EFFECTS OF SOUND TOWARDS GROWTH IN PLANTS

CLASS : 3K1
GROUP : 2
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SUBJECT : BIOLOGY

Title : Effects of sound towards growth in plants

Objective : To study the effects of sound towards growth in plants.

Hypothesis : The presence of sound increases the rate of growth of a plant.

Variables

a) Manipulated : Presence of sound

b) Responding : Height of plant, diameter of plant stem, number of leaves, length of leaves

c) Constant : Type of plant, size of green beans, amount of sunlight and water

Materials : 20 pieces of green beans, tissue paper and water

Apparatus : 2 plastic containers, sieve, ruler, thread and pre-recorded audio of death metal music, classical music, positive speech, negative speech and verses of the Quran

Technique :

1. A piece of thread and ruler is used to measure the diameter of the stem. The thread is coiled around the stem once and the length of the thread is measured to find the diameter of the stem.
2. The green beans seeds are placed in the containers with appropriate distance between them to decrease competition between the seedlings.
3. The music played for all the seedlings of the different students are played at the same volume.

Procedure :

1. 20 pieces of green beans are put in a bowl.
2. The green beans are immersed in water overnight.
3. The water is removed using the sieve.
4. Two plastic containers are labelled as A and B.
5. Tissue paper is put in each plastic container.
6. Some water is sprinkled inside both the plastic containers.
7. 10 pieces of the green beans are put into each plastic container. Both plastic containers are kept in the same area with adequate amount of sunlight and water every day.
8. Plastic container B is kept without music as the controlled plant and plastic container A is kept with music playing for 3 hours every day.
9. Student 1 used classical music, student 2 used positive speech, student 3 used death metal music, student 4 used negative speech and student 5 used verses of the Quran.
10. The following changes are observed every day for 10 days:
    a) The height of the plant
    b) The diameter of the plant stem
    c) The number of leaves
    d) The length of the leaves

e) Any observable changes

11. All the observations are tabulated.
12. Two graphs are plotted:
    a) bar chart of the height of the plant against the presence of sound
    b) line graph of the height of the plant against the number of days
13. The rate of plant growth for 10 days is calculated.

Result and observation:

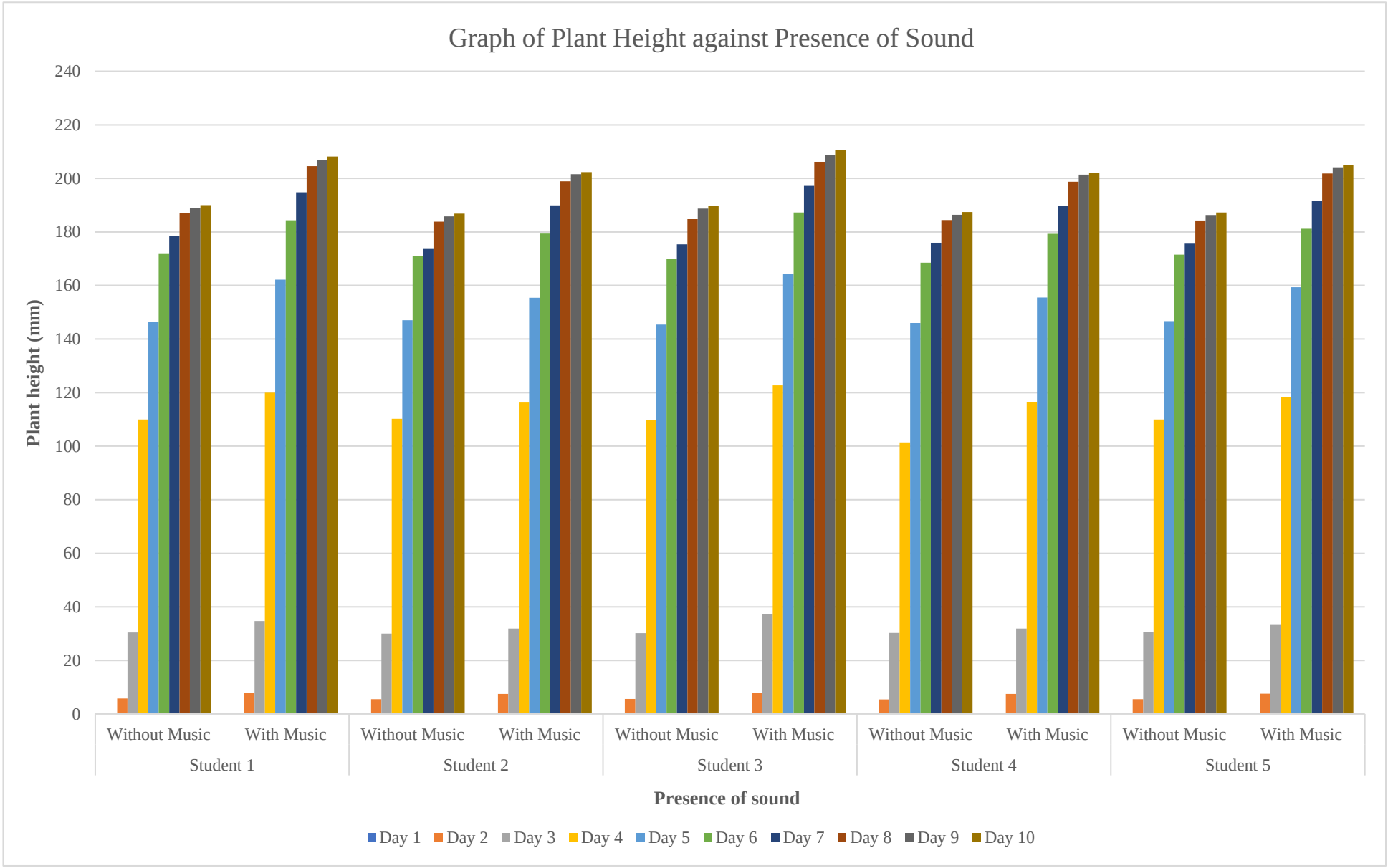
			Student					
Day	Presence of sound	Features observed (average of each student)	1 Classical music	2 Positive speech	3 Death metal music	4 Negative speech	5 Verses of the Quran	Average
Day 1	With music	Height of plant (mm)	0	0	0	0	0	0
		Diameter of stem (mm)	0	0	0	0	0	0
		Number of leaves	0	0	0	0	0	0
		Length of leaves (mm)	0	0	0	0	0	0
		Any observable changes	Seed coat breaks a little during germination and radicle emergence on the seed surface					
	Without music	Height of plant (mm)	0	0	0	0	0	0
		Diameter of stem (mm)	0	0	0	0	0	0
		Number of leaves	0	0	0	0	0	0
		Length of leaves (mm)	0	0	0	0	0	0
		Any observable changes	Seed coat breaks a little during germination and radicle emergence on the seed surface					
Day 2	With music	Height of plant (mm)	7.7	7.47	7.9	7.45	7.6	7.62
		Diameter of stem (mm)	2.65	2.3	3	2.35	2.5	2.56
		Number of leaves	0	0	0	0	0	0
		Length of leaves (mm)	0	0	0	0	0	0
		Any observable changes	Partial breaking of seed coat during germination and roots exhibit positive geotropism					
	Without music	Height of plant (mm)	5.8	5.5	5.6	5.4	5.5	5.56
		Diameter of stem (mm)	2.15	1.95	2.1	2.2	2	2.08
		Number of leaves	0	0	0	0	0	0

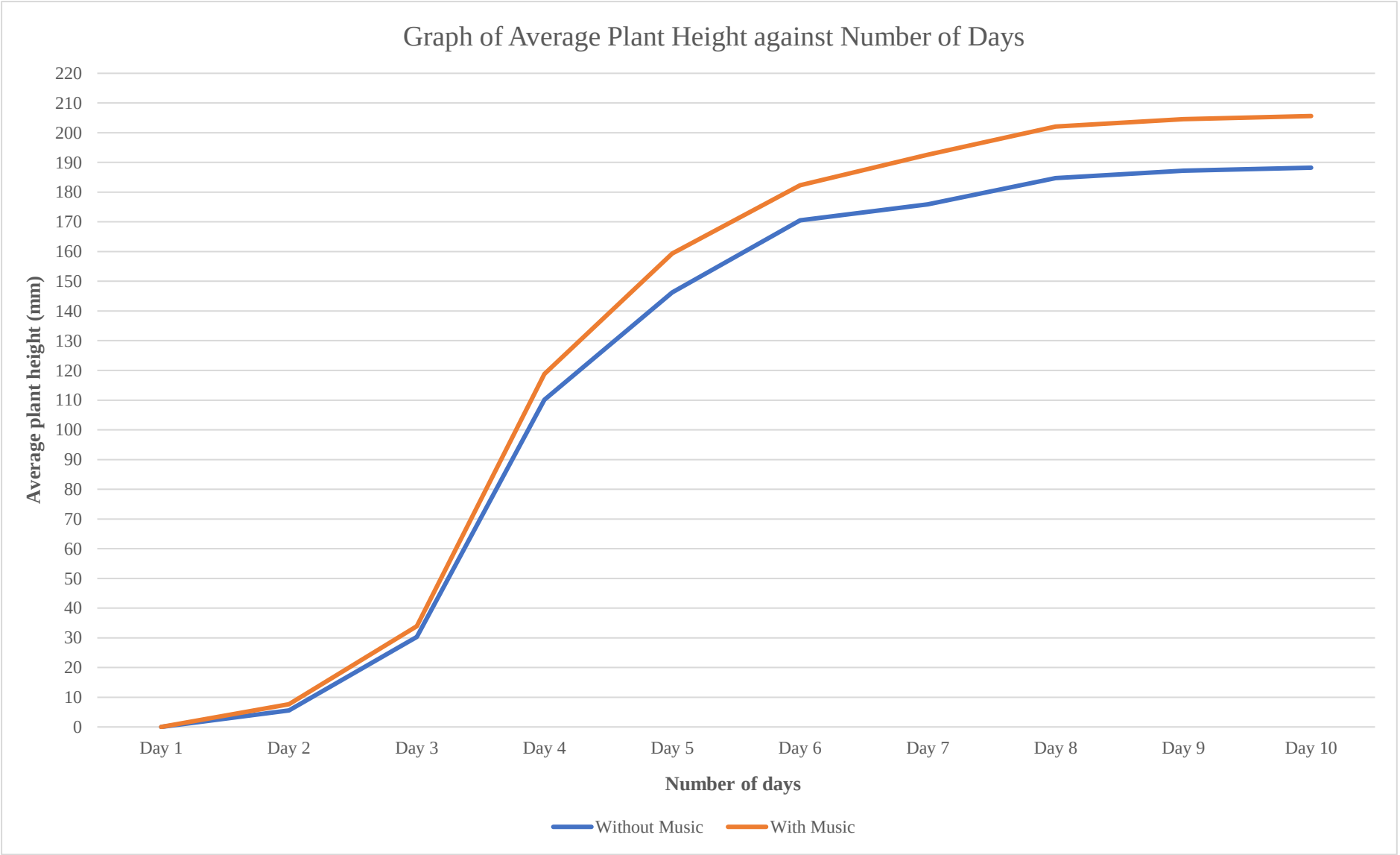
		Length of leaves (mm)	0	0	0	0	0	0
		Any observable changes	Partial breaking of seed coat during germination and roots exhibit positive geotropism					
Day 3	With music	Height of plant (mm)	34.7	31.87	37.3	31.92	33.55	33.87
		Diameter of stem (mm)	5.3	4.8	5.6	4.75	5.1	5.11
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	13.3	12.7	13.7	12.8	13	13.1
		Any observable changes	Seedlings emerge exhibiting negative geotropism and leaves start to grow					
	Without music	Height of plant (mm)	30.4	30	30.2	30.3	30.5	30.28
		Diameter of stem (mm)	4.3	4.2	4.1	4	4.2	4.16
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	12.2	12.1	12.3	12.25	12.1	12.19
		Any observable changes	Seedlings emerge exhibiting negative geotropism and leaves start to grow					
Day 4	With music	Height of plant (mm)	120	116.3	122.7	116.5	118.3	118.76
		Diameter of stem (mm)	7	6.55	7.4	6.57	6.7	6.84
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	23.5	22.3	24	22.2	22.9	22.98
		Any observable changes	Seedlings exhibit positive phototropism					
	Without music	Height of plant (mm)	110	110.2	109.9	110.4	110	110.1
		Diameter of stem (mm)	5.6	5.55	5.5	5.8	5.9	5.67
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	20.75	21	20.8	20.7	20.8	20.81
		Any observable changes	Seedlings exhibit positive phototropism					
Day 5	With music	Height of plant (mm)	162.17	155.4	164.2	155.5	159.35	159.32
		Diameter of stem (mm)	8.73	8.39	8.9	8.39	8.5	8.58
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	27.85	23.2	30.9	23.3	25	26.05
		Any observable changes	Cotyledon are shriveled					
	Without music	Height of plant (mm)	146.33	147	145.4	146	146.7	146.29

		Diameter of stem (mm)	6.38	6.32	5.95	6	6.3	6.19
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	26.1	25.6	25.4	25.8	25.65	25.71
		Any observable changes	Cotyledon are shriveled					
Day 6	With music	Height of plant (mm)	184.33	179.4	187.25	179.3	181.2	182.3
		Diameter of stem (mm)	9.85	9	10.2	9.05	9.45	9.51
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	31.1	27.8	33.2	27.7	29.4	29.84
		Any observable changes	Root is longer and root hairs are visible					
	Without music	Height of plant (mm)	172	170.9	170	168.5	171.3	170.54
		Diameter of stem (mm)	7.63	7.45	7.2	8	7.34	7.52
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	27.75	26.7	26.22	27.34	26.1	26.82
		Any observable changes	Root is longer and root hairs are visible					
Day 7	With music	Height of plant (mm)	194.8	189.9	197.2	189.7	191.6	192.64
		Diameter of stem (mm)	10.8	10.1	11.3	10	10.4	10.52
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	33.6	30.05	35.1	30.1	31.5	32.07
		Any observable changes	Cotyledons have fallen off the seedlings					
	Without music	Height of plant (mm)	178.6	173.9	175.4	176	175.65	175.91
		Diameter of stem (mm)	8	7.9	7.5	8.3	7.6	7.86
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	28.68	27.9	28.3	28.8	28.55	28.45
		Any observable changes	Cotyledons have fallen off the seedlings					
Day 8	With music	Height of plant (mm)	204.6	198.87	206.2	198.76	201.8	202.05
		Diameter of stem (mm)	12.73	9.75	13.7	9.8	11.2	11.44
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	36.06	32.2	38.9	32.15	34.88	34.84
		Any observable changes	Some leaves of the seedlings are wrinkled					

	Without music	Height of plant (mm)	187	183.8	184.75	184.4	184.3	184.75
		Diameter of stem (mm)	8.63	8.7	9	8.8	8.7	8.77
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	30.5	31.1	30.2	30.8	31	30.72
		Any observable changes	Some leaves of the seedlings are wrinkled					
Day 9	With music	Height of plant (mm)	206.9	201.6	208.7	201.4	204.1	204.54
		Diameter of stem (mm)	13.05	10.2	14	10.3	11.6	11.83
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	37.53	33.6	39.3	33.7	36.2	36.07
		Any observable changes	Seedlings exhibit higher positive phototropism					
	Without music	Height of plant (mm)	189	185.8	188.7	186.4	186.3	187.25
		Diameter of stem (mm)	8.93	9	9.1	9.3	9	9.07
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	31.5	32	31.3	31.8	32	31.72
		Any observable changes	Seedlings exhibit higher positive phototropism					
Day 10	With music	Height of plant (mm)	208.15	202.3	210.45	202.2	205	205.62
		Diameter of stem (mm)	13.25	10.5	14.2	10.4	11.8	12.03
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	38.1	34.2	39.7	34.2	36.6	36.56
		Any observable changes	Leaves are not wrinkled and are back to original shape					
	Without music	Height of plant (mm)	190	186.8	189.7	187.4	187.3	188.24
		Diameter of stem (mm)	9.1	9.3	9.4	9.45	9.2	9.29
		Number of leaves	2	2	2	2	2	2
		Length of leaves (mm)	32	32.5	31.8	32.2	32.1	32.12
		Any observable changes	Leaves are not wrinkled and are back to original shape					

Graph:


Graph of Plant Height against Presence of Sound
Plant height (mm)
240
220
200
180
160
140
120
100
80
60
40
20
0
Without Music
With Music
Student 1
Student 2
Student 3
Student 4
Student 5
Presence of sound
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8
Day 9
Day 10


Graph of Average Plant Height against Number of Days
Average plant height (mm)
220
210
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
Day 1
Day 2
Day 3
Day 4
Day 5
Day 6
Day 7
Day 8
Day 9
Day 10
Number of days
Without Music
With Music

Rate of plant growth with presence of music:

$$\frac{0 + 7.62 + 33.87 + 118.76 + 159.32 + 182.3 + 192.64 + 202.05 + 204.54 + 205.62}{10}$$

$$= 130.67\ mm/day$$

Rate of plant growth without presence of music:

$$\frac{0 + 5.56 + 30.28 + 110.1 + 146.29 + 170.54 + 175.91 + 184.75 + 187.25 + 188.24}{10}$$

$$= 119.892\ mm/day$$

Discussion :

1. The green beans in plastic container A that are exposed to music show a greater increase in plant growth compared to the green beans in plastic container B that were not exposed to music. This shows that sound can stimulate the plants to grow faster.
2. Different sounds stimulate the plants to grow at different rates. The plant growth from the highest rate to the lowest rate are as follows:
   a) The green beans in container A of student 3 which was exposed to death metal music.
   b) The green beans in container A of student 1 which was exposed to classical music.
   c) The green beans in container A of student 5 which was exposed verses from the Quran.
   d) The greens beans in container A of student 2 and 4 which was exposed to positive speech and negative speech that grew at the same rate.
3. The greens beans in container B of all the students that were not exposed to any sound grew at a slower rate compared to the plants exposed to sound.
4. Sound can stimulate the plants to grow faster because the vibration of the sound waves affects the plants. Plants transport nutrients, protein and organelles in their fluids which are cytoplasm through a process called cytoplasmic streaming. The vibration of certain types of music and sound will help stimulate this process.
5. When the cells are stimulated by the sound and the process happens at an increased rate, nutrients move throughout the plant body quicker, promoting new growth and strengthening their immune system.
6. In nature, plants may grow at a quicker rate around bird songs and areas with strong breezes.
7. Some leaves of the seedlings were wrinkled on day 9 due to lack of water. After seedlings were watered sufficiently, they began to revert to their original shape.

Conclusion : The hypothesis is accepted. The presence of sound increases the rate of growth of a plant.

Scientific attitudes while conducting experiment :

1. Having interest and curiosity towards the environment
   a) Interest is shown and particular attention is paid to the growth of the green beans
2. Being honest and accurate in recording and validating data
   a) A truthful report of observations is given and data recording is accurate
3. Being diligent and persistent when carrying out a task
   a) Being persevere and determined
   b) Tasks are carried out carefully and wholeheartedly
4. Having critical and analytical thinking
   a) Suggestions and conclusions are based on evidence
   b) Information is analysed and evaluated
5. Being systematic
   a) Investigation is conducted using step-by-step procedures with cause and effect