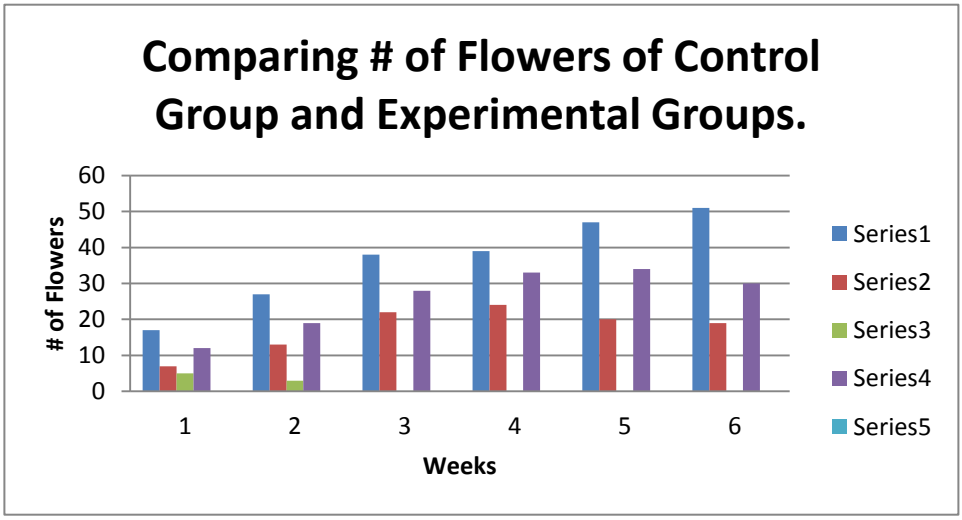
4.3: CONTROL GROUP vs EXPERIMENTAL GROUPS

Graph 7: Control Group (Height) vs Experimental Groups (Height

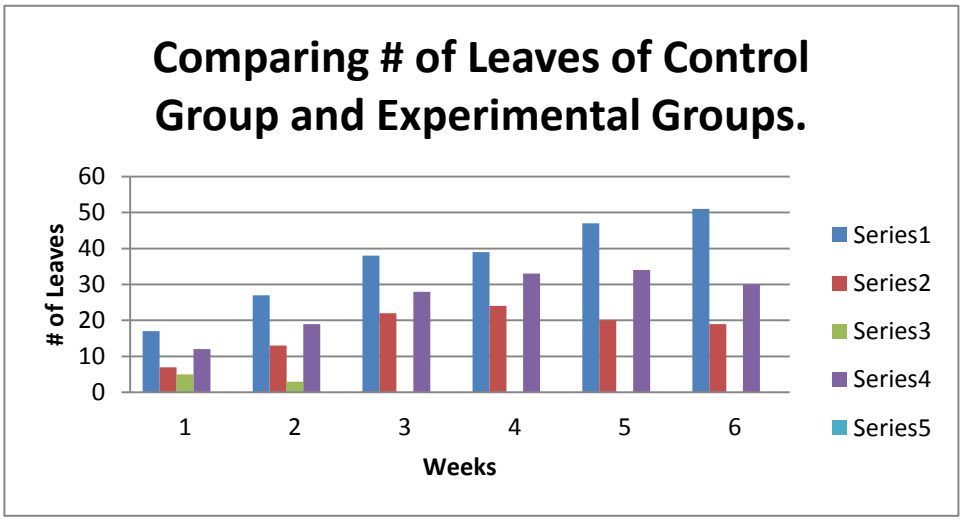


NOTE: ***Color Blue = Control Height***
Color Red =Experimental Group 2 (Height)
Color Green = Experimental Group 3 (Height)
Color Violet = Experimental Group 4 (Height)

Graph 8: Control Group (# of Flowers) vs Experimental Groups (# of Flowers))



Graph 9: Control Group (# of Leaves) vs Experimental Groups (# of Leaves)



4.4: Results

The results from this experiment indicate many findings. Based on the average of all height measurements collected, experimental group number 2 had the highest growth out of all of the experimental groups with an average height of 11.1cm(table 1) following after this group is control group 2 with an average height of 9.8cm. The third highest group was group 1 with an average growth of .3 cm. the last group was experimental group 3 with showed no growth throughout the experiment. None of the experimental groups exceeded the control group that averaged a height of 12cm throughout the experiment.

5. DISCUSSION

The analysis of the data and results revealed that there was vast significant impact on the growth of the fast plant by these two variables namely sand and salt. As the tables and the graphs depict, the control group germinated very flourish as compared to the experimental groups. The salt and sand which were used as the experimental variables did affect the growth of the fast plant in the experimental group.

5.1 Control Group;

Plants in the control group grew fruitfully. From the first week of the experiment, all the 16seeds which were planted began to grow with an average height of 4.8cm as well as 17 average numbers of leaves. These plants continued to grow without any hindrances throughout the six weeks of the experimental under the room temperature and also under the fluorescence light where they received and absorbed light from. They produced substantial amount of flowers between the 5^{th} and 6^{th} weeks. At the end of 6^{th} week, most of the plants have reached its maximum height, and bearing enough flowers and leaves, though some of them began to show some sign of receding (dying). The average number of flowers and leaves produced at the end of the 6^{th} were 21 and 51 respectively, and this, however signifies that the plants have grown well and have been fruitful with yellow flowers and green color leaves. The green color leaves also implies that the plants have been receiving good nutrients and other necessary element from the soil.

5.2 Experimental Groups

The experimental group was divided into four groups. The experimental group 1 contained salt and soils which were mixed together at the beginning before the seed was implanted in it. The experimental group 2 also contained sand and soil which were mixed together as well at the beginning before the seeds of the fast plant were implanted in it. The experimental group 3 is where salt is added to on top of the soil after the 1st week, and the experimental group 4 is also when the sand is added to the soil after the 1st week.

For the experimental group 1, no plants were able to grow. All the eight seeds planted did not grow. This signifies that the salt has a strong impact on the plant growth. The seeds did not get enough nutrients in the soil to grow because of the salt component. The presence of salt in the soil affect the plant by reducing the water uptake, restrict root growth, cause marginal burning of the foliage, inhibit flowering, limit seed germination, and reduce fruit and vegetable yields. The presence of the salt still affected the plants in the experimental group 3 as well. Within a week after the salt has been added to the soil in the experimental group, the plants which have already began to grow then started to die. Their color of their leaves and thickness of their stem showed that they were lacking some nutrients. This, however, proved the presence and effect of the salt on the plant growth. The figures and graphs above proved that. From the 5 number of planted germinated, it then reduced to 2 quantity and eventually they all died.

For experimental group 3 and 4, there wasn't any significant impact of the sand on the plant growth. With the mixture of sand and soil at the beginning, the plants were able to germinate. Also, as sands were added to the soil which already has germinated plants, these plants continued to grow. However when you compare the two experimental groups (2 and 4), there was a slightly

distinct difference between them in terms of the height and number of flowers and leaves. Though, all the plants in both experimental groups grew, those in the experimental group produced more plants with more substantial number of flowers and leaves than those in group 3. Besides, the rate of growth in group was also slower than in group 4. This, however showed that even though, the planted grew well, the presence of sand had a slightly effect on its growth. The presence of sand creates a faster draining soil so therefore the plants will need a lot of water; and without adequate water will eventually retard the plant growth. Also the sand will change the density of the soil.

5.3 Control Group vs Experimental Groups

The graphs and tables revealed that plants in the control group germinated very will than those in the experimental group. As graph 7, 8, and 9 depict in terms of height, number of flowers and leaves respectively, the control plants beard the greatest and largest amount of leaves and flowers, and also grew taller as compared to those plant in the experimental group. All the 16 seeds planted in the control were able to germinate and produce flowers. Only few plants (average 5) in the experimental group were able to grow; and even those which were germinated, some of them did not grow well to bear flowers and died along its life cycle. And those which survive did not grow tall and produce more flowers as compare with the control group. The figures above supported this; the average height of plants, number of flowers and leaves in the control group were 16.3cm, 25 and 51 respectively as compare to that of as 9.8cm, 20.5 and 24.5.

6. LIMITATIONS

Many factors could have affected the data recorded for this experiment.

Human error could of accord when deciding on the closest reading when performing height measurements. The ruler that was used could have been placed into the soil at different angles or depths that would have effected the proper height measurements. By having one person take all the measurements efforts were taken to remove any error created by having multiple people measuring the plants.

By handing the plants the scientist were also creating error that could have altered the recordings. The handling of the plant caused many flower petals to fall off which could have affected the data when it came to counting the number of flowers. The oils from human hands could also have affected the leaves of the plant by affecting their stomata.

Time also plays a factor in the results. One three occasions there was periods exceeding 4 days between sets of recording data. These periods happened between April 10th and April 16th, April 16th and April 23rd, and April 25th and April 30th. This result into a large peak in height recorded on the data recorded on April 23rd which goes exceeds the upward curve indicated on the graphs.

Elements of the experiment could also have factored the results. The constant source of fluorescent light could have effected overall height growth. Also the amount of water in the reservoir could have affected the health of the plant since it did fluctuate during the experiment.

CONCLUSION

It can therefore be inferred and concluded that the experimental variables namely the sand and salt had effect on the plant growth. The control plants grew very well than their experimental counterparts which were impeded by the presence of salt and sand. From the graph and tables, the average height of plant growth in the control group was 16.3cm at the end of sixth week whilst its experimental counterpart was 9.8cm. Also the amount of flowers produced in the control was much substantial than those in the experimental group. Thus, the amount flowers and leaves in the control were 25 and 51 respectively as against 20.5 and 24.5 in the experimental group. This, therefore, support the hypothesis that the presences of salt and sand have effect on the plant growth.