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Use of Transgenic Crops to Increase Production on Saline Soil

The central idea of this essay is that the use of transgenic crops is a reality in this world, and that it might be the principal tool to fight food insecurity in Mexico, by applying this new form of technology to avoid the principal issues that impede a successful maintenance of crops and increase the production of them, we might reach as a country the standard levels of alimentation on the population.

Food security has become a national issue in Mexico because of the global economic situation, and guaranteeing necessary food production is very important in order to avoid having to import products and raising prices as well as losing crops because of plagues and droughts. It is urgent to exploit soil that has not been taken advantage of, for which it is important to use new technologies, with the support of the government because up to now it has not been enough in order to guarantee food security.

All around the world, pure water resources are becoming extinct, and irrigated soils present a great amount of salinity. This is a dangerous risk for food security, especially because corn and bean represent the most important crops in Mexico, regarding production and consumption (biggest number of producers, 3.2 of about 4 million farmers in the country). They constitute the alimentary basis for almost all of the population. (Ceccam)

Most agricultural losses Mexico has had as well as basic problems regarding non-utilization of natural resources for agricultural benefits have to do with saline soil and droughts in the north part of the country. In the rest of the country, the main agricultural problems are related to plagues and the indiscriminate use of very strong insecticides, among others.

Thanks to the diversity of its weather, Mexico produces many and a great variety of crops. Sugarcane and maize are in the first place, followed by sorghum, orange and wheat, but due to lack of appropriate technology, many crops are lost annually.

The annual production of maize in Mexico in 2008 was about 24.7 million tons, and it is expected that by the end of this year we will reach 26 million tons (approximately 2.7-3.3. tons per hectare).

Bean is one of the oldest plant foods that humanity knows. It seems that the first crops of this leguminous plant were about 7000 years ago. However, the intensive desertification of soil in recent years makes the culturing of this product increasingly difficult. Generally, it is sowed with maize because of rotating crops, which helps soil stay fertile. Furthermore, bean, in combination with maize, provides a substantial amount of the necessary proteins the population needs. (INEGI)

Chemical soil components can be contained either in solid phase, part of the minerals are included in organic compounds, or in liquid phase, in which electronic charges take place. Saline soil is soil that has an excess of soluble salt, which means greater conductivity, and ions hinder or do not permit the normal development and growth of plants. (Ibáñez)

Maize has little tolerance to salinity, which can be determined by measuring the electric conductivity of the soil. This measurement is done in "milliohms" per cubic centimeter (mohms/cm^3), also known as "millisiemens" (ms/cm^3). In order to have a successful production, soil salinity should be less than 1.5 (the normal range of salinity is less than 2 ms/cm^3). The different saline soils go from 2 ms/cm^3 to 16 ms/cm^3 . All around the world there are approximately 897

million hectares (ha) that present a higher than normal salinity level. In Mexico, approximately 20% of irrigated soil is affected by salinity, from which 64% is in the north part of the country (Cerda)

During the spring cycle of the current year, 12 million ha. of different crops were sowed in all the Mexican Republic, of which it is estimated that half a million will be a total loss because of drought and that this loss is going to represent in monetary terms 30 million USD. Due to this loss, the cost of bean is soon going to increase to 3.4 USD per kg. (while the current price is from 1.7 to 2.3 USD), and many of the poorest people will be practically incapable of acquiring it. (Norandi)

In the same cycle in 2005, due to a drought there was also an important loss of bean crops. According to "Unión Nacional de Productores de Frijol de la Confederación Nacional Campesina", 1, 400, 000 ha. of bean were sowed, and drought affected about 37, 258 ha (70%), which caused a decrease in the annual production by 20% approximately, including losses in other regions. (U)

But the most recent news is that the red light in agriculture is already on. Drought is seriously affecting 15 states of the country, in which there are losses bigger than a million ha, particularly in bean and maize, and the loss of around 5,000 heads of cattle (because there is no water to drink, nor enough foliage). Mexico reports the biggest alimentary inflation in the Organization for Economic Cooperation and Development, which was 13% between February 2008 and 2009.

Increase in prices is clearly represented in the fact that in 2006 Mexicans destined 29.4 of their incomes to alimentation, and in 2008 it increased to 31.6. But the most affected ones are the poorest, because they destine 48.9% of their incomes to it. (Hernandez) CONAGUA (National Water Commission) reported that from the 635 aquifers Mexico has, 104 are over-exploited. So, this is already a national problem, for which money investments are needed in order to control the alimentary crisis.

These difficulties and the willingness to improve our knowledge of science has led humanity to discover new alternatives, such as genetically modified organisms, which somehow have been rejected by society and governments. But there is no formal proof that genetically modified maize or bean are harmful to health, and yet there is proof that they are good at overcoming adverse external factors, such as plagues, lack of water, salinity, insecticides, and pesticides. (Greenpeace)

To respond to similar problems, and because of the need to develop new technologies in genetic studies, researchers have managed to combine the genetic information of varieties of commercial bean with some wild types and a mushroom. The result of this combination has generated a bean capable of growing with a minimum of water, actually 60% less water than needed by normal beans, and with an increase of 30% in production.

The bio-security law in Mexico has been approved, and its purpose is to regulate activities such as the utilization, experimentation, commercialization, and production of genetically modified organisms, in order to prevent, avoid, and reduce possible risks of harm to human health, the environment, or biodiversity. (Guillen)

San Luis Potosi is one of the states in which 70 to 80% of the population does not consume the recommended minimum amounts of food. Of the 750 000 ha. of agricultural soil in San Luis Potosi, even after some desalinization measures have been taken, 37.3% are saline. An important fact is that 47.7% of all soil in Mexico is arid or semiarid. (INEGI)

The American company Monsanto is soon going to make an enormous investment in experimental sowing of transgenic maize in some of the north regions of the country, because an agricultural study showed it might be very beneficial in Mexican territory. Monsanto's main interest is to avoid damages caused by plagues and insecticides, which affect many crops annually. (U)

The proposal I am advancing is to use transgenic maize and bean on saline soil. In San Luis Potosi the predominant weather, covering 71% of the surface of the state, is dry and semi-dry, which means that a great percentage of the soil is not being used because of its excessive salinity or because a lot of crops are lost because of drought.

One of the reasons these transgenics have not been grown in the country is that we do not want to lose our traditional roots of indigenous maize (called "Criollo" by Mexicans.) However, a study realized by the International Center of Improvement of Maize and Wheat (CIMMYT) indicates that these roots have been substituted somewhat by hybrids, due to the promotion of the use of this new and alternative form of crops. (Comission for Enviromental Resources)

The Mexican germplasm bank is one if the richest in the world, and the country is truly the cradle of maize because of its enormous variety of indigenous maize. Having a big variety of species sowed in the same region is beneficial because crop rotation or variety makes the soil more fertile. The crucial issue in this regard is that with transgenic crops indigenous variety is reduced completely and many species would be in danger of extinction. Not only that, when transgenic crops are sowed in open cycle fields, near organic crops, it threatens original grains and pollination, which may also produce a genetic loss. (CIMMYT)

Taking this background into account, this proposal suggests sowing transgenics in those areas that have saline soil or drought and in which, due to those adverse factors, no organic crop will be present in the vicinity. The idea, then, is that rather than sowing them all over the country, transgenics should be sowed exclusively in the necessary zones and only after careful soil, regional, and economic studies have determined that it is going to be good for production as well as for native biodiversity.

According to the National Forest Commission (CONAFOR), germplasm is defined as any structure that carries the total sum of the hereditary characteristics of a species (kind). This definition supposes that the structure can give origin to a new generation, transmitting its genetic characteristics. The seeds, fibers, bulbs, yolks, pollen, and cells are considered germplasm.

Germplasm banks constitute an invaluable reserve of genetic biodiversity of agricultural crops and native species, of which a great part has been lost because of their non-utilization and the destruction of habitats.

Mexico has many germplasm banks, property of different public institutions, universities and research centers. The Agriculture Secretary is investing 15.4 million USD in the construction of a National Germplasm Center, which in 2012 will work as part of the National System of Genetic Resources. The Global Crop Diversity Trust is inviting Mexico to join the bank they are constructing in Salvard, Norge, to preserve the biodiversity of crops and boost research to improve them.

In accordance with the needs of the country, the government intends to increase production in terms of 5 or 6 million tons by the year 2012. In order to do this, it is necessary to invest enormous monetary resources in new technologies.

A complementary part of this proposal is that once transgenic maize and bean have been accepted in saline soil and dry places, the second and natural step would be to stop importing transgenic products and to open more Mexican germplasm banks for the study, experimentation, and creation of transgenics.

Boosting the creation of Mexican transgenic seeds would be extremely beneficial for food security because in this way Mexico would have a sustainable system, food security would increase enormously, and rather than buy, we would invest and thus reduce the prices of the crops.

More than 22.6 million ha. in Latin America are already covered by transgenic crops, and they have been beneficial in increasing production and lowering investment. The basic idea of this proposal has already been carried out with maize in El Salvador. The first results yielded an increase of 15% in productivity, and a reduction of 10% in investment, that is to say savings of 546 USD per hectare. Another country that has successfully implemented this process, according to Monsanto, is Argentina, which is the second biggest transgenic producer in the world, and whose annual production increase in 2007 (compared with 2006) was 1.1 million ha in transgenic crops, creating about 1 million jobs.

Conclusion

Food insecurity is a major problem against which governments and all humanity must take immediate action. Transgenic crops can be more resistant to draught, plagues, and other adverse factors that can destroy complete agricultural productions destined to feed millions of people, or even billions. Transgenics also can adapt to diverse weather and soil conditions. The use of transgenic crops, in this case of transgenic maize and bean, in unexploited and wasted soils is a viable solution for some of the causes of food insecurity..

The utilization of Mexican germplasm banks for the study, experimentation, and creation of our own transgenics, rather than importing them, would assure, food security in the country because we would have all the benefits of transgenics without sacrificing monetary resources to purchase them in other countries.

By furthering the use of transgenic plants, the recommended minimum amount of food per person would be easily reached and even surpassed. Without having extreme losses during drought periods, prices would decrease, and almost all of the population would be able to acquire these food.

The proposal is to carry out a national response to food insecurity and to contribute to the assurance of food supplies by doing exhaustive studies in order to determine where and how transgenic crops can be sowed harmlessly, while preserving our unique Mexican cultural roots as well as our delicious native varieties of plants.

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