Mindanao Journal, Vol. XVII, Nos. 1-2 (1990):147-152.

EFFECT OF LIGHT ON EVAPORATIVE H_2O LOSS IN PLANTS (SAN FRANCISCO)

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Transpiration, as defined by Devlier, is a process whereby water is lost from the plant by means of evaporation. It can occur in three main places in the plants, namely: stomata, cuticle and lenticles. Of the three, stomatal transpiration, which is responsible for 80 - 90% of the total amount of water loss, was the one considered in the experiment presently being discussed. Transpiration is a process that is dependent on both the plant itself and the environment. Factors such as light, temperature, humidity, wind, and availability of soil water are among the environmental factors influencing transpiration. Light, having the most influential effect on the transpiration, is the one considered in the experiment.

Statement of the Problem

The main focus of the experiment was to determine the effect of light on the evaporative water loss in plants. More specifically, the experiment conducted to determine the effects of the different location of the setup and leaf treatment on the evaporative water loss in San Francisco (*Codiacum Variegatum*) leaves.

Objectives

The objectives of the experiment are the following:

1) To find out the effect of light on the evaporative water loss in plants.

2) To find out the effect of lead treatment on the evaporative water loss in plants.

3) To find out the effect of different locations of the setup as the evaporative water loss in plants.

Materials and Methods

The photometer method was used in measuring transpiration. The experimental setup included the preparation of glass and plastic tubings of approximately 45-72 centimeters in length and about 5.6 mm internal diameter attached to a hoard. Calibration of the glass tubings were made with the aid of a 10 ml syringe.

At the start of the experiment, glass tubings were filled with distilled water up to the zero calibration. San Francisco leaves taken from the campus were used; they were of approximately the same size or width, ranging from 6.62 - 8.09 centimeter, and length, ranging from 22.9 - 23.3 centimeter.

Leaf petiole were inserted on one end of the glass tubing. Modelling clay was used to seal both ends to prevent leakage. The presence of stomates was also taken into consideration. Vaseline was applied on only one side of the leaf blade, and both surfaces of the treated leaves. To complete the setup, two leaves which were unplugged and a control (one without a leaf and both tube ends sealed) were added.

Duplicated experimental setups were done simultaneously in three chosen locations within the campus and on an open shaded place at the left side of the William Shaw Theater under a coconut tree, an open exposed location on the same site without any obstruction, and the third was a completely shaded place in an umbrella shade on the right side of the theater.

The air temperature, light intensity and the amount of water loss were measured. A centigrade thermometer and a light meter were used. No readings were obtained for the wind velocity due to the insensitivity of the wind meter. Four readings were done at 9:30 A.M and the last reading at 3:30 P.M.

Data obtained were treated using the two-factor analysis of variance. Mean standard deviation and range of water were graphed.

Discussion and Analysis

A) Table 1 shows that there is a significant difference in water loss depending on the place where experiment was conducted. This can be attributed to the varying light intensities and temperature in the three locations, namely, open exposed, open shaded and completely shaded locations.

In support of this finding, Strafford mentions that increasing light intensities causes an increase in stomatal opening and increases permeability of the protoplasm. Furthermore, an increase in temperature causes an increase in stomatal opening.

B) As reflected in Table 1 there is an effect of the leaf treatment on the evaporative water loss in San Francisco leaves. The data showed that there was a difference in the amount of water loss in untreated and treated leaf blades. This is due to the fact that light and temperature influencing the working mechanism of the stomata was blocked by Vaseline in the case of treated leaf blade and left unblocked in unplugged ones. There was a significant interaction between the leáf treatment and the different locations of the setups. Since the statistical method used was the two factors analysis of variance, the fully plugged and the partially plugged results were taken as one, hence, the interaction between the location and the leaf treatment was significant (See Table 1).

Table 1. **Anova Summary**

Source of Variation	SS	df	ME	Fo,05	Decision
Total	7.29	53			
Cell	13.47	3	1.684		
Factor A	1.77	2	0.884	2.84	reject Ho
Factor B	1.62	2	0.811	2.84	reject Ho
A X B	10.08	4	2.54	3.15	reject Ho
Error	6.18	45	0.137		

For Ho : The leaf treatment has no effect on water loss

$$F = \frac{FA}{E} = \frac{0.884}{0.137} = 6.452$$

F0.05 = 2.84 Therefore, reject Ho (P> 0.0005)

For Ho : Location has no effect on water loss.

$$F = \frac{FB}{E} = \frac{0.811}{0.137} = 5.92 \quad P>0.0005$$

FO.05 = 2.84

Therefore, reject Ho

For Ho : There is no interaction effect between leaf treatment and location on water loss.

$$F = \frac{A \times B}{E} = \frac{2.54}{0.137} = 18.54 \quad P> 0.0005$$

F0.05 = 3.15

Therefore, reject Ho

Table 2 presents the mean, standard deviation and range of water loss in relation to location and leaf treatment. This water loss was inversely proportional to the leaf treatment. Likewise, H^20 loss was directly proportional to light intensities in different locations.

Table 2 - Water loss in treated and untreated leaves exposed to different locations. Means, standard deviations and range (in parenthesis).

	Plugged	Upper part plugged	Not plugged
Exposed	0.41 ± 0.1 (0.30 _ 0.55)	0.61 ± 0.05 (0.70 _ 0.54	0.94 ± 0.06 (0.65 _ 1.25)
Shaded Exposed	0.16 ± 0.070 (0.12 - 0.28)	0.48 ± 0.3 (0.28 - 0.69)	0.55 ± .02 (0.5 - 0.8)

Shaded Close	0.04 ± 0.05 (0 - 0.1)	0.19 ± 0.007 (0.1 - 0.26)	0.46 ± .08 (0.3 - 0.31)

Table 3. Raw data showing the rate of transpiration (ml) in relation with the environmental conditions (Exposed open, shaded exposed, and shaded closed)

Plugged			Plugged (upper part only)			Not plugged		
Exposed: Exposed	Exposed	Shaded Closed	Shaded Exposed	Exposed	Shaded Closed	Shaded Exposed	Exposed	Shaded Closed
0.38	0.12	0.1	0.63	0.28	0.1	0.70	0.5	0.3
0.30	0.13	0.05	0.60	0.37	0.1	0.65	0.55	0.48
0.43	0.13	0.0	0.70	0.43	0.2	0.9	0.7	0.49
0.33	0.24	0.1	0.58	0.42	0.22	1.1	0.75	0.5
0.55	0.28	0.0	0.54	0.68	0.26	1.15	0.8	0.5
0.50	0.18	0.09	0.6	0.69	0.25	1.25	0.8	0.51

Total for Plugged	= 3.78	a =	3
Total for upper part	= 7.65	b =	3
Total for not plugged	= 11.75	r =	6
Total for exposed	= 11.76	N =	54
Total shaded exposed	= 7.27	C =	9.95
Total for shaded closed	= 4.15		

Recommendations/Suggestions

1. Photometer should have been constructed with the use of the buret and a rubber tubing for an ideal setup. This would reduce possible errors in the calibration and the resistance to the flow of water.

With the absence of the buret, glass tubings can be used just like our setup but the U - curve should not be as sharp as illustrated:

This  instead of 

2. A more sensitive wind meter should be used so as to detect the effect of wind velocity on transpiration.

3. So as to obtain a more significant data on stomates influence on transpiration, vaseline treatment should be on the surface which contains a greater number of stomates. In the case of San Francisco, treatment should have been on the lower leaf blade.

4. It is very important to control air bubbles in the experimental setup so as to minimize errors in measurement.

5. To completely account for transpiration in plants both cuticular and lenticular transpiration should also be taken into consideration.

Limitations

The study was limited to measurement of stomatal transpiration as related to variations of light intensity and temperature.

Implications

1. Environment as a whole controls transpiration, thus plants thrive in a specific habitat.

2. Plants develop structure adaptations in response to change in some environmental factors.

3. Transpiration rate affects greatly plant growth and development.

4. In the Photometer Method, transpiration is nearly equal to absorption of water.