Plants on Acid

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Introduction

The Fast Plants experiment involved the experimentation with the *Brassica Rapa* seed. This seed has been genetically altered to facilitate seed growth in just 35 days. This makes the seed an excellent choice for testing a hypothesis on plant growth. It is also a very helpful tool in studying biology and genetics because multiple generations of a plant seed can be observed. The seed typically produces flowers after 14 days and grows to an average height of 13 cm by this time. Between the 40th and 42nd days, seeds can be expected to be harvested.

In our experiment, we chose to examine the effects of hormones on plant growth. We selected Absiscic Acid and Gibrilic Acid for our experiment. Absiscic Acid is a growth inhibitor and works to severely inhibit plant growth. According to www.plant-hormones.info/abscisic_acid.htm, it "stimulates the closure of stomata" which effectively inhibits plant growth. Contrarily, Gibrilic Acid is a growth stimulator and promotes abnormal and excessive plant growth. Just a few drops of Gibrilic Acid, "applications of very low concentrations can have a profound effect" (http://www.cefg.org/fallow/gibberellic.html) on the intensity of plant growth. We therefore set up plant boxes and planted *Brassica Rapa* seeds and set up three experiments, one box with absisacic acid nurturing the seed, one box with gibrilic acid nurturing the seed, and a control box with no hormones but solely water helping the plant grow.

From this, we hypothesized that the gibrilic acid would elongate stem growth, stimulate seed generation, increase the diameter of the stem, and stimulate seed germination. The absiscic acid would have the effect of stunting plant growth.

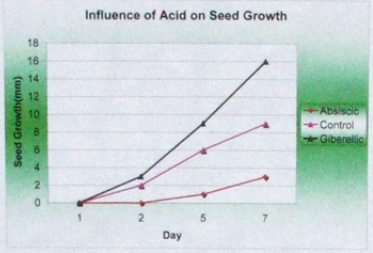
Seed Growth: day 2

Absiscic

Control

Gibberellic

Influence of Acid on Seed Growth



From Table 2

Materials and Methods

The process of testing the effects of hormones on Brassica rapa seeds began with the observation of the seeds in the first week. Three sets of seeds were placed on a moist piece of filter paper inside a Petri dish. The Petri dishes were placed in a bowl with water to keep the seeds moist. The first Petri dish was used as a control and a drop of water was added on top of each seed. The second dish was treated by the hormone Gibberellic Acid. A drop of Acid was placed on each seed every other day. The third Petri dish was affected by Absiscic Acid. Like the other dishes every other day one drop of acid was put on each seed. These seedlings were observed for a week until they out grew the Petri dishes. Each observation collected the average height of the plants in mm for each treatment.

Along with the observations from the Petri dishes Observations were drawn from seeds planted in quads and grown under constant florescent lights. Three quads were prepared and each with a wick then potting soil, two fertilizer pellets more soil and then three brassica rapa seeds. Finally another layer of soil was added and then the plants were affected by treatment. All three quads were placed on a water mat that was placed on top of a bin filled with water so that the mat would stay moist. Then the three quads were treated. 5ml of water was added to each section of the control quad. 5 ml of Gibberellic acid was added to each section of the second quad and finally 5 ml of absiscic acid was added to each section of the third quad. The plants were observed and treated every two to three days. Heights of the tallest and shortest plant were measured in each quad and averaged

Results

The three quads and three Petri dishes that grew the fast plants having been watered with water, absiscic acid or gibberellic acid grew at different rates. The average measurement by the end of lab on day 1 was 0 millimeters for all the seeds. By day 2, the seeds watered with absiscic acid had not grown at all, the seeds with only water had grown on average so 2 millimeters from seed to the point farthest away and the seeds affected by gibberellic acid had grown to 3 millimeters. On day 3, the seeds with absiscic acid had grown to 1 millimeter, the water seeds to 6 millimeters and the gibberellic seeds to 9 millimeters. On the last day, day 7 the seeds had grown to 3 millimeters, 9 millimeters and 16 millimeters in the absiscic, water and gibberellic seeds respectively. These results are shown in Figure 2.

The plants in the quads were observed about 4 times as long as the seeds in the Petri dishes. On day one none of the quads had shown any growth. By day two the quad with absiscic acid had an average of 1 millimeter of growth, the water quad showed 2.5 millimeters of growth and the gibberellic quad showed 4.5 millimeters of growth average. On day 5 the quads showed 1.5 millimeters, 10.5 millimeters and 18.5 millimeters of growth in the absiscic, water and gibberellic quads respectively. On day 7 the quads showed 9.5 millimeters, 40.5 millimeters and 43 millimeters of growth in the absiscic, water and gibberellic quads respectively. On day 11 the quads showed 14 millimeters, 65 millimeters and 62.5 millimeters of growth in the absiscic, water and gibberellic quads respectively. On day 14 the quads showed 22 millimeters, 94.5 millimeters and 97.5 millimeters of growth in the absiscic, water and gibberellic quads respectively. On day 18 the quads showed 40 millimeters, 120 millimeters and 120 millimeters of growth in the absiscic, water and gibberellic quads respectively. On the last day (day 26) the absiscic quad showed an average of 112.5 millimeters of growth, the water quad showed 125 millimeters of growth average and the gibberellic quad showed 170 millimeters of growth. These numbers are represented in Figure 1.

Unsurely, though the plants grew at different rates, at least 1 of the 4 plants in each quad had grown leaves and started to grow small blossoms. Furthermore, the gibberlic quad and the water quad each had 1 plant of 4 that grew up to the light (170 mm high). By the end of the time this may had stunted the growth of the plants in the gibberlic acid and 1 of the plants in the water quad because they had no place to keep growing.

Quad Measurements
Average Plant Height (mm)

Day	Absisic		Control		Giberellic	
	Tallest	Shortest	Tallest	Shortest	Tallest	Shortest
1	0	0	0	0	0	0
2	2	0	5	0	7	2
5	3	0	16	5	27	10
7	18	1	45	36	48	38
11	25	3	90	40	45	80
14	30	14	132	57	125	70
18	60	26	170	70	155	85
26	150	75	170	80	170	170

Day	Absisic	Control	Giberellic
1	0	0	0
2	1	2.5	4.5
5	1.5	10.5	18.5
7	9.5	40.5	43
11	14	65	62.5
14	24	94.5	97.5
18	40	120	120
26	112.5	125	170

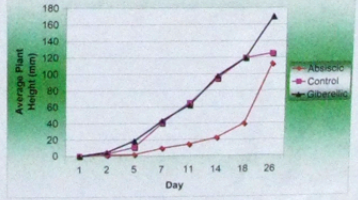
Table 1

Petri Dish Measurements
Seed Growth (mm)

Day	Absisic	Control	Giberellic
1	0	0	0
2	0	2	3
5	5	6	9
7	5	9	16

Table 2

Influence of Acid on Plant Growth



From Table 1

Conclusion

The hypothesis of this experiment was a supported by the results. As hypothesized and seen in the results from the Petri dish part of the experiment the seedlings affected by the Gibberellic acid showed accelerated growth in the first week and possible stimulated seed germination. And the absiscic acid showed obstructed growth during that same period of time. The seeds affected by the gibberellic acid were the first to sprout and the control was second. It wasn't until day 5 that the seed affected by the absiscic acid sprouted. To compare the seedlings on the final day of observation the seed treated with absiscic acid was far behind the others only growing to an average height of 3 mm. The control and seed affected by the gibberellic acid grew to 9 and 16 mm respectively. As of this point in the experiment the hypothesis that Gibberellic Acid will promote growth and absiscic acid will hinder growth is ultimately supported.

The data collected from the plants grown and treated in the quad also supports our hypothesis but the results were not as strong. Every day of observation except one showed the plant treated with the gibberellic acid to be taller than both the control and the plant treated with the absiscic acid. While at one point the control plants equaled the height of the gibberellic acid treated plant in the very beginning of the observation period and at the end of the observation period it can be seen that the gibberellic acid enhanced the growth of the plant. While the control plant had a noticeable growth spurt from day 11 until day 18 growing almost 60 mm the plant affected by the gibberellic acid had a similar spurt lasting from the 11 until the 18 growing over 60 mm. Then the control slowed and only grew 5 mm in the next 8 days while the gibberellic acid treated plant continued its spurt and grew another 50 mm.

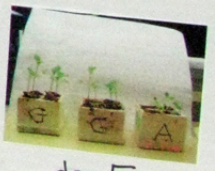
As for the plant treated with absiscic acid every observation showed these plants to be much shorter than the control and the plant affected by gibberelic acid. Within the first week the absiscic acid treated plant had fallen 30 mm behind the other two plants reaching only 9.5 mm while the others were 40 mm or taller. Then by the 18th day while both the control and the gibberellic acid treated plants had reached a height of 120 mm the plant treated with the absiscic acid had only reach 40 mm.

The results show that the gibberellic acid increases growth in the stem and increased diameter of the stem of the plant brassica rapa. It was very affective in increasing growth during the first week as seen in the seedlings from teh Petri dish and throughout growth seen in the quads. While the control caught up to the growth of the gibberellic acid plant it was only for a short time and over the total observation period the gibberellic acid plant was on average taller. These results also show that the absiscic acid hinders the growth of the plant brassica rapa. During the Petri dish stage the seedlings were obstructed in germination and were the last to sprout. In the quads these plants were far behind in average height compared to the other treatments. Therefore brassica rapa is susceptible to the affects of hormones such as Gibberellic and Absiscic Acids.

The only clear problem, which is noted in the results, is that toward the end of the observation period certain plants had reached the florescent lights and this may have stunted growth. This can be fixed by raising the lights at the beginning of the experiment or the period of observation could be shortened. Another problem is that the plants could have been treated with the hormones on a more precise schedule with even intervals of time in between each treatment.

Plant Growth:

day 2



day 5