Effect of Different Miracle-Gro Concentrations on the Growth of Wisconsin Fast Plants

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EFFECT Of DIFFERING MIRACLE-GRO CONCENTRATIONS ON THE GROWTH OF WISCONSIN FAST PLANTS

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Abstract

The Wisconsin Fast Plant, Brassica rapa (Brassicaceae) seeds were planted in three, six celled containers and were filled with standard potting soil under continuous grow-lux lighting. After the first week of plant growth, E1and E2 were placed in a separate trays and given 1.0 and 1.5x the recommended amount of Miracle-Gro formula, respectively. The control was left in tap water and all were kept at a 1 cm of solution. Every seven days the plants height was recorded and the total number of flowers were counted. By the fifth week the average height of the control plants was 128.1 mm, of the E1 plants was 73.5 mm, and of the E2 was 55.9 mm. The t-test for the height of control vs. E1 was significant with p=6.04e^{-5} and the control vs. E2 was significant with p=8.90e^{-7}. The heights between E1 and E2 was significant with p=0.04. This data proved our hypothesis was not supported; we thought that the recommended rate would work the best, but the control group was the healthiest with the highest average growth. We believe that the control fast plants will continue to grow better than the experimental plants because of the trend observed over the conclusion of the experiment.

Introduction

The Wisconsin Fast Plant (Brassica Rapa), belongs to the Cruciferae (Brassicaceae) family and is an annual species. The Wisconsin Fast Plant has green foliage, leaves that are smooth or slightly hispid when young, can grow from 30 cm up to 120 cm and longer and has upper leaves partially clasping the stem. This plant has branched stems, but the degree of branching depends on the biotype and environmental conditions (Amasino 2011).

Whiting and Card (2015) discuss that the need for plants to increase growth under less time is only growing with the population. This need can be solved by finding the maximum growth for the specific soil contents and nutrients.

Barko and her colleagues (2004) used this 3 week inquiry based ecology lab to demonstrate the growth of Fast Plant under four different concentrations of Miracle Grow fertilizer: ½, normal, double, and triple the recommended rate. They concluded that the normal rate of Miracle Grow worked the best and had greater plant heights, measured from the base to the epicotyl (Barko et. al 2004).

The goal of this experiment was to study the effect of soil nutrients on the plant, specifically Miracle Grow. We hypothesized that the recommended rate of Miracle Grow would work best and would offer the appropriate nutrients to Fast Plant, whereas the any more than the recommended would give the plant excessive nutrients to where it would die.

Methods Section

Three trays of six cells each were filled with soil and compacted. Holes were poked into the soil in the cells. One Wisconsin fast plant (Brassaca rapa) seed was placed into each hole and covered with soil. The trays were then placed in a trough, under continuous "grow lux" lighting, and water was added into the trough. Thereafter, water was maintained at one centimeter.

After one week, experiment 1 plants (E1) were given the recommended rate of Miracle Grow solution. Experiment 2 plants (E2) were given 1.5x recommended rate of Miracle Grow, while the last tray (control) was given only tap water. The height of the plant from soil surface to the top of the apical meristem or flower cluster was recorded in a lab notebook on Tuesdays for all plants. On the third week, the plants were supported with a small sticks and plastic collars as needed. On the third week we started to count the numbers of leaves and fruits and all plants as they appeared and recorded the results into the lab notebook. On the final lab day, all plants were cut at ground level and weighed individually and were recorded in the lab notebook. Data was analyzed statistically using the student T-test.

Literature Cited

Amasino R, Woody S. [Internet]. 2011 Sep 11. University of Wisconsin-Madison; [2016 Mar 13]. Available from: http://fpsc.wisc.edu/growguide/Instructions_and_Tips_for_Growing_FPsc.pdf
Barko VA, Burke BA, Gibson DJ, Middleton BA. Seedling Growth of Wisconsin Fast Plants (Brassica rapa) in Field Environments. [Internet] 2004 Jan 1.Teaching Issues and Experiments in Ecology; [2016 Mar 20]. Available from: http://www.esa.org/tiee/vol/v1/experiments/fastplants/pdf/fastplants.pdf
Card A, Whiting D. [Internet]. 2015. Colorado Master Gardener; [2016 Apr 1] Available from: http://www.ext.colostate.edu/mg/Gardennotes/231.html
Plant Biosafety Office. 1999. The Biology of Brassica rapa L.Canadian Food Inspection Agency: 4-8. [2016 Mar 13] Available from: http://www.tari.gov.tw/df_ufiles/GMO/(P101-112)-full%20paper%20of%20SATACP-Beckie.pdf

Results

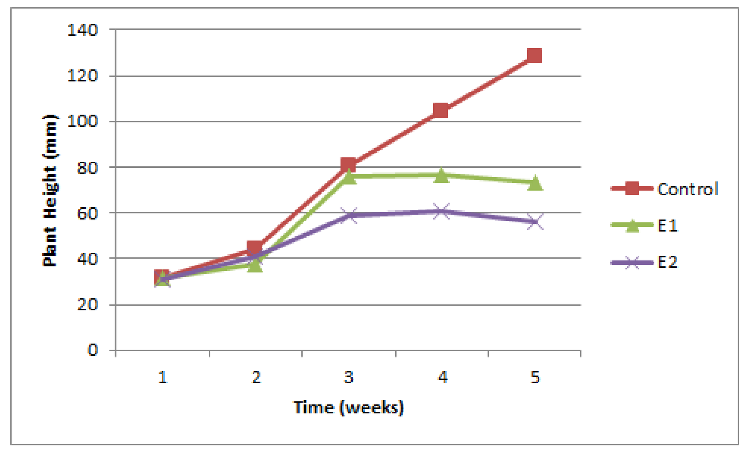

Figure 1. Plant Heights (Control, E1, E2) measured during a period of 5 weeks.

The control plants over the 5 weeks grew steadily as both experimental conditions wilted and eventually died (Fig.1). In the first week, the plants all started around the same average height. The curve for E1 and E2 shows growth leveling off, while the control continues to increase past 120 mm.

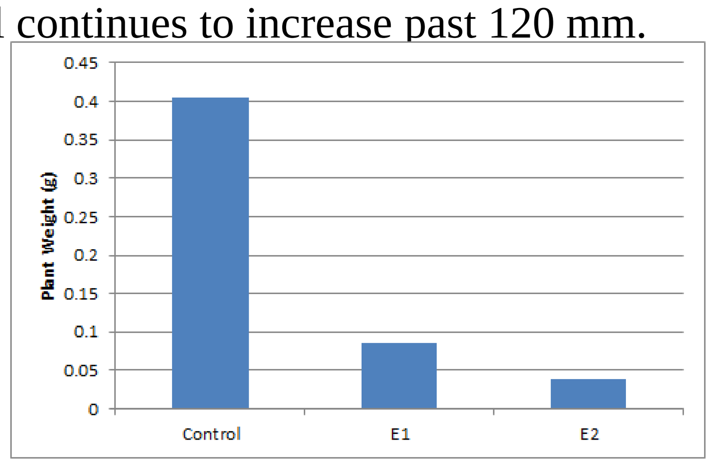

Figure 2. Average plant stem weight (g) measured on week 5 after cutting the plants at soil level for the control, E1, and E2.

The control's weight was heavier than both experimental conditions (Fig.2). The control plants contained more foliage leaves and flowers which caused it to outweigh the other two conditions. For example, week 4, the control, E1, and E2 plants had an average flower count of 9, 8, and 7, respectively. E1 and E2 leaves, on the other hand, were shriveled and drooping, which correlates to the low average mass. The p-value for the control vs. E1 was significant (p=0.023), as well as the p-values for the control vs. E2 (p=5.63e^{-5}) and the E1 vs. E2 (p=0.003).

Week Number (from start of measurements)	Control vs. E1	Control vs. E2	E1 vs. E2
1	p=0.45	p=0.44	p=0.41
2	p=0.015	p=0.11	p=0.17
3	p=0.20	p=0.0018	p=0.017
4	p=0.023	p=5.63e^{-5}	p=0.003
5	p=6.04e^{-5}	p=8.90e^{-7}	p=0.04

Table 1. P-values on average plant height determined using the student t-test; comparing control vs. E1, control vs. E2, and E1 vs. E2.

Discussion

In Figure 1, the data shows that our hypothesis was incorrect because the control grew better than both E1 and E2 with p-values of 6.04e-5 and 8.90e-7, comparing the control with E1 and E2, respectively. According to Card and Whiting (2015), fertilizer only aids plant growth if the plant has a deficient nutrient supply and when other growth factors are not also limiting plant growth. The fertilizer will not compensate for any lack of water, poor soil preparation, weed competition, or anything else that would interfere with growth (Plant Biosafety 1999). From this, we can conclude that the Miracle Gro contains excessive nutrients that Wisconsin Fast Plants do not need to exceed controlled growth. Furthermore, in Figure 2, we observed that the control group outweighed both experimental groups. Since many manufactured soil fertilizers, such as Miracle Gro, contain high salt contents, the activity of beneficial microorganisms that help breakdown fertilizers for subsequent nutrient absorption was slowed down (Barko et al 2015). This causes the plant to not be able to uptake the nutrients it needs to promote growth, although there are many ionic nutrients present in the fertilizer. With the microorganisms activity being slowed down, the soil tilth is affected and relying only on the manufactured fertilizer concentration will not help the plant grow (Amasino and Woody 2011). Therefore, we conclude that the plants did not have enough water to compensate for the high salt content in the Miracle Gro and the slower activity of the beneficial microorganisms and were not receiving the necessary nutrients to grow. Figure 2 supports this conclusion because the average mass of the control group was higher than both experimental conditions, showing that the E1 and E2 plants were oversaturated with nutrients since they were grown in the same soil as the control. In fact, major differences were seen in the appearance of E1 and E2 plants as they had fewer flowers, brown foliage, thinner stems, and were a yellowish color, indicating a salty environment. These visible observations were supported from the the p-values seen in Figure 3 from weeks four and five. In the fourth week the control vs. E2 p-value finally came into the range of significance. This was also seen in the fifth week, where the control compared to both the E1 and E2 had significant p-values.