Forum: Environment Commission

Issue: Promoting the development of new drought-resistant crop varieties to sustain dry lands productivity

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Introduction

The phenomenon known as drought has historically diminished crop yields and is caused by the disruption of weather patterns that alters the water cycle (National Geographic Society, n.d.). Wind patterns can also suffer changes and affect the problem. In drylands specifically, these issues are enhanced, since the already existing climate patterns make for a worsened situation. This leads to a need to combine measures taken for droughts and previous dryland farming techniques. "Dryland farming encompasses specific agricultural techniques for the non-irrigated cultivation of crops (...) Dryland farmed crops may include winter wheat, corn, beans, sunflowers or even watermelon." (Malcolm, Sale, 1996).

A very efficient solution is drought resistant modified crops adapted to dryland farming. This measure is of utmost importance due to the amount of the detrimental effects ignoring this would have in worldwide food availability. The existing wildlife is already going through natural processes to fix the problem, but human intervention is key, and development of new crop varieties could greatly accelerate the quest for a solution.

Definition of Key Terms

Genetically modified organisms

Genetically modified organisms (also known as GMOs, or GM crops) are crops created through plant breeding, especifically through genetic engineering. The objective of these types of organisms is to create a stronger, more resilient strand of a specific type of plant through the combining of desirable traits from other plants they wish to see in the original plant, and the original plant they wish to improve. "Resistance to insects and disease and tolerance to herbicides" (GMO Answers, n.d.) are among usual desired characteristics of crops to improve productivity.

Drought

Drought is defined as long-lasting dry weather period that can cause several problems such as water supply shortage or crop damage (among other things). It is an 'Abiotic stress', also known as the "negative impact of non-living factors on the living organisms in a specific environment" (Biology-Online Dictionary, 2014). It heavily depends on the climate the place in question has, and the average rainfall, seeing as in arid environments with low amounts of rainfall a year can usually face a significantly smaller amount of water than other less arid places and still not be in a drought period. "Agricultural drought accounts for the water needs of crops during different growing stages." (LiveScience, 2018).

Drylands

Covering over 40% of the earth's surface, drylands host a large amount of the world's denizens, estimated to be around 2.5 billion people. These are lands that have a ver distin tive characteristic: scarcity of water. The causes for the creation of this type of land are the next: "...low precipitation, droughts and heat waves, as well as human activities such as fire use, livestock grazing, the collection of wood and soil cultivation." (FAO). The determination of a dryland as such is made by the UNEP according to the standandarts of the aridity index (AI).

Drought tolerant (DT) crop varieties

Droughts in combination with failure in agricultural water have led to the need to use Drought tolerant (DT) crop varieties, among other tools for the efficient use of water. These were mainly created to replace to the utmost degree irrigation, which is vital in drylands. Thanks to advanced molecular breeding, the creation of these crops has been facilitated and made to maintain the drought resistant traits the plant originally possesses as much as possible, since the identification process of such traits is much more precise nowadays.

Background Information

Global food security is being haunted by the rapid increase in population and drastic changes in the climate (Lesk et al., 2016). "In the past 10 years, global food insecurity has been aggravated by human population growth, environmental deterioration, and climate change. Hence, developing drought-tolerant crops by modern biotechnology may contribute to global food security because drought-tolerant crops may become a factor to maintain

plant growth and productivity, and to increase the area of arable land worldwide." (Liang, 2016). Studies have shown that many new and very recent advances in the mutation of genetically modified crops can be applied for increasing drought resistance.

While some plant species can adapt ("Some plants (such as grasses) will slow their growth or turn brown to conserve water. Trees can drop their leaves earlier in the season to prevent losing water through the leaf surface." (National Geographic Society, n.d.)), some cannot deal with the conditions they are subjected to ("Plants are subjected to the drought conditions when either the water supply to the roots is limited or the loss of water through transpiration is very high" (Anjum et al., 2011)), and in those case genetic intervention is necessary.

Scientist have spent considerable amounts of time researching plant response to the stress of drought, and only after all that extensive information was collected was it possible to start to assemble the correct variety of desirable stress to create the most ideal strand of crop to be drought resistant and work well in drylands. In spite of all of this, there are still a lot of steps to take in order to develop even more effective and less expensive varieties.

Should we fail to improve dryland agriculture, effects (which are primarily negative) vary, among which are: "...damage to habitats, loss of biodiversity, soil erosion, and an increased risk from wildfires..." (National Geographic Society, n.d.). There are economic and social problems as well; loss of product can decrease the cost of the land that in turn can lead to unemployment, and many health issues, like malnutrition, famine and water scarcity could be present too. Farmland cannot be allowed to rest (as per the traditional method of crop rotation) because of the current demand in food worldwide (because of the rapid increase in population. The drying of the soil (again; water scarcity) erodes the earth, that turns arable land into desert-like land, unusable for agricultural production.

These effects greatly impact food availability in the planet, and with the ongoing overpopulation, it has never been more pressing to find an effective and fast solution to such an important problem.

Major Countries and Organizations Involved

The United States

The United States is an important party in the crops industry given that it is the largest grower of genetically modified crops. Throughout history, the American government has prioritized the development of new resistant crops in order to increase the productivity of the agricultural industry (The Statistics Portal, n.d.). Therefore, many agencies have been created to manage its production. Some of these agencies are: the FDA (Food and Drug Agency) which is responsible of protecting the well being of the American society by controlling the food and the medicine sold in the national market; and the EPA (Environmental Protection Agency) which is qualified to preserve human health and the environment's (FAS, n.d.).

FAO (Food and Agriculture Organization of the United Nations)

FAO is a specialized organization of the United Nations for the special purpose of defeating worldwide hunger. In order to accomplish food security, the organization is focused on helping the agricultural communities after a drought or other sorts of crises. In many cases, after evaluating the benefits and the negative effects on the environment and the human health, FAO encourages the Member Governments to use genetically modified organisms. Therefore, the corporation is not responsible for implementing policies but to provide advice and assistance to those interested (Drought, n.d.).

ICRISAT (International Crops Institute for the Semi-Arid Tropics)

ICRISAT is a non-governmental organization responsible of encouraging the development of dryland in Asia and sub-Saharan Africa through agricultural research. Its objectives are to charge against hunger, reduce poverty and the negative effect on the environment. The party is fond of the use of genetically modified organisms if needed to improve the quality of life of the local community. Kenya is a perfect case given that due to the devastating drought the country is suffering, the NGO has been helping the agricultural community by implementing the use of drought-tolerant crops (ICRISAT, n.d.).

Iraq

Iraq, in collaboration with the International Atomic Energy Agency (IAEA) and Food and Agriculture Organization of the United Nations (FAO) recently genetically modified crops through induced mutation breeding (hence the intervention of the IAEA) in order to increase crop yield. Recent production has accounted to four times as much yield than production prior to the introduction of this new modified crop.

India

Drought-tolerant rice varieties in South India have had, as of late, a huge positive economic impact in comparison with previous unmodified rice varieties that weren't as productive under stressful drought conditions. Through conventional breeding in addition to molecular breeding of high yielding varieties these new crops increased crop yield of the white slender grain quality. Farmers that have tested this brand have said that they saw improved nutritional quality, better yield, good straw quality, better milling recovery, slender grain size, found themselves needing less human labour, farm yard manures and fertilizer and realized that production loss was minimal during drought period (Tamil Nadu Agricultural University, 2015)

Argentina

This country, in collaboration with Arcadia Biosciences, has created multiple successfully improved strands of modified drought tolerant soybeans, for more stability in areas of constant lack of water stress.

Timeline of Events

Date	Description of event
1987	United States field tests for the first time genetically modified crops (tobacco and tomato) (American Public Media, n.d.).
1992	The FDA states that genetically modified crops are not dangerous and are not required for special regulations (American Public Media, n.d.).
1994	France approves the first genetically modified crop of the European Union (tobacco) (American Public Media, n.d.).
2000	130 countries approve the International Biosafety Protocol. This consists on agreeing to label all

	genetically modified crops. However, it can only go into effect if another 50 countries approve the protocol (American Public Media, n.d.).
2001	The adoption of the International Treaty on Plant Genetic Resources for Food and Agriculture (FAO, n.d.).
October 8, 2018 to February 28, 2019	FAO Malawi is a project which is funded by the European Union, is part of a larger programme called Kulima. Its objective is to establish three Farmer Field School (FFS) master's trainer course and transfer knowledge and skills to 600 workers (FAO Malawi, n.d.).

Relevant UN Treaties and Events

- Report of the Secretary-General "Sustainable agriculture and rural development, Biotechnology for sustainable agriculture", April 24 - May 5, 2000 (U.N., 2000).
- Regulation of the European Parliament and the The Council of the European Union "Genetically modified food and feed", September 22, 2003 (EC 1829/2003) (EFSA, n.d.).
- Report of the Secretary-General "Review of implementation of Agenda 21 and the Johannesburg Plan of Implementation: drought", May 5-16, 2008 (U. N., 2008).
- Report of the Secretary-General "Policy options and actions for expediting progress in implementation: drought", May 4-15, 2009 (U. N., 2008).
- Report of the Secretary-General "The role of science, technology and innovation in ensuring food security by 2030", May 8-12, 2017 (U.N., 2017).

Previous Attempts to solve the Issue

Due to the characteristics of the Earth's environment, in some parts of the world natural disasters as droughts have been occurring since early on. However, due to unsustainable human activities, these crises have increased their regularity. Hence, with the

help of technology, the issue of low productivity in dry lands has been previously attempted to solve.

The creation of EFSA (European Food Safety Authority)

EFSA is an independent agency which began to work in 2002. It was established by the European Union with the aim of developing scientific research on food safety. Through environmental risk assessments, the organization is able to reach a conclusion on the issue studied and formulate its advice for the European Union Member States. It has provided awareness and information about important topics which affect human health and the wellbeing of the environment. Due to the existence of the Panel on Genetically Modified Organisms more information of the topic has been provided causing an increase on the willingness of the countries involved to implement GMOs into the food market (EFSA, n.d.).

The use of resolutions

As the government is responsible of deciding what is able to enter legally the national market, the implementation of regulations have been previously used in order to the solve the issue at hand.

"GMOs are equivalent to organic crops"

In 1992, FDA (Food and Drug Administration) of the United States established a policy which stated that genetically modified crops did not require more regulations than organic crops, implying that they were not dangerous to human health. This resolution was an attempt to increase the demand for resistant crops in the domestic food market in order to intensify the productivity of the agricultural industry. By encouraging the productivity of resistant crops, the objective was to develop new crop varieties (American Public Media, n.d.).

The imports, exports and transit regulations

Due to the prolonged drought crisis in Kenya, in August 2011 the National Biosafety Authority decided to publish the imports, exports and transit regulations for genetically modified organisms. The aim was to increase the involvement of these in the agricultural market in order to solve the hunger issue while protecting the environment and human health of possible side effects. Thanks to this regulation, consumers are now more aware of how GMOs work and how they intervene in their diet. Moreover, it has also encouraged the implementation of proper risk

management measures during research on resistant-crops (National Biosafety Authority, n.d.).

Possible Solutions

With the global human population growing a considerable amount each year, it is essential to find possible ways to increase the food supply. A viable way of achieving this is by implementing scientific discoveries in the agricultural industry. Through technological development, research on genetically modified organisms has been accomplished. However, it is very important to introduce these new crop varieties to the human system without harming the human health nor the environment.

Recognition of farmers tenure rights

Tenure rights are the rules followed by societies in order to control the behaviour of individuals. These rights establish how a piece of land can be controlled and used by the owner. It also determines their responsibilities and restrains over their property. If governments prioritize the recognition of farmers tenure rights, the demand for resistant-crops would increase. This is because the individuals would feel more confident on investing in their land if they know what their rights are and their probabilities of earning a profit. Therefore, by spreading awareness drought-tolerant crop varieties would develop (FAO.org., n.d.).

The improvement of infrastructure

The infrastructure is all the physical resources used in a business or a country. Some clear examples are transport and power supplies. Without these services, an industry is not able to function properly. Therefore, it is indispensable that the infrastructure is proper. However, in many circumstances it is not the case. A possible way of promoting the development of new drought-resistant crop varieties is by improving the efficiency of its production. This way producers are better-off given that they earn a higher profit due to the increase in productivity. Consumers would also be better-off since they would become more aware of the benefits of the use of genetically modified organisms due to the improvement on the communication system (FAO.org., n.d.).

A financial aid from the government

A possible solution to promote the use of drought-resistant crops is by implementing subsidies on the materials needed for its production. Through a financial help from the governments, the producers of GMOs would be able to increase their productivity due to the decrease on the cost of production. Therefore, more scientific research would be able to occur leading to a development on crop varieties. Moreover, with the introduction of a subsidy on the product, the demand for these would increase given that the number of consumers willing and able to purchase would enlarge.

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