Mutualism In Action

Pre-discussion:

Use the following table to identify what do plants need to grow and where these things come from?

|  |  |
| --- | --- |
| Requirement for growth | Source |
|  |  |
|  |  |
|  |  |
|  |  |

What is mutualism?

Which requirements listed above may involve mutualistic relationship between a plant and rhizobia?

**Experiment I:**

Question: How does light and rhizobia affect plant growth?

Hypothesis: Light and rhizobia are important for plant growth.

You will be given four bean plants. Half have been grown in light and half in dark. In each light/dark treatment half of the plants were exposed to rhizobia and half were not exposed.

Observe the four plants and record your observations in the following table:

|  |  |  |
| --- | --- | --- |
|  | Light | Dark |
| With Rhizobia |  |  |
| Without Rhizobia |  |  |

Measure the height of each plant and graph the results:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Treatment | Height (mm) | Number of Leaves | Number of Nodules | Mass |
| Light with Rhizobia |  |  |  |  |
| Dark with Rhizobia |  |  |  |  |
| Light without Rhizobia |  |  |  |  |
| Dark without Rhizobia |  |  |  |  |

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What conclusions can be drawn from this data?

**Experiment II: Environmental Affects on Mutualistic Relationships**

Does the presence of nitrogen affect the relationship between plants and rhizobia?

Hypothesis:

Experimental Design:

Results:

**Methods for Experiment II**

Obtain the following materials:

4 clear plastic cups Fertilizer

Sharpie Inoculum (available at garden store or use garden soil)

Bean seeds vermiculite

1. Label each cup as shown below
2. Add vermiculite to ¾ full
3. To the cups labeled #3 and #4 add 3 fertilizer pellets
4. Add vermiculite to all cups to fill completely
5. Water until vermiculite is completely saturated and water drips out drain
6. Make a 1 inch indentation with your finger
7. Add a bean seed and cover loosely with moist soil
8. Add rhizobia inoculum(5ml) using pipette to cups labeled #2 and #4
9. Add water (5ml) using pipette to cups labeled #1 and #3 as control.
10. Place all plants in a warm, light location

Experiment II Setup

#1

No N

No Rhiz

# 2

No N

Add Rhiz

# 3

Add N

No Rhiz

# 4

Add N

Add Rhiz

Data Collection:

After four weeks of growth, measure and record the height of each plant. Carefully remove each plant and count the number of nodules on the roots.

|  |  |  |
| --- | --- | --- |
| **Treatment** | **Plant Height (mm)** | **Number of Nodules** |
| No N , No Rhizobia |  |  |
| No N, Rhizobia added |  |  |
| N added, no Rhizobia |  |  |
| N added, Rhizobia added |  |  |

**Conclusion:** What can you conclude about the presence of nitrogen on the relationship between Rhizobia and the bean plants?

**Field Observations of Plant/Rhizobia**

As you find different plants with relationships with rhizobia add your observations to the following chart:

|  |  |  |
| --- | --- | --- |
| Plant | Description of Nodules | Number of Nodules |
|  |  |  |
|  |  |  |
|  |  |  |

Hypothesize about how the environment may affect rhizobia and plant interaction.