Effects of European Corn Borer (ECB) Infestation on Corn Yields

Introduction:

In this activity you will use a virtual lab simulation on the laptop to further your understanding of independent and dependent variables. To do this, you will model a controlled experiment to test the effect of different levels of European Corn Borer (ECB) infestation on the yields of four different varieties of corn. The level of ECB infestation is the independent variable or the experimental factor, because it is the only item that affects the outcome of the experiment. You should assume all other conditions necessary for corn plant growth, such as soil and nutrients conditions, watering amounts, and light conditions remain adequate. Keeping all these conditions similar represents some of the constants of the experiment.

While changing the variable, you observe and measure the dependent variable that results from the change. In this experiment, the dependent variable you measure is the yield of the corn plants in terms of kernel weight per ear of corn. The amount of corn produced in a field is called its yield. The number of kernels on an ear determines the yield. A high yield results from many kernels on every ear and many ears in a field. A corn plant normally produces one ear per plant. Many problems, including insects, plant diseases, extreme weather conditions, or poor soil conditions can cause low yields. In current agricultural practices, corn plants have been selectively bred and genetically engineered to resist insect pests.

Procedure:

1. Get a laptop and open up the simulated lab activity by going to the following web address:

   http://www.mhhe.com/biosci/genbio/virtual_labs/BL_01/BL_01.html

3. Click on the Greenhouse Handbook on the bookshelf and read the ten pages of background information to assist you with understanding the lab activity.
4. After reading the Greenhouse Handbook please proceed to reading and performing the listed procedures on the webpage.
5. Please note that you are required to perform a series of experiments with three trial runs for each experimental variable.
6. Please keep in mind that in this activity you will be changing the independent variable while observing and measuring the dependent variable.
Effects of European Corn Borer (ECB) Infestation on Corn Yields

**Observations & Data:**

<table>
<thead>
<tr>
<th>Corn Variety</th>
<th>Level of ECB Infestation</th>
<th>Pot 1 Yield</th>
<th>Pot 2 Yield</th>
<th>Pot 3 Yield</th>
<th>Average of 3 Pots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golden Crop (non-Bt Crop)</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golden Crop (non-Bt Crop)</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Golden Crop (non-Bt Crop)</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bt 123 Corn</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bt 123 Corn</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bt 123 Corn</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bt 456 Corn</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bt 456 Corn</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bt 456 Corn</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super Harvest (non-Bt)</td>
<td>None</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super Harvest (non-Bt)</td>
<td>Low</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Super Harvest (non-Bt)</td>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Effects of European Corn Borer (ECB) Infestation on Corn Yields

Analysis:

1. Using graph paper or excel please create a graph showing three bar graphs for each corn variety. One bar graph will show no ECB infestation, the next one will show low ECB infestation and the final bar graph will depict a high ECB infestation.
2. Please use three different colored pencils to shade in the three different bars for each corn variety. One of the colors will always represent no ECB infection, the second color will always represent a low ECB infestation, and the final color always represent a high ECB infestation.
3. Create a key or legend to show what each color represents.
4. Make sure you label each trio of bar graphs with the type of corn variety they represent.
5. Make sure your graph has a title centered at the top of the graph.
6. Use the full page of paper to draw your graph.
7. Make sure you label the horizontal axis and the vertical axis of your graph.
8. Please be sure to put units with your labels when applicable.

Questions:

To assist you in answering the following questions please use the Greenhouse Handbook that you read earlier.

1. What will always be the dependent variable in this experiment? ________________________________

2. List three constants that you would make sure are the same between the control groups and the experimental groups.
   1. __________________________ 2. __________________________ 3. __________________________

3. What is the control in this experiment? _____________________________________________

4. What is the independent variable or experimental factor in this experiment? _________________________

5. Explain what is meant by the term “yield” with regard to this experiment.
Effects of European Corn Borer (ECB) Infestation on Corn Yields

6. Which factors may affect a corn's yield?

7. What makes Bt corn different from the other variety of corn you used in this lab?

8. Describe the effects of the ECB infestations you used. Were all corn varieties equally effective at controlling the ECB? How do you know?

9. How did the level of ECB infestation change the results you obtained in the lab?

10. Which corn variety would grow best when you have no ECB infestation, when you have a low ECB infestation, and when you have a high ECB infestation?
Effects of European Corn Borer (ECB) Infestation on Corn Yields

11. If there was no ECB infestation in a certain year, would a farmer gain or lose financially by planting Bt corn? Explain why.

12. What might happen if Bt corn affects non-target organisms such as beneficial insects or harmless insects?

13. What might happen if ECB became resistant to Bt?

14. Discuss possible benefits and drawbacks of a transgenic organism such as Bt corn?
Effects of European Corn Borer (ECB) Infestation on Corn Yields

15. A farmer planted a field of BT 123 corn and wants to estimate the yield in terms of bushels per acre. He counts 22 ears in 1/1000 of an acre. He determines that each ear has about 700 kernels on average. He also knows that a bushel contains about 90,000 kernels on average. What is the farmer's estimate of yield in bushels/acre?

Conclusion:

In the space below write a concise paragraph to summarize your hypothesis by basing your conclusion on your collected data, your graph, and the analysis of your observations.