

What effect do the
different levels of ecb
infestation of the bt
and non-bt corn ...



**ASSIGN
BUSTER**

Biology IBO Group 61 Teacher: Lorena Isabel Garza Hinojosa Student:

Angelica Lopez Hernandez ID: A01211745 Due Date: 19/08/2008 “ Design

your own Bio Lab” Dependent and Independent Variables Problem

Statement: How different wavelengths of light affect the rate of

photosynthesis? Variables: *Dependent: wavelength of light (color)

*Independent: *Control: Method for controlling variables: All types of corn

must be grown in the same soil and nutrient conditions, watering amounts

and light conditions. They must be grown in separated plant chambers, and

the seeds will be planted in three pots and each grow chamber will be

labeled. The amount of ECB that is added to the plantation must always be in

the same quantity corresponding to the level of infestation.

Also the amount of seeds must always be the same in every experiment.

Hypothesis The yield of a Bt corn must be larger than the yield of a non Bt

corn because of the pesticide that the Bt corn has that helps exterminating

the ECB plague which causes low yield weight. Background The European

Corn Borer (ECB) is a major corn insect pest. The adult moths of ECB emerge

from the pupae and mate during April and May. Each female lays up to 600

eggs on the undersides of leaves.

After hatching, larvae begin feeding on leaf surfaces. This process continues

until pupation in spring. ? A corn plant seed weighs about . 28 g. In less than

10 weeks (~140 days) it grows into a plant of 2-3 meters tall.

In the following two and half months, it produces 500 to 1000 seeds. ?

Bacillus thuringiensis, or Bt is a soli acterium found worldwide. This

bacterium produces crystalline proteins (Cry proteins) that are stomach

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poisons for specific insects. Various formulations of Bt have been used as insecticides against the ECB on different types of corn.

? Geneticists create Bt corn by inserting a Cry protein gene from Bt into the corn plant's own DNA. This corn is a transgenic organism because it has been genetically altered. Then the transgenic corn plant produces Bt Cry protein insecticide in its tissues, protecting the plant from environmental degradation. The potential benefits include reduced applications of broad-spectrum insecticides.

Although, the impact on non-target insect species such as honeybees or monarch butterflies may not be beneficial. ? An evaluation led to the decision that the transgenic Bt corn variety was safe for animal consumption, but not for human consumption due to the possibility of allergic reactions.

Material The raw materials for plants to grow and carry out the necessary metabolic processes are water, sunlight, macronutrients and micronutrients from the soil, and carbon dioxide and oxygen from the air. Method for developing the experiment 1. Soil preparation: Every type of corn must be grown in separated plant chambers with the following characteristics: in a wind sheltered spot in full sun which provides good drainage and enough humus to insure that the ground will not dry out too quickly in hot weather.

Dig up your plot in the winter being sure not to bring clay to the surface and incorporate a good grade of compost into the soil. Two weeks prior to sowing the seed, rake in a good source of fertilizer. 2. Sowing & planting: Two seeds together will be sowed in three pots and each grow chamber will be labeled according to the type of corn and level of infestation that is being tested. 3.

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Looking after the plants: Make sure to provide plenty of water for the plants in hot weather, which is especially necessary when they flower.

Feed the plants with a good liquid fertilizer source when the cobs begin to swell. Corn growth stages (days): ? 9-12: root system and ear shoots determined. ? 14-21: number of kernel rows determined. ? 21-25: ability to take up nutrients and water established.

42-49: number of kernel per row determined ? 63-68: pollen shed begins ? ~140: all kernels have attained maximum dry weight. 4. Harvesting: At the end of the time period, the chamber opens and the fully grown plants are harvested. Carefully twist the ripe ear from the plant's stem, being careful not to injure the plant. 5. Weighing: Drag each ear on each of the plants to the weighing dishes to weigh its kernels.

The yield of kernels of each plant is now on a weighing dish. Drag a weighing dish to the balance to read the weight of the kernels. Record the weigh of a Data Table. Proceed to weigh the kernel yield from all plants. Calculate the average kernel yield form each set of three identical plants that are grown under identical conditions from the same type of seed. Record the calculations on the Data Table.

Method for collection of data The yields of each experiment must be weighed on the same weighing dish, and the results must be measured in a labeled table considering four significant numbers. The unit that must be used is grams. Uncertainty will be considered as half of the minimum weight that can be measured on the balance (± 0.05).

Data collection CORN VARIETIES AND YEILDS CORN VARIETYLEVEL OF ECB
 INFESTATIONGROWING POT 1 YEILD (GRAMS)GROWING POT 2 YEILD
 (GRAMS)GROWING POT 3 YEILD (GRAMS)AVERAGE YEILD (GRAMS)
 UNCERTAINTY + - . O5 (GRAMS) BT 456HIGH157. 30157. 00159. 00157. 77
 BT 456LOW178.

80172. 60179. 60177. 00 BT 456NONE190. 00183.

20184. 80186. 00 BT123HIGH155. 10163. 00163. 90160.

67 BT123LOW164. 00162. 60168. 30164. 97 BT123NONE160.

10164. 80164. 20163. 03 GOLDEN CROP (NON BT)HIGH135.

40139. 60138. 30137. 77 GOLDEN CROP (NON BT)LOW177. 90171.

20170. 60173. 23 GOLDEN CROP (NON BT)NONE181. 60182. 80189.

0184. 73 SUPERHARVESTHIGH125. 50129. 00130.

00128. 17 SUPERHARVESTLOW159. 10155. 00157.

50157. 20 SUPERHARVESTNONE164. 10164. 30161. 90163.

43 Processing raw data *BT 456 (transgenic) *BT 123 (transgenic) *Golden
 crop (non BT) *Superharvest Journal *Describe the effects of the ECB
 infestations you used. Were all corn varieties equally effective at controlling
 the ECB? How do you know? *BT 456: When the level of ECB was high, the
 average yield was 157 g. When the level of ECB was low, the average yield

was 177 g. When the level of ECB was none, the average yield was 186 g.

*BT 123: When the level of ECB was high, the average yield was 160 g.

When the level of ECB was low, the average yield was 164 g. When the level of ECB was none, the average yield was 163 g. *Golden crop (non BT): When the level of ECB was high, the average yield was 137 g. When the level of ECB was low, the average yield was 173 g. When the level of ECB was none, the average yield was 184 g.

*Superharvest: When the level of ECB was high, the average yield was 128 g. When the level of ECB was low, the average yield was 157 g. When the level of ECB was none, the average yield was 163 g. Not all corn varieties were equally effective at controlling the ECB. For example, the ECB infestation did not affect very much the BT 456 and the BT 123 corn because those are transgenic corn which produces Bt Cry protein insecticide in its tissues; this increases the yield of the corn because it exterminated the plague. The opposite happened with the non Bt corn because it does not have insecticide within its tissues and is not able to exterminate the plague which causes low yield weight.

*If there was no ECB infestation in a certain year, would a farmer gain or lose financially by planting Bt corn? Explain why. It will depend on the type of Bt corn the farmer chose to plant. If he chose the BT146 he will win financially regardless of the infestation because it has the major yield weight including Bt and non-Bt (186 g), or the other two which have the lowest yield weight (163 g-BT123, and 163 g-Superharvest) in that case he will always lose financially. The average of non-Bt corn (Golden Crop) is 184.73 which give

us an insignificant difference, approximately 2 g between BT146 and Golden Crop. *What might happen if Bt corn affects non-target organisms such as beneficial insects or harmless insects? Those species will extinct eventually unless they adapt and form resistance to the insecticide which is very unlikely to happen.

*What might happen if ECB became resistant to Bt? The scientists will have to come up with a more powerful insecticide than the Bt because Bt will not be able to fight against the ECB anymore and we will return to the initial problem before Bt. *Discuss possible benefits and drawbacks of a transgenic organism such as Bt corn? The benefit of transgenic organisms is that it is supposed to be better than the original, but I do not see any benefit in a transgenic corn. I think that all animals (including the ECB) are there for a reason whether it affects human or not. What we must do coming up with something natural that allows humans to coexist with all the animals in the earth instead of contaminating our soil with pesticides. Since scientists do not know everything about transgenic organisms we are risked to develop allergies, and the insecticide could harm innocent animals such as butterflies, honeybees and ladybugs. *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? ? Total ears: 1 acre = 22 ears Number of ears * total of acres $22 \times 1000 = 22,000$? Total kernels: Total ears * total kernel average $22000 *$

700 = 15, 400, 000 ? Estimate of yield: 1 bushel= 90, 000 kernels Total kernels/kernels of a bushel 15, 400, 000/ 90, 000 = 171.

11 bushel/acre Conclusion The hypothesis was confirmed, the Bt corn has a larger yield weight than the non-Bt corn. That is due to the fact that the Bt corn produces Bt Cry protein insecticide in its tissues, protecting the plant from degradation caused by ECB. The type of corn that exterminates ECB the best is BT146 because it gave the highest yield in every level of infestation. In relation to the effect that the transgenic organisms may have on the earth I consider that whatever the potential benefits are, we must find a way to coexist with all animals or find a natural way to diminish the damage instead of contaminating the soil and exposing non-target animals to death.

Evaluating procedures The potential limitations that the investigation may have are that the number of times the experiment was run may not be enough, due to the fact that the results varied in the three different pots. This does not allow us to give a definite response to the problem statement and our conclusions will be superficial.

Improving the investigation In order to improve the investigation what must be done is repeating the experiment until the results are consistent. After a repeated phenomenon is registered it will be possible to give a finite conclusion about the effect of ECB in the transgenic corn. References: Biology Life on Earth, Eight Edition (2008). Teresa Auderisk by Prentice Hall Inc. How to grow corn.

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