Environmental Science Lab

EFFECT OF POPULATION DENSITY ON PLANT GROWTH

OVERVIEW

Competition between organisms for resources such as food, water and space is a fundamental part of ecology. It can strain limited resources, cause stress among organisms, and even lead to environmental degradation. Competition is generally classified as two types: interspecific and intraspecific. Interspecific competition occurs between members of two different species. Therfore, it involves communities of living organisms. Intraspecific competition occurs between members of the same species. Therefore, it involves populations of living things. In this lab you will investigate the effects of intraspecific competition for resources on the growth of a plant species by varying its population density.

1. You will study the growth of mung bean plants in five indentical containers. Each container will have a different number of individuals, and therefore represent a different population density.

2. Next, you will study the effect of the intraspecific crowding on plant height. You will measure the height of individual plants and determine the average height per container. You will then look for a correlation between average plant height and population density.

3. Finally, you will measure the wet biomass of individual plants and determine the average wet biomass per container. You will then look for a correlation between plant biomass and population density.

TIME REQUIREMENTS

This lab activity requires one 50-minute class period.

Note: The mung bean seeds must be planted in the containers approximately two weeks prior to the scheduled lab period.

LAB EQUIPMENT AND MATERIALS

A list of equipment and materials you will need to perform this lab is given below. The mung bean seedlings will be started by your teacher approximately two weeks before the lab. They should be located in an area where they can receive an even amount of sunlight.

Equipment	**Amount Needed**
Plant container with mung bean seedlings	5
Balance	1
Ruler (cm scale)	1
Materials	**Amount Needed**
Graph paper (linear)	2 sheets
Paper towels	various

LAB PROCEDURE

Hints for a Successful Lab:

⇒ Be careful with the seedlings as they are very delicate at this stage, especially the roots. Do not tear the plant from its roots when making the height measurement, or when removing the plants from the container.

⇒ Be sure remove all soil from the roots in order to determine an accurate wet biomass.

Measure the plant height

1. Measure the height of each plant using a ruler, The height should be measured from the soil surface to the tip of the shoot. Repeat the process for each container.

2. Record the height of each plant on the data worksheet.

3. Determine the average height of plants in each container by adding up the individual heights and then dividing by the total number of plants in the container.

4. Record the average plant height for each container on the data worksheet.

Measure the plant wet biomass

1. Remove each plant from the container. Be very careful and shake off (over the garbage can) as much soil as possible from the delicate roots.

2. Rinse the remaining soil from the roots using water running from tap. Do not wash soil down the drain. Catch it in some type of container or trap. Pat the plants dry with paper towels.

3. Measure the wet biomass of each plant using a balance.

4. Record the wet biomass data on the data worksheet.

5. Determine the average wet biomass of plants in each container by adding up the individual biomasses and then dividing by the total number of plants in the container.

6. Record the average wet biomass for each container on the data worksheet.

LAB REPORT/ANALYSIS QUESTIONS

Provide answers to the following questions using complete sentences.

1. What effect did population density have on the height and biomass of the mung plants?

2. What are some factors that can limit a plant's growth? Which were tested in this lab?

3. Which do you think is more of a controlling factor on the mung plant's growth: the genetic makeup of the plant, or the environment in which the plant lives?

4. Due to time and equipment constraints, this lab activity measured the plant's wet biomass, not its dry biomass. Why would it be better to measure the dry biomass?

5. Make a graph of average plant height vs population density using the average height data from the data worksheet. Be accurate and label your axes.

6. Make a graph of average biomass vs population density using the average wet biomas data from the data worksheet. Be accurate and label your axes.

7. Discuss your results using the graphs and data from your worksheet. A complete discussion includes an analysis of the data.

8. What are the possible sources of error in this lab?

9. Write a comprehensive summary and conclusion of your lab results.

END OF LAB

DATA WORKSHEET

CONTAINER 1		Height (cm)		Wet Biomass (g)
plant 1				
	ave Height:		ave Wet Biomass:	

CONTAINER 2		Height (cm)		Wet Biomass (g)
plant 1				
plant 2				
	ave Height:		ave Wet Biomass:	

CONTAINER 3		Height (cm)		Wet Biomass (g)
plant 1				
plant 2				
plant 3				
plant 4				
	ave Height:		ave Wet Biomass:	

CONTAINER 4		Height (cm)		Wet Biomass (g)
plant 1				
plant 2				
plant 3				
plant 4				
plant 5				
plant 6				
plant 7				
plant 8				
	ave Height:		ave Wet Biomass:	

CONTAINER 5		Height (cm)		Wet Biomass (g)
plant 1				
plant 2				
plant 3				
plant 4				
plant 5				
plant 6				
plant 7				
plant 8				
plant 9				
plant 10				
plant 11				
plant 12				
plant 13				
plant 14				
plant 15				
plant 16				
	ave Height:		ave Wet Biomass:	