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WHY ARE GMOs CONTROVERSIAL

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Abstract

Nowadays, there are many controversies around GMOs, mainly due to the lack of information, but also to the fact that the technology of obtaining the transgenic organisms is relatively new and therefore unknown by ordinary consumers. Many people believe that GMOs are harmful to human and animal health but also, for the environment. While some of these claims have been proven to be true, most of them are just speculations. Despite all the backlash, it has not been scientifically proved that GMO consumption is more dangerous than organic food. Regarding the environmental potential issues, in order not to bring ecological imbalances, the states that have embraced GMO breeding and cultivation have adopted very restrictive regulatory rules. This way, both ecosystems and food are secured. The present paper tries to detail, besides advantages and disadvantages, some myths and facts about GMOs.

Keywords*: biotechnology, environment, food, GMO.*

INTRODUCTION

Genetically modified organisms have been the subject of many controversies through the years due to a lot of misinformation spread to a wide audience and this is the reason why it peaked our interest. The world isn't black and white, there are some estimated dangers that come from GMOs production but they also have potential to solve some problems that we have been fighting for so long.

The term "Genetically modified organism" or GMO for short is pretty vague, but usually people refer to GMOs as organisms that, through genetic engineering (GE), receive genes extracted from the DNA of another plant, animal, insect, bacteria or virus. But GMOs can also be categorized as "Natural", which means that these are still GMOs but do not contain added flavours, colours or synthetic substances. Non-GMOs are a little tricky because these are not modified through GE but could have been modified through selective breeding over the centuries.

Selective breeding is a "traditional" agricultural method that farmers have been practicing since 10.000 years ago. People noticed that some plants or animals from a population are a little better than the rest, meaning that some plants are more resilient to heat than others or tastier and some animals are bigger than others, for example. So, farmers decided to breed the ones with the desired traits. One thing led to another and now the vegetables, fruits and animals that we know today look nothing like they used to. One popular example is the teosinte which is the ancestor of corn. Nowadays the corn, that we all know, is 1.000 times bigger than what it used to be and also sweeter.

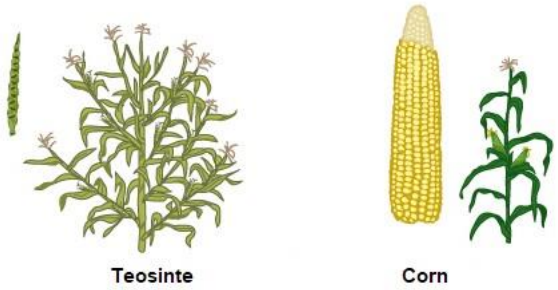

Figure 1. [1]

The difference between selective breeding and genetic engineering is that the latter is more precise. While through GE we can choose what trait we want, for selective breeding is more of a lucky strike to get what we want.

DEVELOPING A GMO SEED

We can divide the process of developing a GMO seed, in a few consecutive and easy

steps. This way it can be noticed the differences between a natural and an improved seed even better by analyzing the changes at a microscopic scale.
The first step requires choosing and finding the desired trait (like insect pest resistance or drought tolerance) in nature or in other related species, next, a copy of the gene for the trait is transferred into a plant that will be the GMO. This can be done with either a Gene Gun, that shoots DNA coated metal particles into the seed, or a plasmid inserted into the bacteria that will "infect" the cell. The final step is to place the seed into carefully controlled growth chambers that are monitored to ensure replication.

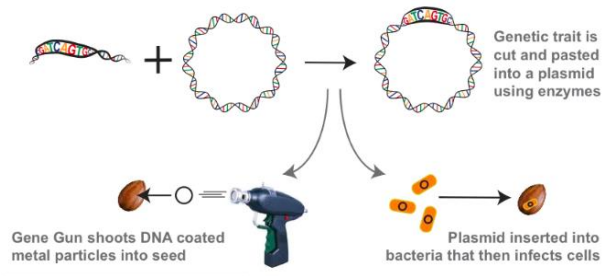

Figure 2. [2]

WHY DEVELOP A GMO SEED?

GMO's are using resources efficiently, because they are made this way. Some GMO corn crops for example, can protect harvests in water-limited conditions better than conventionally produced crops. They are also fighting pests and diseases, the scientists are developing crops that look and taste the same as their non-GMO counterparts, but are resistant to insects and plant-specific diseases that can impact a farmer's harvest. Some of the plants have traits that protect roots from insect damage, or other possible traits as specified during the first step of developing a GMO seed, by choosing a desired trait and gene from a related species. Another great reason to choose genetically modified seeds is for conserving natural habitats, these can help farmers around the world meet the increasing demand for food by making the most of their existing arable land, thus preserving nearby habitats.

ARE GMOS DANGEROUS?

There have been debates over debates regarding this subject: if GMOs can actually harm the environment, or if these are dangerous for us to consume?
The thing that "scares" farmers most is the gene flow.
Gene flow happens when the "organic" crops intermingle with GM crops and they acquire undesired traits. Another downside to this, is that GM crops may be harmful to the bee populations but that is still uncertain. Some people claim that GM crops are drenched in a type of insecticide called neonicotinoids or "neonics" for short, that is a danger to the honey bees' health, although this insecticide is also used for regular crops.
Another concern for the bees' health was the BT crops which are GM crops with a gene from the bacterium Bacillus Thuringiensis that allows the plants to produce a protein that destroys the digestive system of insects but this was debunked through several studies which concluded that the BT crops do not affect negatively the bees' health in any way.
BT crops have been controversial not only because they supposedly affect the bees but also humans. The problem was raised because these were engineered especially to be toxic to pests and people were concerned that it may also be dangerous for human consumption. The thing is that, even if these are poisonous to pests it doesn't necessarily mean that they are poisonous for humans. A good example is chocolate, while it is toxic for dogs, humans can consume it without any problem, in fact, it's quite delicious.
While we are on the topic of BT crops, it's worth mentioning that these help agriculture a lot, by reducing the use of multiple pesticides. A particular case was in Bangladesh, where farmers had to rely heavily on pesticides to defend the eggplant crops from pests. Pesticides are not only expensive but are also toxic to humans, workers occasionally getting sick from the long exposure to those. Another example of BT crops put to good use was in 1998 when the ring spot virus threatened 50% of the papaya population, which is Hawaii's second most important crop.
Now, going back to the main subject. We can't let GMOs contaminate other crops so what do we do?
A solution to this issue was the "terminator seeds" which are crop seeds that do no breed

any further. Although this sounds good, the downside and the reason this solution was dropped was because it was too costly for farmers to buy new seeds each year.
Another solution would be "buffer zones" which are empty spaces around the crops.

GM PIGS
Scientists from the University of Edinburgh announced that they had deleted the section of DNA that leaves pigs vulnerable to porcine reproductive and respiratory syndrome. However, genetically modified animals are banned from the EU food chain. Laboratory-based diagnostic tests have evolved significantly since initial discovery of the PRRS virus in the late 1980s. Initially viral culture was used to confirm PRRSV in serum or tissue samples [3].

GM MOSQUITOES
The British company Oxitec has created genetically modified male mosquitoes that carry a "self-limiting gene". When they are released into the wild and mate with females their offspring do not reach adulthood, so crucially do not contribute to the spread of the Zika virus. Other researchers are concerned about using genetic modification to curb the spread of malaria. Zika is spread mostly by the bite of an infected species. These mosquitoes bite both during day and night.
Zika can be passed from a pregnant woman to her fetus. Infection during pregnancy can cause certain birth defects.
There is no vaccine, nor medicine for Zika [4].

GM COWS
Scientists in both China and Argentina have developed genetically engineered cows to produce milk similar in composition to that made by humans. After modifying embryos, an Argentinian cow was born that expressed milk containing proteins present in human milk but lacking in cow milk. However, there are a number of scientific issues that we have to overcome before this replaces "mother's milk" for infants [5].

GM CHICKENS
The Roslin Institute is working on GM chickens that contain an extra gene that interrupts the transmission of avian flu. Unlike a vaccination, the modification still protects the bird if the virus mutates. However, some farmers argue it is better to enforce good farming practices than creating disease-free animals. Though the avian flu is adapted to birds, it can also stably adapt and sustain person to person transmission.
The type with the greatest risk is highly pathogenic avian influenza (HPAI). Bird flu is similar to swine flu, dog flu, horse flu and human flu, as an illness caused by strains of influenza viruses that have adapted to a specific host [6].

GM SALMON
The Canadian authorities allowed a GM salmon designed by the US company Aqua Bounty to be sold to consumers. It is engineered to reach market size in 18 months, half the time of its natural counterpart. However, the fish is not labelled GM in shops.
The bigger salmon is always going to be the GM specimen.
They both have the same age and are the same species, however, the difference is very clear between the two in size [7].

MONSANTO AND GMO
Having been voted "the evillest corporation" in the world by readers of the Natural New website in 2013, there's no denying Monsanto has had some reputation problems. In 1901 Monsanto company was founded and in 1920 it became the world's largest Aspirin manufacturer, and later in 1941, the globe's biggest manufacturer of "PCB". In 1960 Monsanto was one of the only producers of the biochemical weapon "Agent Orange". However, in 1970 the production and usage of PCB were banned due to birth defects and various disorders and in 1975, DDT (a chemical used in pesticides) was prohibited because it was somehow linked to cancer, Monsanto also being one of its manufacturers.

Perhaps because so many of the company's products have been banned, the executives at Monsanto decided by the 1980s that the group had to let go of both its chemical and plastic departments. Monsanto then headed in a new direction as it began buying up seed companies while also investing in biotech research. With approval from the US Department of Agriculture, in 1994 farmers began growing soybeans with Monsanto's GM seeds, making their crops immune to the most commonly used weed killer in the industry (Round-Up). However, backlash from anti-GM activists occurred all the same, with many accusing Monsanto of preventing farmers from using their best seeds; still the company's attitude at the time was "if they try to block it, we'll sue them". They even held a campaign called "Food biotechnology is a matter of opinions – Monsanto believes you should hear all of them".

And so, despite regulatory approval from the EU, consumers in the UK rebelled against Round-Up Ready seeds, they didn't want to have anything to do with Monsanto. In return, they dubbed the British as the "sad sacks of Europe". "The GMO opposition originally formed around two primary issues: the social and ethical aspects of designing life, and the potential impacts on seed diversity and control". Monsanto's biggest mistake has been its failure to understand the cultural significance of farming, or that many people feel strongly about the idea of 'parenting nature'. Nevertheless, this has been nothing but a war between letting Mother Nature follow her course and exploiting its potential for our increased benefits.

CONCLUSIONS

We believe that we should set out differences aside, pro-GMOs and anti-GMOs, be more open-minded and invest more in GMO research so we could know for sure if these are harmful or not, or if these can be actually helpful and in which way. GMOs use may not be able to solve all the problems that agriculture has, like the use of pesticides and fertilizers and deforestation, but at the very least it can lower the impact. Another problem is that the population of humans will keep growing, the arable land is lower every year and so we will need more and more food and other resources. From this point of view, rather than expanding the agriculture a solution would be to intensify it.

REFERENCES

https://commons.wikimedia.org/wiki/File:Mais_ja_teosint.jpg

http://sitn.hms.harvard.edu/flash/2015/how-to-make-a-gmo/

https://www.theguardian.com/science/2018/jun/20/scientists-genetically-engineer-pigs-immune-to-costly-disease

https://medicalxpress.com/news/2018-08-genetically-mosquitoes-weapon-curbing-disease.html

https://www.telegraph.co.uk/news/worldnews/southamerica/argentina/8569687/Scientists-create-cow-that-produces-human-milk.html

https://www.ed.ac.uk/roslin/research/isp/control-infectious-diseases/genetic-basis-of-host-resistance/gm-chickens-that-dont-transmit-bird-flu

https://www.scientificamerican.com/article/first-genetically-engineered-salmon-sold-in-canada/?redirect=1