The Effects of Repellent and Fertilizer on the Growth of Fast Plants, Brassica rapa

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Introduction

The Brassica rapa is from the Kingdom plantae, Genus Brassica. The Brassica rapa, also known as the Wisconsin Fast Plant, is a rapid-cycling plant with a life cycle of 35-40 days (seed-to-seed). The Brassicas are closely related to cabbage, turnips, broccoli and other vegetables. They were bred at the University of Wisconsin-Madison by Professor Paul H. Williams (Fast Plants).

These plants are ideal for experiments because of their short life cycle and ability to grow in classroom environments (Krantz). They can grow in small, crowded areas, indoors under florescent light, as long as they have enough water and fertilizer. The immediate changes that take place can be seen every week.

The purpose of our experiment was to observe if extra fertilizer had an effect on the plant growth. We also sprayed half the plants with Off! Insect Repellent, to observe how chemicals would affect the development of the plants. It was hypothesized that the experimental group of plants that received double fertilizer would grow taller, have more leaves, and have more buds than the controlled group of plants with only one fertilizer pellet. It was also hypothesized the experimental group of plants that were sprayed with Off! would die sooner than the controlled group that were not sprayed. If insect repellent kills plants, is it really safe to spray on ourselves?

Materials and Methods

Obtain a large, rectangular Tupperware container to be used as a water reservoir. Fill it more than midway with distilled water then add one algal growth control square, this will prevent the harvesting of algae that could effect the growth of the *Brassica rapa.* Saturate a felt mat with distilled water and place a portion of the mat's "tail" in the water so that there is a constant wicking of water; as one end of the mat dries more water will be absorbed creating a constant flow of water. Make an opening in the bottom of each well of the Styrofoam container, and place one small, diamond shaped cloth in each well, letting one half of the cloth touch the larger, felt mat wicking water from the reservoir. This apparatus allows for constant water dispersal to each of the wells that contain two *Brassica rapa* seed each. Fill each well with one-third of soil, then place one fertilizer pellet, fill the remainder of the well with soil and insert two *Brassica rapa* seeds. It is important to create a fair amount of space between the fertilizer pellet and seeds, for close proximity can result in burning of the fragile seed by the fertilizer. The Styrofoam container was arranged as follows *Figure 0.1*

Figure 0.1

P1a		P1b		P2a		P2b	
4	3	4	3	4	3	4	3
1	2	1	2	1	2	1	2
4	3	4	3	4	3	4	3
1	2	1	2	1	2	1	2
C1a		C1b		C2a		C2b	

Each cell of the container has four small wells in which soil, seed and fertilizer were placed in. One side of the Styrofoam grids are plants to be treated with repellant and the other to be the control plants not treated with repellant. Each individual well in each Styrofoam cell is number one through four; four cells were given one fertilizer pellet and four cells were given two fertilizer pellets.

On a weekly basis, observe and recording new growth making note of the appearance of the plants. After initial growth occurs, select one seedling to remove from each well. Select a seedling that appears to be more apt to survive; consider which seedling exhibited the greatest initial growth.

Results

The plants were observed and measured weekly. Initial observations made on April 03, 2008 were recorded and included the number of new seedlings in each Styrofoam container well were counted and the heights of each plant's growth were recorded. Height was measured in centimeters; the measurements were taken from the soil to the apical meristem. Counting the number seedlings included all new, individual growth that broke the soil. After the first week of growth, the plants treated with one fertilizer pellet exhibited a growth rate larger than those plants that were treated with two fertilizer pellets *Figures 1.1 and 1.2.* Divided into two sections-plants treated with a repellant and control plants-both divisions had similar average rates of growth; all of the variable plants had an average growth of 1.13cm while all of the control plants had an average growth of 1.18cm *Figure 1.3.*

Tables and Figures

Figure 1.1 Plants exposed to Repellant

Section	Well #	# of Plants	Height (cm)
P1 a	1	2	2.0
	2	2	1.5
	3	1	1.8
	4	1	1.0
P1 b	1	2	1.5
	2	2	1.1
	3	1	0.8
	4	2	2.1
P2 a	1	1	0.8
	2	2	0.9
	3	1	0.5
	4	2	0.8
P2 b	1	2	1.0
	2	2	1.0
	3	2	0.8
	4	1	0.6

Figure 1.2 Control Group

Section	Well #	# of Plants	Height (cm)
C1 a	1	2	2.0
	2	1	0.5
	3	2	1.8
	4	1	1.1
C1 b	1	2	1.9
	2	1	1.1
	3	2	2.3
	4	1	0.9
C2 a	1	2	0.7
	2	1	0.8
	3	2	0.6
	4	2	1.0

C2 b	1	2	1.4
	2	2	1.1
	3	2	0.7
	4	2	1.0

Figure 1.3 Average Growths for Repellant and Control Plants

P	1.1375cm
C	1.1812cm

The second period of observation, April 10, 2008, no new seedlings broke through the soil. Data recording the number of new seedling in each Styrofoam well was no longer recorded or considered as it was projected that no new seedlings would grow. The number of axillary leaves was considered and recorded. Height was continuously measured in centimeters from soil to apical meristem *Figure 2.1 and 2.2.* Variable plants treated with one fertilizer pellet exhibited a larger growth rate than those treated with two pellets; variable plants with one fertilizer had an average growth of 5.7cm while those with two pellets had an average growth of 5.0cm *Figure 5.1.* Control plants treated with one fertilizer pellet exhibited smaller average growth rates than those exposed to two pellets. Control plants with one pellet had an average rate of 4.11cm while plants with two pellets had an average of 4.43cm *Figure 5.2.* The variable plants were exposed to the repellant on Friday, April 11 and Tuesday, April 15.

Figure 2.1 Plants exposed to Repellant

Section	Well #	# of Leaves	Height (cm)
P1 a	1	4	10.2
	2	5	11.5
	3	6	7.2
	4	5	5.2
P1 b	1	6	5.8
	2	4	5.5
	3	4	2
	4	6	10

P2 a	1	4	4.25
	2	4	5
	3	5	3.5
	4	5	8
P2 b	1	6	8
	2	7	5.5
	3	6	10.5
	4	4	2

Figure 2.2 Control Group

Section	Well #	# of Leaves	Height (cm)
C1 a	1	5	0.5
	2	3	2.1
	3	3	1.7
	4	5	7.5
C1 b	1	6	6
	2	6	5
	3	6	12
	4	5	5.2
C2 a	1	4	4.25
	2	4	5
	3	5	3.5
	4	5	8
C2 b	1	6	7.5
	2	5	6
	3	5	3.5
	4	4	5

Figure 5.1 Rates of growth change in Repellant plants

Change	P Group	
	4/10-4/3	4/17-4/10
P1a	8.2	3.3
	10	6
	5.4	11.8
	4.2	12.8
P1b	4.3	19.2
	4.4	14
	1.2	5
	7.9	6.4
P2a	3.45	4.75
	4.1	10

	3	11.5
	7.2	13
P2b	7	10
	4.5	14.5
	9.7	8.5
	1.4	3
Averages	5.371875	9.609375

Figure 5.2 Rates of growth change in Control plants

Change	C Group	
	4/10-4/3	4/17-4/10
C1a	3	9.6
	1.6	1.9
	-0.1	20.3
	6.4	6.5
C1b	4.1	13
	3.9	14.4
	9.7	8
	4.3	11.2
C2a	3.55	6.75
	4.2	13
	2.9	12.5
	7	19
C2b	6.1	7.5
	4.9	9
	2.8	0.5
	4	8
Averages	4.271875	10.07188

The next observation period, April 17, exhibited the largest new growth for all plants. All of the variable plants exhibited an average new growth of 9.6cm. All control plants showed an average new growth of 10.0cm *Figures 5.1 and 5.2.* Plants with one fertilizer pellet had a larger growth rate than those treated with two: Variable plants with one pellet showed an average of 9.8cm; control plants with one pellet showed 10.6cm; variable plants with two pellets showed an average growth of 9.4cm; while control

plants with two pellets showed 9.5cm. Although this period marked one of greatest new growth, the quality of all plants had declined. Some plants remained unaffected, standing upright with buds and new flowers. Most plants began to lose upright posture and began to take on a “dried out” appearance. Color was no longer green, mostly gray and brown. Plants that were not standing upright and that had bore flowers were also dry in appearance, lacking color. Among the plants that were not upright, few never developed flowers or buds. Some plants were pronounced dead, having no rigidity or uprightness, lacking all color and had no flowers at all; these plants appeared wilted.

Figure 3.1 Plants exposed to Repellant

Section	Well #	# of Leaves	Height cm
P1 a	1	4	13.5
	2	3	17.5
	3	7	19
	4	7	18
P1 b	1	4	25
	2	5	19.5
	3	3	7
	4	6	16.4
P2 a	1	5	9
	2	4	15
	3	4	15
	4	6	21
P2 b	1	2	18
	2	5	20
	3	3	19
	4	3	5

Figure 3.2 Control Group

Section	Well #	# of Leaves	Height cm
C1 a	1	6	14.6
	2	4	4
	3	5	22
	4	5	14
C1 b	1	6	19
	2	5	19.4
	3	3	20

	4	6	16.4
C2 a	1	4	11
	2	4	18
	3	7	16
	4	3	27
C2 b	1	4	15
	2	4	15
	3	5	4
	4	4	13

The last period of observation, April 20, no heights were recorded. The quality of all plants continued to deteriorate. All of the variable plants were no longer green; they all assumed a brown appearance, most assumed a somewhat upright posture and had flowers. Control pants also had a similar appearance, however all control plants were no longer upright and if they had produced flowers, they were all dried

Figures 4.1, 4.2 and 4.3.

Figure 4.1 Wells that contain water

	Wells that are moist
P1 a	1,2,3
P1 b	3
P2 a	none
P2b	none
C1 a	2
C1 b	none
C2 a	none
C2 b	none

Figure 4.2 Quality of Repellant Plants

Section	Well #	Quality of plants
P1 a	1	Standing w/ flowers
	2	Standing w/ flowers
	3	Standing w/ flowers
	4	Standing w/ flowers
P1 b	1	Standing w/ flowers
	2	Falling w/ flowers
	3	Not standing, no flowers
	4	Standing w/ flowers
P2 a	1	Not standing w/ flowers

	2	Standing, no flowers
	3	Not standing w/ flowers
	4	Not standing w/ flowers
P2 b	1	Standing w/ flowers
	2	Standing w/ flowers
	3	Not standing, no flowers
	4	Dead

Figure 4.3 Quality of Control Group Plants.

Section	Well #	Quality of plants
C1 a	1	Standing w/ flowers
	2	Not standing, no flowers
	3	Standing w/ flowers
	4	Standing w/ flowers
C1 b	1	Not standing w/flowers
	2	Standing w/ flowers
	3	Standing w/ flowers
	4	Standing w/ flowers
C2 a	1	Not standing, no flowers
	2	Not standing w/flowers
	3	Standing w/ flowers
	4	Dead
C2 b	1	Dead
	2	Not standing, no flowers
	3	Dead
	4	Standing no flowers

Discussion/Conclusion:

This experiment was supposed to observe the effects a repellant has on plants fertilized with one fertilizer pellet and plants fertilized with two fertilizer pellets. Data collected reveals that plants receiving more nutrients- those with two fertilizer pellets- would not necessarily have a better chance of survival. All plants ultimately appeared to be malnourished, having little or no green pigment left in them and all having very dry and brittle stem and leaf growths. All plants that were treated with

repellant remained in a partially upright position, while the control group of plants, those with no repellant treatments, all withered and no longer exhibited vertical growth. After the two repellant treatments, it appeared as though each plant's ability to obtain water was affected. The growing apparatus included a wicking mat that would draw water up to the plants housed in the Styrofoam container and smaller absorbent wicks that were placed entering each individual growth well. Observations taken on April 17, 2008 revealed that all of the plants began to appear as though dehydrated, lacking rigidity and color. Observations also revealed that the soil in each well was dry, having little to no moisture saturating it, suggesting that water was no longer wicking from the pool located below the growth blocks. Human error can account for the lack of water absorption from the water well up to the plants in the Styrofoam container. The apparatus was moved between two locations weekly as well as handled by researchers conducting the experiment while gathering data. The plants that were given repellant treatments were in better condition than the control plants. All plants lacked vitality, were dry and brown, but collectively the plants sprayed with repellant were more upright than those that weren't. The plants that were sprayed had an additional source for water, for the repellant sprayed contains a fair amount of chemicals and materials that slightly aided in the sustaining of the plant's life. Also, plants that were sprayed with repellant were uniformly a white color, lacking its normal green pigmentation; this could be attributed to the alcohol content of the repellant which promotes fast drying when sprayed on the skin.

Literature Cited

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