

## **Effects of Different Media on Plant Growth**

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Biology 356  
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### *Materials and Methods*

In late October-early November, several tomato plants and rye-grass were set up to grow in various types of media. The tomato plants were grown hydroponically in separate containers containing three different media of poor, moderate, and complete qualities. In each case, three tomato plant sprouts were supported by cotton then passed thru three separate holes in a Styrofoam lid. The roots of these tomato plants were left to dangle in the various media. The complete medium consisted of all nutrients needed to sustain plant life. The moderate medium was the same as the complete medium, only it lacked potassium. The poor medium lacked potassium, iron, and trace elements.

In the second part of the experiment, the growing of rye-grass, the grass was grown in several pots with vermiculite as the substrate. Half of the pots were fertilized with a nitrogen deficient medium and the other half were grown with clover within the pots to add nitrogen to the substrate. Both the grass and the tomato plants were stored in room 106 in the Science building on MSU-Billings campus. They were not in direct sunlight and were watered occasionally by Dr. Barron.

On November 20, 2006, the plants were collected and weighed. The tomato plants were removed from the Styrofoam, weighed intact, and root and stem were then

separated and weighed individually. The rye-grass stems were separated from the roots by cutting the stems off as close as possible to the substrate. A random sample of twenty stems were chosen and weighed for both the nitrogen deficient medium and the substrate with clover. From the sample of twenty, the number of stems per pot (# per plot) was then estimated. After the data were collected on the tomato plants and rye-grass, statistical tests were run using SPSS consisting of a One-way ANOVA test on the tomato plants and t-tests on the rye-grass to determine if the various treatments differed.

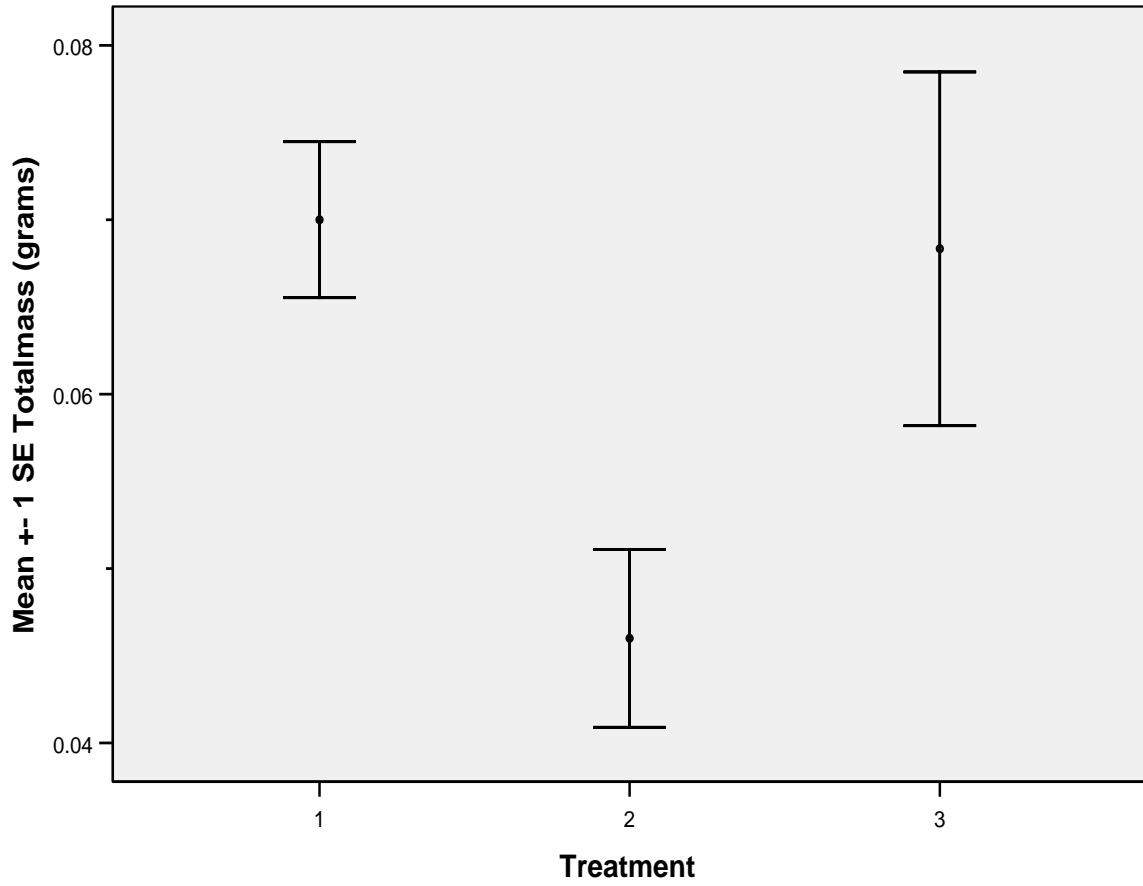
### *Results*

Although there appeared to be a difference between the moderate medium and both the complete and poor media in total mass and stem mass, these results were not statistically significant (Figures 1 and 2). The P-values from the One-way ANOVA run were 0.086 for the total mass, 0.063 for the stem mass, and 0.505 for the root mass. All three of the standard errors of root mass overlapped between the three different treatments (Figure 3), while there was only overlap of standard errors between the complete and poor media in both total mass and stem mass (Figures 1 and 2). This could explain the relatively high P-value from the ANOVA test in root mass.

Much like the tomato plants, there was not much difference between the two treatments in the rye-grass. The average weights of the grass grown with clover and the grass grown without clover were very similar. Even in an instance where the estimated number of stems per plot was relatively low (group 1, grass with clover) the average weight was very similar to the rest. Likewise, the estimated number of stems per plot was very similar between the two treatments. (Table 1) The results of the t-test gave a high P-value of 0.449 (not assuming variances were equal) indicating there was no

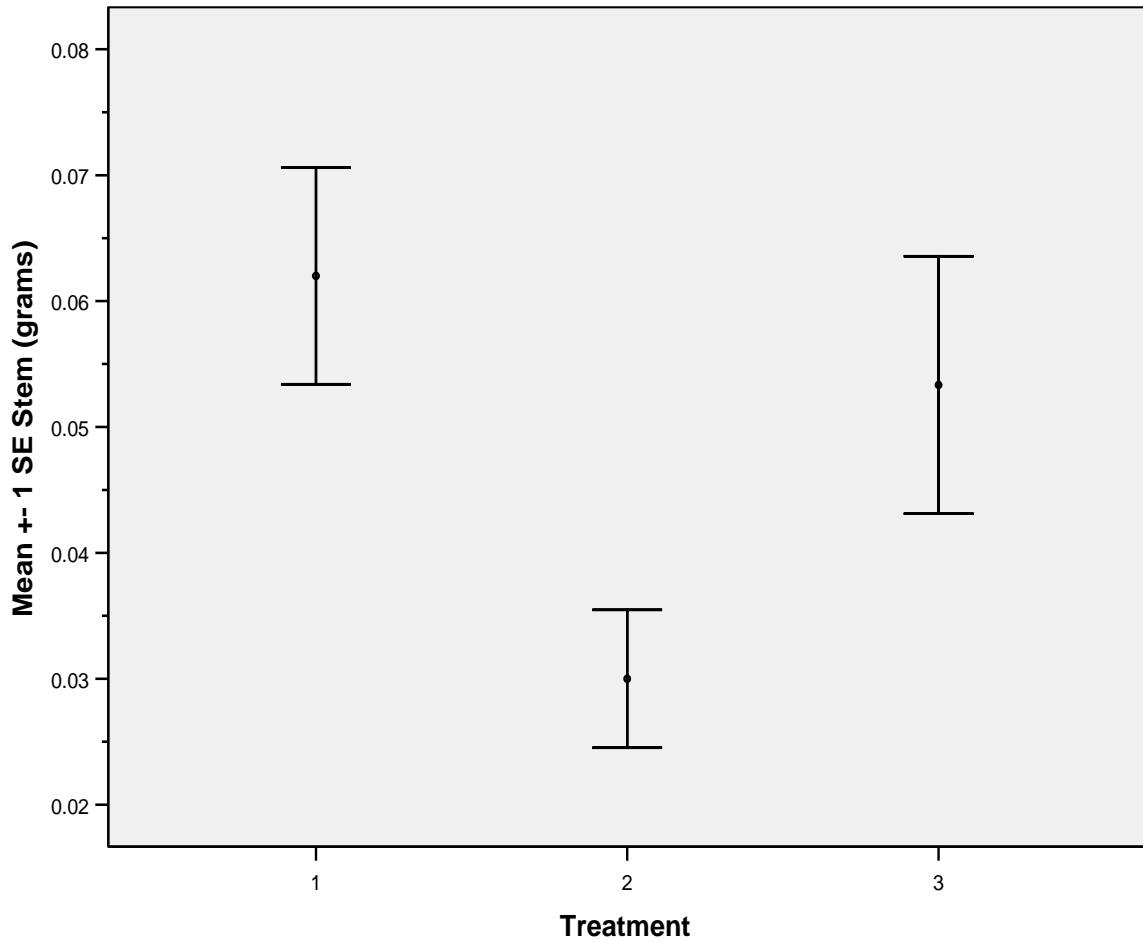
difference between the two treatments.

	Grass with clover		Grass without clover	
Group #	Average Weight (g)	Estimated # per plot	Average Weight (g)	Estimated # per plot
1	0.014	56	0.011	140
2	0.013	140	0.018	140
3	0.012	135	0.015	125
4	0.011	124	0.0135	105
5	0.012	124	0.0105	112
Overall Average	0.0124	115.8	0.0136	124.4



**Figure 1: Mean and Standard Errors of the Total Mass of Plants**

Note: "1" denotes complete medium  
"2" denotes moderate medium  
"3" denotes poor medium

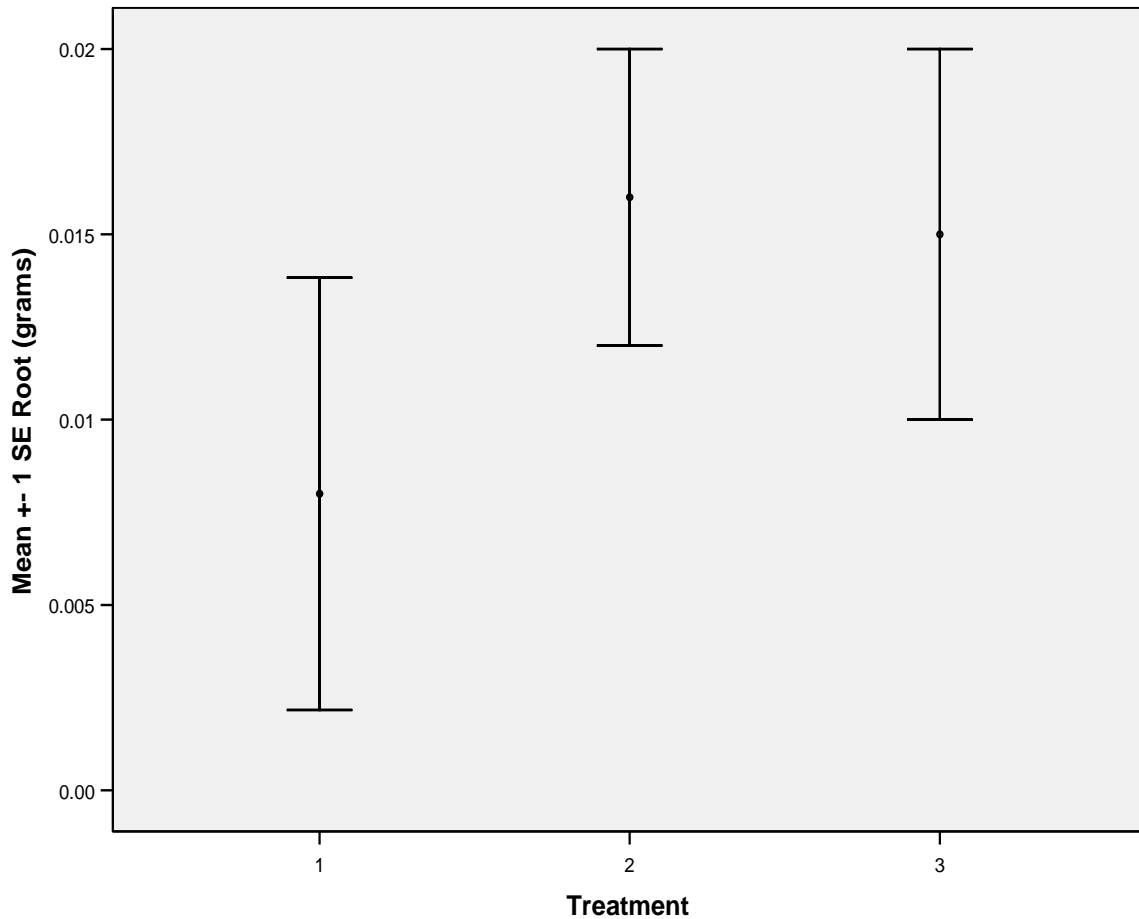


**Figure 2: Mean and Standard Error of Stem Mass of Plants**

Note: "1" denotes complete medium

"2" denotes moderate medium

"3" denotes poor medium



**Figure 3: Mean and Standard Error of Root Mass of Plants**

Note: "1" denotes complete medium

"2" denotes moderate medium

"3" denotes poor medium

### *Discussion*

In the tomato plants, the differences in the means of total mass and stem mass between the treatments were not significant at the 0.05 level (P-values of 0.086 and 0.063 respectively); however, they were close to being statistically significant. On the other hand, the difference in means of root mass between the treatments was not close to being statistically significant (P-value of 0.505). This suggests, in all three of the media, the

data could have happened by chance and we can not conclude that there is an actual difference between the three media. However, for each media there were only two containers each having a total of three plants (some plants died and were not included in the data), and the plants were considered to be “individuals” not the containers. This could have affected the data by pseudo replication. If there was a problem with one container, it would affect all the plants within that container. This could have caused a more significant skew to the data than had there been only one plant per container or more containers with several plants. Thus, a simple way to improve this experiment would be to create more containers for each media all having three or more plants within them.

Much like the tomato plants, the results of the t-tests on the rye-grass were not significant (P-value of 0.449). This suggests there was no difference between the grass grown with the clover and the grass grown without the clover. However, this is not very likely since the substrate without clover was lacking nitrogen, a substance vital to plant growth. A reason there may have been no difference between the two treatments is because the grass grown with clover may have been struggling to grow because of competition. Although the clover supplied the grass with nitrogen, it may have been consuming other vital nutrients and thus competing with the rye-grass. This leads to an easy way to improve this experiment. Clover could be grown in the vermiculite in half of the pots prior to adding the rye-grass. The clover could then be removed and the rye-grass added. This would give half the pots nitrogen rich substrate without competing with the clover.