Measurement and Data Analysis LAB

"Measure the area of Leaf"

By

Shanmugakumar M

Veeramani S

Dhanalakshmi

Sudhanwa Deo

Aim

To measure the area of leaf with Grid techniques and image processing technique for Better approximation

Objective

Measure the area of leaf with Different grid size varies from 1 sq.cm to 0 .01 sq.cm And analyse the change in error with a different technique.

Required Equipment's

Physical Component

1. Fixed Focal length Camera - Pixel Size (5, 10, and 20) Mega pixel.
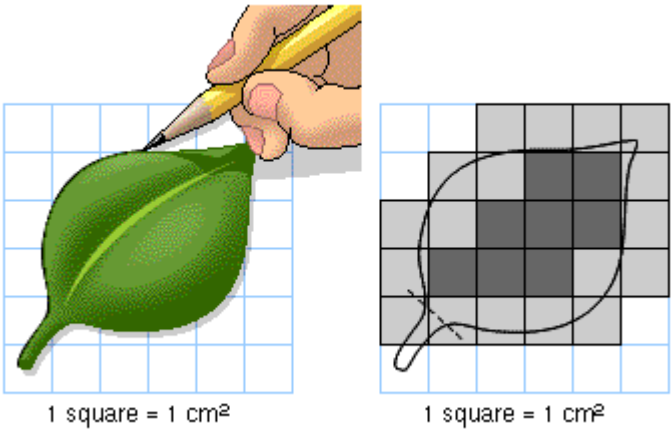
2. Graph Sheet

3. Leaf

Software

1. Photoshop Portable Edition

Theory

The rate of transpiration is measured as the amount of water lost/ square meter/ minute. Because water evaporates through the many stomata on the leaf surface, the rate of transpiration is directly related to the surface area. To arrive at the rate of transpiration, therefore, you must calculate the leaf surface area of each plant: Because most stomata are found in the lower epidermis, you will determine that surface area. This Application of Area measurement in Botany. In Engineering we see this in Different Perspective, Measuring area of irregular structure. There are no standard formulae for measuring irregular structure. To overcome this leap we need to move towards Approximation. For the approximation we need to convert the irregular shape into regular shape *(Preferably square).* In this case, make the area of square of Zero. So we will get infinite squares in our interested region, in ideal case this is feasible. But in practical case, it's not feasible, it holds infinite number squares in the interested region. To overcome this leap, we need an optimization, make the square size as small as possible and the number of squares in interested region should be finite.
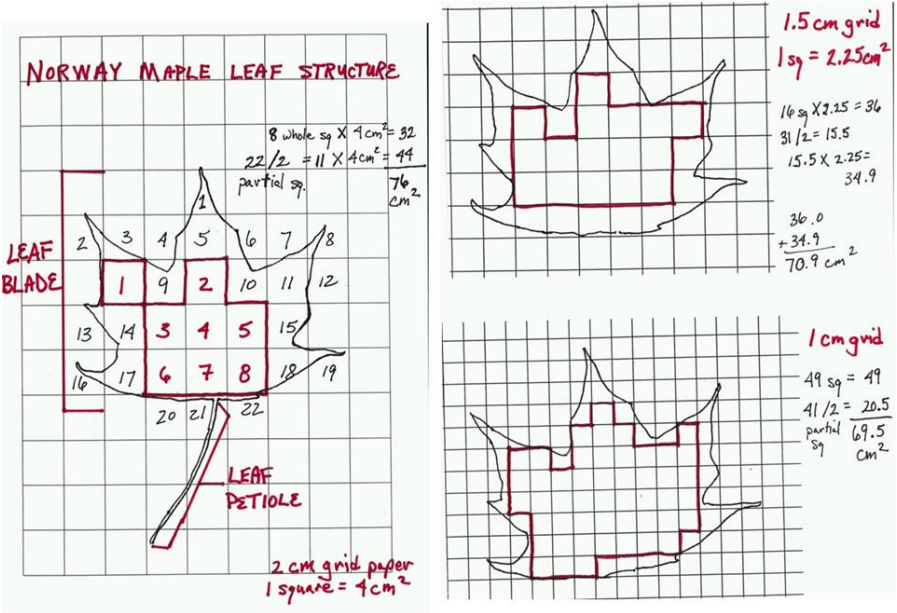
Procedure

Method 1: Grid Technique

1 square = 1 cm²   1 square = 1 cm²

"**Grid size is directly proportional to error**"

Visual Explanation

NORWAY MAPLE LEAF STRUCTURE

8 whole sq X 4cm² = 32
22/2 = 11 X 4cm² = 44
partial sq.
                    76
                    cm²

LEAF
BLADE

LEAF
PETIOLE

2 cm grid paper
1 square = 4cm²

1.5 cm grid
1 sq = 2.25cm²

16 sq X2.25 = 36
31/2= 15.5
15.5 X 2.25=
            34.9

36.0
+34.9
70.9 cm²

1 cm grid

49 sq = 49
41/2 = 20.5
partial 69.5
sq   cm²

Method 2:   Image processing

Condition: Focal length of the image should be constant.

Step 1: Draw a square of 2 cm & outline of leaf on graph sheet.

Step 2: Take photos of outline of leaf & square of 2cm simultaneously using camera. Vary

　　　　Camera picture quality (5, 10 & 20 MP).

Step 3: Using Photoshop measure number of pixels inside 2cm square & outline of leaf.

Step 4: *1 Pixel area (1PA) = Area of Square/ No of pixel*

Step 5: Area of leaf

　　　*Area of leaf = 1PA * No of pixel in leaf.*

Results and Discussion:

Method 1: Grid Technique

Grid Size (sq. cm)	Number of blocks	Area of leaf (sq. cm)
1		
0.25		
0.01		

Method 2: Image processing

Picture Size (Mega Pixel)	Number of pixels in 4 sq. cm box	Area of pixel	Number of Pixels in leaf	Area of leaf (sq. cm)
5				
10				
20				

Conclusion

Measured the area of leaf with Grid techniques and image processing technique with Better approximation.