Student 5: Low Achieved

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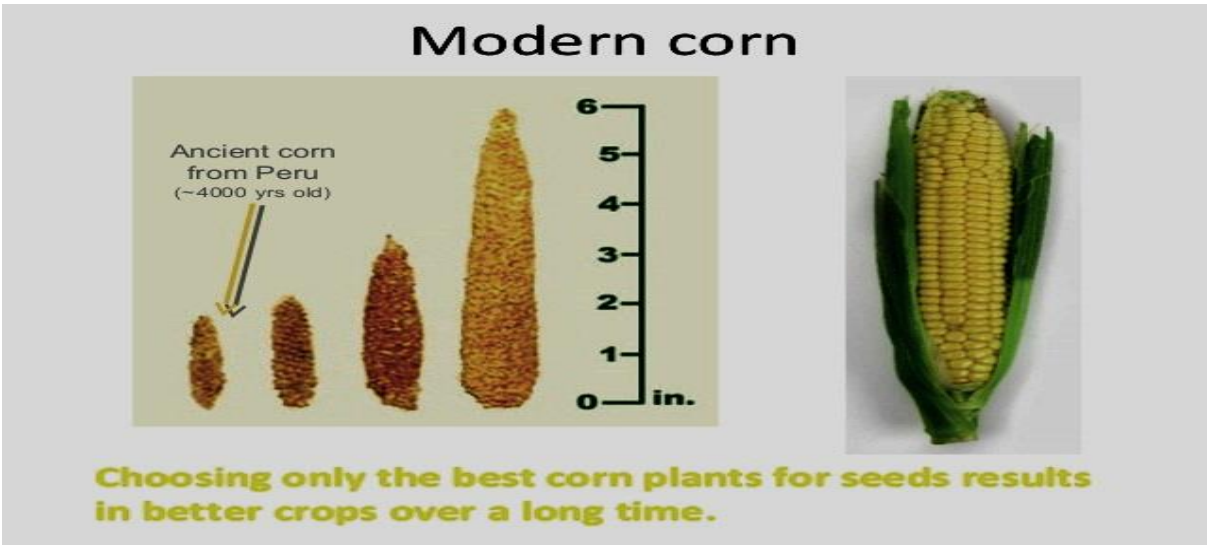
The history of modern-day corn begins at the dawn of human agriculture, about 10,000 years ago. Ancient farmers in what is now Mexico took the first steps in domesticating maize when they simply chose which kernels (seeds) to plant. These farmers noticed that not all plants were the same. Some plants may have grown larger than others, or maybe some kernels tasted better or were easier to grind. The farmers saved seeds from plants with desirable characteristics and planted them for the next season's harvest. This process is known as selective breeding or artificial selection. Maize cobs became larger over time, with more rows of kernels, eventually taking on the form of modern maize.

(1)



The study of genetics shows that corn's wild ancestor is a grass called teosinte. This plant doesn't look much like maize, especially when the seeds are compared compare to those of corn. However at the DNA level, they are both very similar; they have the same number of chromosomes and a remarkably similar arrangement of genes. In fact, teosinte can cross-breed with modern maize varieties to form maize-teosinte hybrids that can go on to reproduce naturally.

Planting a seed from a corn plant that appears to have one or more desirable features is not always reliable. Even though its phenotype may seem to be suitable, the genotype of its offspring may not be desirable. If the original plant had a recessive gene in its genotype there would be a chance of the seed being homozygous recessive. The particular phenotype expressed in the original corn plant would not be expressed in the new plant.

(2)

The offspring of selectively bred corn plants will inherit similar genes from its selectively bred parents. Farmers can now deliberately cross two members of the same species that both possess either homozygous dominant or homozygous recessive genes and almost guarantee a purebred offspring. The first way was by using a test cross. By crossing one organism that is showing the dominant form of a trait with another of the same species that is homozygous recessive for the same trait; it is possible to determine the other organism's genotype from the traits expressed in the offspring. Another method is marker assisted selection (MAS).

(1)

When crop plants like corn are made by selective breeding, there is a noticeable in a decrease in their genetic diversity. The plants share similar genes with each other which then increases the risk of disease. Similarity within a species means that if the species comes into contact with a disease, there is a chance of the whole species being wiped out. This will have effects on other things like ecosystems if one species is removed from a food chain. 2

Genetic cloning of whole corn plants is another way to produce crops with desirable features. Bt-corn is a type of genetically modified organism (GMO). It has been genetically modified through the addition of a small amount of genetic material from other organisms through molecular techniques. A gene that produces a feature of interest is identified and separated from the rest of the genetic material from a donor organism. Most organisms have thousands of genes; a single gene represents only a very small part of the total genetic makeup of an organism. 3

With Bt corn, the donor organism is a soil bacterium, *Bacillus thuringiensis*, and the gene of interest produces a protein that kills ECB (European corn borer) larvae. This protein is called the Bt delta endotoxin. The toxin was selected because it is highly effective at controlling ECB caterpillars. It is during the larval stage when most of the damage by European corn borer occurs. The protein is very selective, generally not harming insects in other orders (such as beetles, flies, bees and wasps). *Bacillus thuringiensis* (Bt) is a soil bacterium that produces insecticidal toxins. Genes from Bt can be inserted into crop plants to make them capable of producing an insecticidal toxin and therefore resistant to certain pests. The toxin affects the insect's digestive system, so damage to the plant stops soon after the insect is exposed to the toxin. Mortality may take several days, so the effects of delta endotoxins are very different from what we expect from conventional insecticides. 3 4

There are many different Bt corn hybrids available. While some experimental transgenic plants have caused allergic responses in humans, there are no known serious human health effects associated with Bt corn. A biological implication of Bt corn, however, is the possible negative effects it can have on populations other than those intended. A study done in 1999 found that Bt corn is also toxic for Monarch butterfly larvae. They suffered when their normal diet was dusted with Bt corn pollen. Bt corn can affect non-target insects if they are closely related to the target pest, as is the case with Monarch butterfly. These effects are considered minor, relative to those associated with the alternative of using insecticides. 4

Another biological implication of pest resistant Bt corn is that there is less genetic diversity in the species. If all the corn plants have identical DNA they will all be affected by the same things such as diseases and pesticides. Bt maize has revolutionized pest control in a number of countries, but there still are questions about its use and impact. The control of insects by Bt corn has many scientists worried that overuse of Bt corn could produce pests resistant to Bt toxins. Resistance to Bt corn has occurred for two moth species in South Africa, so this concern is warranted. 4