Light Color

Light for life

Overview

This lab explores the role of light in plant growth. You will measure light intensity, study the effects of different light spectra, and test how different transparent materials affect light transmission. Using databot™, you will collect and analyze data to design the most efficient greenhouse environment for plant growth.

Grades: Middle School
Time: 45 Minutes
Subject: Life Science
Topics: Light, Light Intensity

Background

Light is one of the most important factors in plant growth. In a process called photosynthesis, plants convert light energy into chemical energy, producing the nutrients they need to survive. The intensity, spectrum, and duration of light can affect how efficiently plants grow.

Plants respond to different light conditions in unique ways. For example, blue light stimulates vegetative growth, while red light stimulates flowering and fruiting. The angle of sunlight changes throughout the day, affecting how much energy plants receive. Similarly, transparent materials, such as greenhouse coverings, affect how much and what type of light reaches plants, influencing their growth.

Greenhouses are designed to optimize light conditions for plants, balancing these factors to create the ideal growing environment. By experimenting with light angles, spectra, and materials, you can uncover the science behind greenhouse design and gain insight into sustainable agriculture.

Databot™ provides an accurate and interactive way to measure light intensity and study how these factors affect plant health. In this lab, you will learn the principles of light and its relationship to plant growth through hands-on learning.

What You Will Need/Prep

- databot
- IOS/Android Smart Device
- Install Vizeey™ on your Smart device.
- The source of light and a box
- A ruler and a protractor
- Colored filters (red, green, blue) or RGB lamp.
- Transparent Materials for testing (glass, plastic, translucent fabric, etc.)

- Test your databot™ connection.
- You will be prompted to select and connect to databot™ each time you launch an experiment.
- If there are two or more databot's listed, the one closest to your device will be highlighted in blue.
- Study the background information and terms and prepare to explore!

Light Color

Learning Objectives

By completing this lab, students will:

- Understand how the angle of light affects its intensity.
- Explore the impact of different light spectra on plants.
- Evaluate the efficiency of transparent materials for greenhouse environments.
- Develop critical thinking and data analysis skills using databot™ sensors.

Important Terms

Light Spectrum: The range of wavelengths of light, including visible light, which plants use for photosynthesis. Key wavelengths include red and blue light.

Light Intensity (Illuminance): The amount of light energy hitting a surface, measured in lux. It directly affects the rate of photosynthesis.

Lux: A unit of light measurement where the area is taken into account.

Transparent Materials: Substances like glass or plastic that allow light to pass through and can influence the quality and intensity of light reaching plants.

Blue Light: A wavelength that promotes vegetative growth and strong stems.

Red Light: A wavelength that enhances flowering and fruit production.

Green Light: A wavelength that penetrates deeper into plant canopies but is less efficiently absorbed by chlorophyll.

Photosynthesis: The process by which plants use sunlight, carbon dioxide, and water to produce energy (in the form of glucose) and release oxygen.

Interesting Facts

Greenhouses and Light: Modern greenhouses are designed to optimize sunlight usage, often equipped with automated systems that adjust shades and vents to control light levels.

Glass vs. Plastic: Glass allows more light to enter but is heavier and more expensive, while modern plastics can be treated to block harmful UV rays while letting in beneficial light.

Plant Behavior: Some plants, like sunflowers, exhibit heliotropism—a behavior where they track the sun's movement across the sky to maximize light absorption.

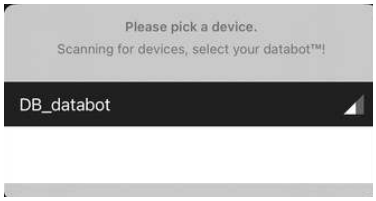
Light and Productivity: Studies show that optimizing light conditions in greenhouses can increase crop yields by up to 30%, making efficient lighting crucial for sustainable agriculture.

Using Vizeey

In order to work with the experiment you need to launch the Vizeey application and click on + in the upper right corner.

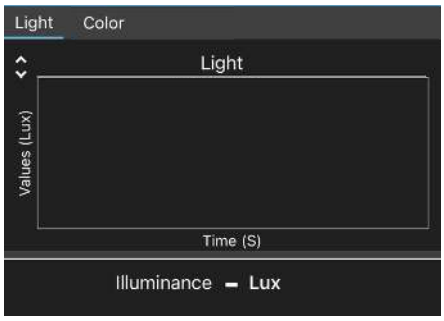
Then select “Add experiment from QR code” and scan the QR code prepared for this experiment. Your experiment will appear in the list.

When you start the experiment you will be immediately offered to connect to your databot. Make sure that databot is enabled.



Once in the Experiment

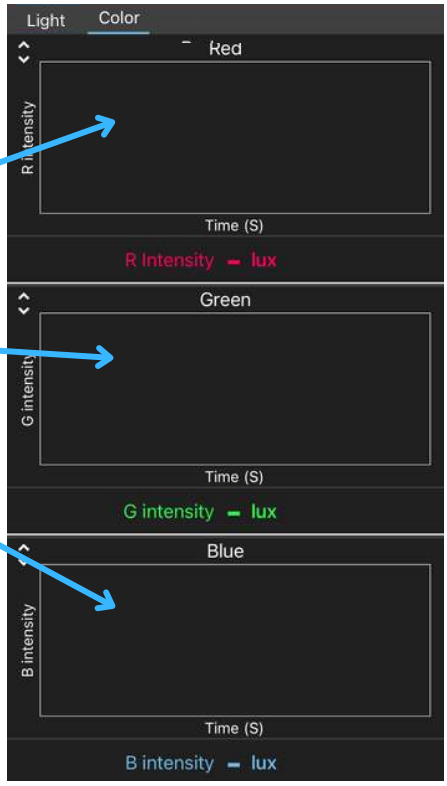
There are 2 tabs available for analyzing and capturing data in this experiment. You can see them here and use any of them. Light Color



In the first and third parts of the lab, you will use the light sensor. This sensor measures light intensity in lux, helping you understand how different conditions affect the amount of light reaching a surface. By collecting accurate data, you can evaluate factors like angle, material transparency, and light efficiency. The illuminance sensor is essential for determining optimal conditions for plant growth.

In the second part of the experiment you will test how different shades of color affect growth:

- Red spectrum is displayed here
- Green spectrum is displayed here
- Blue spectrum is displayed here



Light Color

Part 1: Initial Observations and Discussion Questions

- Do you think all colors of light are equally beneficial for plant growth? Why or why not? _____

_____

- Why do plants grow better in sunlight compared to artificial light?

_____

_____

_____

- Why do you think greenhouses use materials like glass or plastic instead of leaving plants exposed to the open air?

_____

_____

Part 2: Hypothesis

Write your hypothesis for each part of the experiment

How do you think the angle of light will affect its intensity? Which angle will provide the most light? _____

_____

_____

Which color of light (red, green, or blue) do you think will be most beneficial for plants? Why? _____

_____

_____

Which material (glass, plastic, or fabric) do you think will allow the most light to pass through? Why? _____

_____

_____

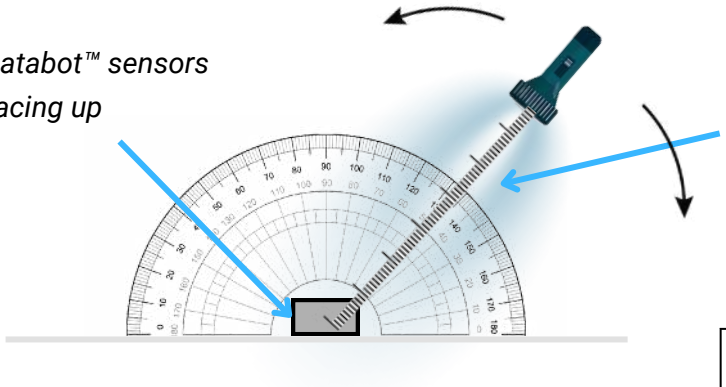
Part 3: Experiment Procedure

Angle of Light

Determine how the angle of light affects its intensity.

- Setup your workspace: place databot™ on a flat surface, such as a table. Ensure the workspace is free from other light sources to prevent interference. databot™ should be installed with the sensors facing up.
- Position the light source: set up an adjustable light source (e.g., a lamp or flashlight) so that it can be moved to different angles relative to databot™. Use a protractor or angle guide to measure the angle accurately.
- Tap on "**Light for life**" in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Light"* and start your experiment using:
- Use these icons at the top of the screen in Vizeey to start and to pause the experiment.
- Measure at 0° Angle: Position the light source directly above databot™ (at a 0° angle) and turn it on. Wait 5 seconds for the sensor to stabilize, then record the light intensity in lux.

databot™ sensors facing up



Keep the light source at a fixed distance from databot™ throughout the experiment. Use a ruler to confirm the distance remains constant.

- Repeat the process for angles of 30°, 45°, 60°, and 90°, carefully measuring and recording the light intensity at each position.
- Write the obtained data into the table.

Angle (°)	Light Intensity (lux)
0	
30	
45	
60	
90	

Write down your observations._____

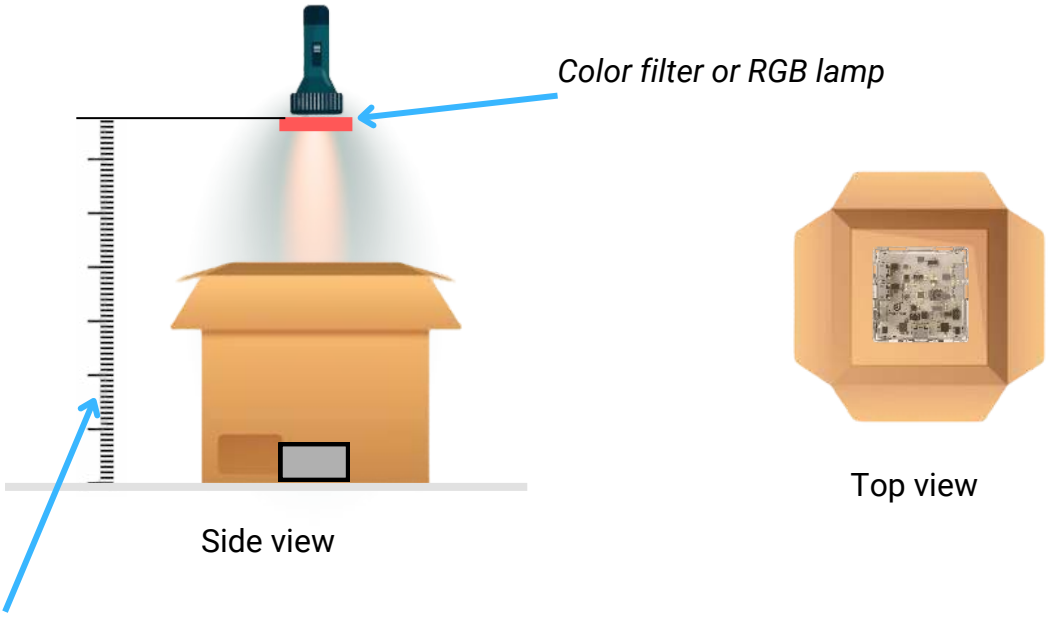
_____

Part 5: Experiment Procedure

Light Spectrum

Investigate how different light colors affect plants.

- Turn on databot.
- Tap on **"Light for life"** in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Color"* and start your experiment using: ▶
- Use these icons ▶ ⏸ at the top of the screen in Vizeey to start and to pause the experiment.
- Place databot in a box to create a dark area, the databot's sensors should be facing upwards.
- Make a hole in the top of the box to allow light to pass through.
- Prepare the light source: take a lamp or flashlight with interchangeable colored filters (red, green, blue).
- Attach the red filter to the light source and shine it directly into databot™. Wait 5 seconds for the sensor to stabilize, then record the light intensity in lux.



Keep the light source at a fixed distance from databot™ throughout the experiment. Use a ruler to confirm the distance remains constant.

- Record the data in the table

Light Color	Light Intensity (lux)	Effect on Plants
Red		Promotes flowering and fruiting
Green		Penetrates deeper into plant canopies
Blue		Encourages vegetative and leaf growth

- Replace the red filter with the green filter and repeat the measurement process, recording the intensity.
- Record the data in the table

Light Color	Light Intensity (lux)	Effect on Plants
Red		Promotes flowering and fruiting
Green		Penetrates deeper into plant canopies
Blue		Encourages vegetative and leaf growth

- Replace the green filter with the blue filter and repeat the measurement process, recording the intensity.
- Record the data in the table

Light Color	Light Intensity (lux)	Effect on Plants
Red		Promotes flowering and fruiting
Green		Penetrates deeper into plant canopies
Blue		Encourages vegetative and leaf growth

- Remove all filters and run the experiment without filters.
- Record the data in the table

Light Color	Light Intensity (lux)	Effect on Plants
Red		Promotes flowering and fruiting
Green		Penetrates deeper into plant canopies
Blue		Encourages vegetative and leaf growth

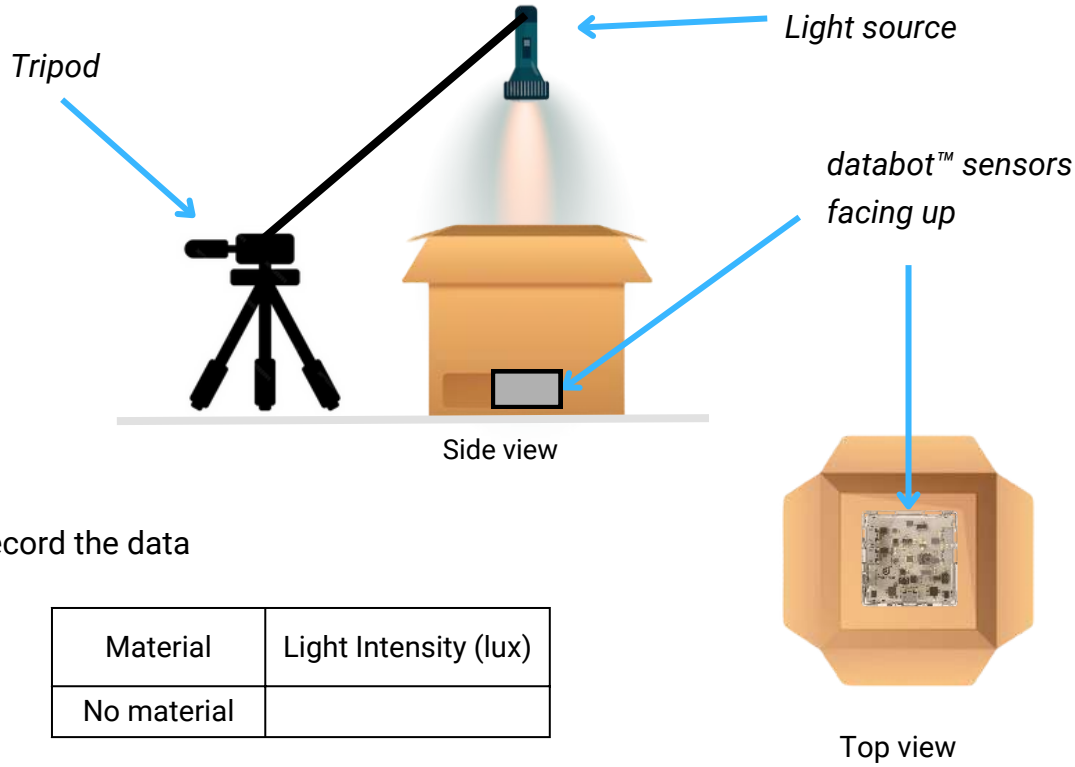
Write down your observations._____

_____

Transparent Materials

Evaluate how different materials transmit light and determine which is the most suitable for greenhouse design.

- Turn on databot.
- Tap on **"Light for life"** in Vizeey to load the experiment.
- You will be prompted to connect to databot.
  - Hint- if there is more than one databot in use, the one closest to you will be in blue!
  - A solid blue light on databot means you are connected.
- Choose the tab *"Light"* and start your experiment using:
- Use these icons at the top of the screen in Vizeey to start and to pause the experiment.
- Place databot in a box to create a dark area, the databot sensors should be facing upwards.
- Make a hole in the top of the box to let the light to pass through.
- Place the light source on a tripod so that it shines on databot.
- Turn on the light source without any material between the light and databot™. Wait 5 seconds and record the light intensity as the control value.



- Record the data

Material	Light Intensity (lux)
No material	

Light Color

- Place a sheet of glass between the light source and databot™. Ensure it completely covers the light path. Wait 5 seconds and record the light intensity.
- Record the data

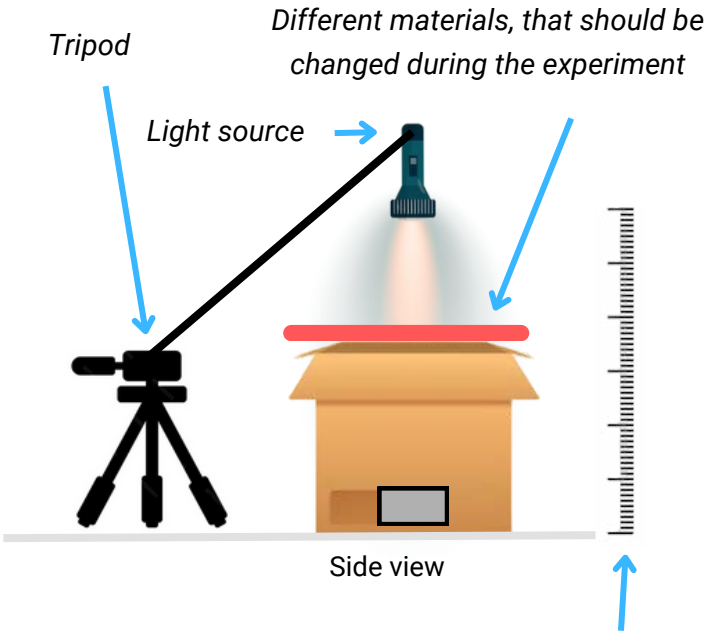
Material	Light Intensity (lux)
glass	

- Replace the glass with a sheet of clear plastic and repeat the measurement process.
- Record the data

Material	Light Intensity (lux)
plastic	

- Replace the plastic with a piece of translucent fabric and repeat the measurement process.
- Record the data

Material	Light Intensity (lux)
plastic	



Keep the light source at a fixed distance from the databot™ throughout the experiment. Use a ruler to confirm the distance remains constant.

Make a histogram from the obtained values that would show how the greenhouse material can prevent light penetration.

Extension Idea: If time permits, experiment with combining materials or overlapping light spectra to see how multiple factors interact. For example, test the light intensity when using a red filter under a plastic sheet.

Part 6: Concept Questions

After completing all three experiments, analyze the results to determine:

- The best angle for maximizing light intensity

_____

- The most effective light spectrum for plants.

_____

- The ideal material for building a greenhouse.

_____

Part 7: Reflection

1. How could you apply what you learned to real-world scenarios (e.g., farming, indoor gardening)?

_____

_____

2. What surprised you the most during the experiments?

_____

_____