Rates of Transpiration

Abstract

This experiment was conducted to measure the rates of transpiration between 3 variables (Control, Wind, Light, Heat). Each plant was to be monitored and massed over 48 hours. After 48 hours the mass lost was divided by the surface area and this was measured through a T-Test to see if there were differences. The heat lamp was able to produce a difference and show that heat would cause the most water loss and produce a higher rate of transpiration.

Introduction

This lab was performed to see the differing rates of transpiration and the opening and closing of stomata on plant leaves between certain conditions. Different variables were used to test how the stomata would react to each condition (Heat, Light, Wind) and be measured through water loss. An increased amount of water loss would signal that the stomata remained open longer and lost more water therefore supporting higher rates of transpiration.

Hypothesis

If the Coleus Plant is placed under a heat lamp then it will lose more mass due to transpiration than the other conditions (Control, Light, Wind)

Materials

4 x Plastic Bags
4 x Approx. 1 foot long string
4 x Coleus Plant Cuttings
1 x Wind Fan
1 x Heat Lamp
1 x Scale

Procedure

I. Acquire 4 Coleus Cuttings
II. Cut off any flowers/buds on the cuttings
III. Place each of the cuttings in their own plastic bag with the top wrapped tightly around the stem(s) of the cuttings and tied in place with a string
IV. Mass each cutting (with the plastic bag)
V. Place one cutting in a controlled environment (near window)
VI. Place a separate cutting under a heat lamp

VII. Place a separate cutting next to a constant fan
VIII. Place a separate cutting under increased light sources
IX. Wait 24 hours

Plant	Control	Wind	Heat	Light
Group 1	0.0446	0.0722	0.1002	0.0596
Group 2	0.0509	0.0836	0.1065	0.0522
Group 3	0.1001	0.0939	0.1406	0.0222
Group 4	0.0617	0.0555	0.1040	0.0661
Group 5	0.0404	0.0940	0.0760	0.0638
Average	0.0595	0.0798	0.1055	0.0528
T-Test	None	0.0810	0.0076	0.3140

X. Mass each cutting separately
XI. Place each cutting in their respective places again
XII. Wait another 24 hours (48 hours in total)
XIII. Mass each cutting separately
XIV. Repeat Steps 1-13 for multiple trials

Coleus 48-Hour Transpiration with T-Test (Mass of Water Lost/Surface Area) ($g/cm^{2)}$

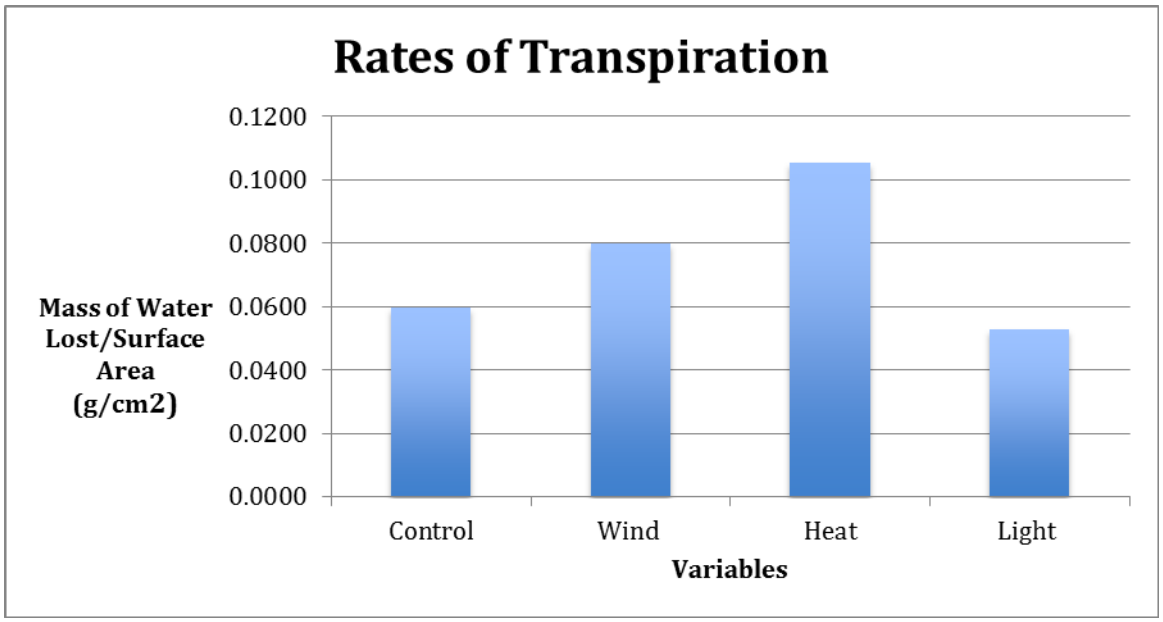
Null Hypothesis/ T-Test

-If a Coleus Plant is placed besides a source of constant wind then there will be no difference (Value of .0810 is NOT less than .05) Null Hypothesis is not rejected

-If a Coleus Plant is placed under a heat lamp then there will be no difference (Value of .0076 IS less than .05) Null Hypothesis is rejected

-If a Coleus Plant is placed under a direct light then thee will be no difference (Value of .3140 is NOT less than .05) Null Hypothesis is not rejected

Graph



Conclusion/Analysis/Discussion/Questions

Rates of Transpiration were measured on the amount of water lost by the plants divided by the surface area of leaves. The more water lost would imply that stomata were open longer and more transpiration was occurring. After running a T-Test for each average value of the variables, only one p-value was less than .05. Even if the data tables showed differences than the control, the heat variable was the only variable that caused a difference according to the T-Tests. With a p- value of .0076, the heat lamp was able to reject the null hypothesis and in turn support the alternate hypothesis stated at the beginning of the experiment. Even if the values of .0798 (Wind) and .0528 (Light) were different than the control, the p-values failed to reject their respective null hypothesis and therefore show no tangible difference. As a result, our original hypothesis was supported and heat was able to increase the rate of transpiration. Light and Wind failed to show a difference in the rates of their respective plants.

The experiment was valid and was run with multiple trials. There were some discrepancies that could have altered the experiment. The wind fan was turned off for a decent amount of time and could have changed the values in the wind variable plant. Other small items such as the consistency of the bags tied around each plant could also result in alterations. The experiment could be run for more trials and have these problems fixed. Nevertheless, the experiment was able to yield reliable results.

-What other variables could be tested and how would they fare?

Complete Darkness, Arid Conditions, Increased Water?

-Why were the flowers/buds cut off?

What would be the effect?

-How would different plants fare in this experiment?

Begonias?

-How would the experiment fare if the time were longer

96 Hours, 144 Hours, 196 Hours?

Sources

Sadava, David E. *Life, the Science of Biology*. Sunderland, MA: Sinauer Associates, 2011. Print.