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Altiplano Este, San Luis Potosi: Growing Moringa tree using Driptech irrigation system

Water is known as a crucial element not only for agriculture, but also for the existence of human beings. Therefore, it is important that we take care of the little percentage of drinking water that exists in our planet. But, what do we do about it? According to the United Nations (2013), "by 2025, 1.8 billion people will be living in countries or regions with absolute water scarcity and two-thirds of the world's population will be living under water stressed conditions". In order to avoid this problem, around the world, especially in Asian countries, such as China and India, small-farmers have started to use irrigation systems that are cheap and that save a lot of water, such as the Driptech irrigation system, which uses 70% less water than what is usually used, giving them the opportunity to produce more for less, to have a surplus to sell and to have access to other food markets (New York Times Blog, 2011), as well as using this water to plant trees which parts are all exploited for their consumption and medical use.

Hydrologists typically assess water scarcity by looking at the population-water equation. They say that an area is experiencing water stress when annual water supplies drop below 1,700 m^3 per person. When annual water supplies drop below 1,000 m^3 per person, the population faces water scarcity. But when the water supplies go below 500 m^3, it becomes "absolute scarcity".(UN Water scarcity, 2014).

According to the Food and Agricultural Organization (FAO) of the UN (2002), "since the 1960s, global food production has at least kept pace with world population growth, providing more food per capita at generally declining prices, but at a cost to water resources. At the close of the 20th century, agriculture used a global average of 70% of all water withdrawals, and FAO estimates that global abstractions for irrigation will grow by some 14% by 2030." Agricultural water use is undergoing to experience pressure as demands for water increase; competition among cities, farmers, and the environment grows; and as concerns grow over large-scale overdraft of groundwater and water contamination from agricultural runoff. New threats include the challenges of climate change, which is likely to alter both water availability and agricultural water demands. (Pacific Institute, 2015).

This is a problem because agriculture and population growth has increased pressure on water reserves in Mexico, which causes a higher demand in volume to be higher in some regions. This forces the government to decide who to leave without this resource, causing distribution problems. This is what has been happening in the Altiplano Este of San Luis Potosi, which has led the region to overexploit the underground aquifers located in that area (Becerra, Muñoz &Sainz, 2006).

According to the census conducted in 2010 by the Instituto Nacional de Geografía y Estadística (INEGI) the municipalities that comprise the Altiplano Este of San Luis Potosí (Catorce, Cedral, Guadalcazar, Matehuala, Vanegas, Villa de Guadalupe and Villa de la Paz) have a population of 168,739 people, out of which 87.44% is older than six years. Out of this 87.44%, only 78.57% knows how to read and write; 8.25% cannot read or write. The population older than 5 years living in this region is 151,169 people, this is 89.58% of the population. Out of this percentage, 27.37% attends to school, leaving 61.75% without attending school (INEGI, 2010). For the wellbeing of these municipalities' population, each year the government develops health service programs to increase the percentage of people who have access to these services. By 2010, 78.60% of the population of the Altiplano Este was provided with health services by public institutions; 21.03% were not (INEGI, 2010). Families who live within these municipalities are composed of four persons: a father, a mother and two children (Burton & Rhoda, 2010) whose diets are based on beans, chili, corn, tortilla, tacos, esquites, vegetables such as onions, tomatoes, amongst others, and carbonated drinks.

The Altiplano Este of San Luis Potosi has an area of 12,778 km^2 out of which 586.69 km^2 of land are used to plant food crops such as onions, corn, beans, chili, prickly pear, sugar cane, alfalfa, red tomatoes, green tomatoes, zucchini, sorghum, oats, and other products whose commercialization, due to human needs, is destined to self-consumption and, in case of a production surplus, it is sold locally or to municipalities from the same region (Monografías de los Municipios de México, 2010; Coordinación Estatal para el Fortalecimiento Institucional de los Municipios, 2014). In these municipalities two categories of livestock are raised: the consumption livestock and the one used for transportation. The consumption livestock is comprised by cattle, pigs, sheep, and goats.The livestock that is used as a mean of transportation is composed of mules, donkeys and horses (INEGI, 2007).

To obtain a better production from plantations, in Mexico the use of Good Agricultural Practice (GAP) has been tried to be implemented by the Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación (SAGARPA) through manuals issued and distributed to the sectors of field and packing: within the field sector, farmers cannot implement these practices since they are very poor. Due to the high costs, they see themselves forced to continue using traditional agricultural practices; the packing sector, on the other hand, is better regulated, and the percentage of companies that implements these practices is higher than the percentage of farmers who implement them (SAGARPA, 2010); this provokes a low agricultural production, and causes a commercial failure between the municipalities of the region.

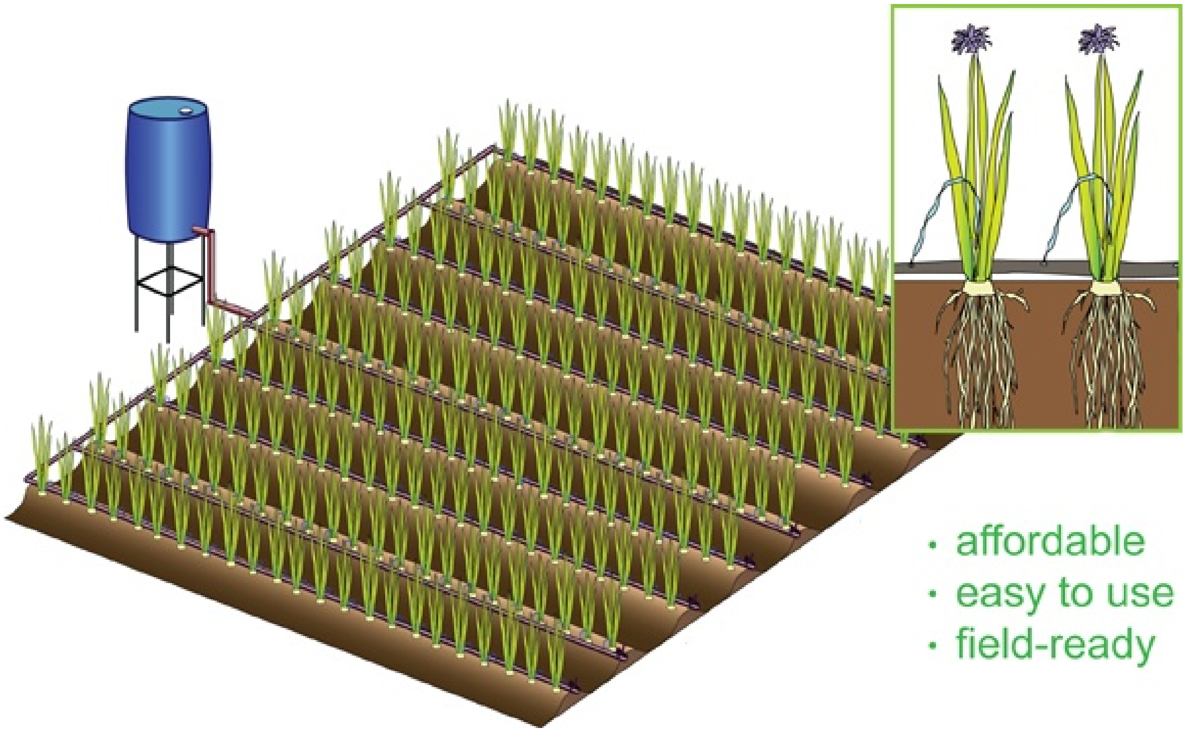
Here is where water comes in. The water resources are exclusively used for households, agriculture and the raise of cattle, creating a problem for companies to settle in, because they will not be able to use as much water as they need. This is, water stress is the obstacle that families have to face when trying to get an employment at a living wage. This leaves people with a problem that is very difficult to overcome, since it is not easy to obtain water resources. According to Becerra, Muñoz & Sainz (2006), water stress is a product of the regional overexploitation of underground aquifers –since the last decade of the last century– that are in it, caused by population growth and bad habits of people in their households, in the field, and raising livestock.

People haven't been instilled the culture of water, which has led to irresponsible management that causes this problem to worsen. As we can see, the problem affects directly the families of this region, because they do not have the water resources to increase agricultural production in order to expand their market to other regions and are therefore unable to expand it and cannot generate profits, which results in the inability to access other food markets and have an adequate nutrition.

Another factor affecting the water stress is climate change, which affects year round this region. With the increase of temperature it is most likely that the water used for irrigation evaporates and generates a higher consumption of water resources that are being overexploited. A Driptech irrigation system can be used to attack this problem in a simple manner, since it generates a better management of the water used in the field, creating an increment in agricultural production. This could work if farmers formed a society of rural production as established in the Mexican Legislation (Article 111 of Título IV de la Ley Agraria).

The creation of a rural production society, funds can be united to be better used. Farmers could ask for economic support. With the economic support that SAGARPA offers them to technify irrigation techniques, they can get up $1,100 USD per hectare, and up to $121,200 USD per loan. If a society of rural production invests on a Driptech irrigation system, it would cost $250 USD per acre. The lifespan of this product is of 5 years, but since it is cheap and easy to install, there would be no problem in replacing it after some years (New York Times Blog, 2011; SAGARPA Economic

Support Program, 2015). What makes the Driptech irrigation system so cheap is that product does not have specialized pipes or an emitter that releases a measured quantity of water and the pipes it uses are very cheap to produce. The pipes have holes that are punched at the distance where the roots will be at,the pipes are connected to a basic barrel of water placed on a stool. Besides, the irrigation system is very easy to install, and it is very easy to change any damaged pipe. The Driptech irrigation system looks as shown below (Retrieved from: Driptech Products, 2015):



Investing on this irrigation system for a certain area of land, could produce more goods for less cost, which would lead to a greater profit for the society of that land. The greater the profit the greater the investments that can be made in the future to increase the size of the land irrigated. With it we can create a perennial crop, whose growing seasons are longer than one year. The economic life of this type of crop may be increased to 30 years (although there are perennials older than 50 years that are still productive). Perennial crops are usually orchards and plantations, such as oranges, coffee, sugar cane, Moringa, among other plants. It is recommended that the Moringa perennial crops are planted in areas where fertile land is not being used to produce the food they eat so that farmers do not have to replace the crops they have been working for years.

Here is where the second part of the proposal comes in. Moringa is a tree that´s known as the “Tree of Life” in many parts of the world, because it has many beneficial properties for humans (Holst 2000). According to Fritz (2000), a famous writer of *"Los Angeles Times"*, the Moringa is a “tree with a gnarly trunk and tousled head of foliage that makes it look like a cypress that just rolled out of bed. It is a common tree that thrives in both the desert and the living room and produces leaves, pods, seeds and flowers that each do uncommon things”.[1] *“Scientifically speaking, Moringa sounds like magic. It can rebuild weak bones, enrich anemic blood and enable a malnourished mother to nurse her starving baby. Ounce for ounce, it has the calcium of four glasses of milk, the Vitamin C of seven oranges, the potassium of three bananas and has triple the iron of spinach”* (Fritz, 2000).

The Moringa tree is native to Northern India. Ancient Sanskrit writers recognized it as a medicinal plant. In Ayurveda, which records the Hindu art of medicine and life, it is said that Moringa leaves could cure about 300 diseases. The ancient Greek, Roman and Egyptian civilizations used the oil extracted from the seeds to make perfume and protect their skin (Holst, 2000). Among the medicinal properties that the Moringa tree has, there are nutrition and energy boosts, helps in detoxification, serves as an antibiotic, helps in skin treatments, serves as anti-inflammatory, helps improve the immune defense system, it has an anti-ulcer effect, helps to level blood pressure, have certain effects on diabetes, among other properties. The properties mentioned and many others can be treated with Moringa products, which are being leaves, pods, seeds and flowers (Holst, 2000).

In developing countries, water cannot be purified as it is in developed countries, because the chemicals used are scarce and extremely expensive. In developing countries people are forced to use polluted water for drinking and cooking, which causes about 6 million children to die annually due to infections contracted by drinking contaminated water. Moringa seeds are as effective as the chemicals used to purify water. This helps reduce deaths each year in developing countries (as cited in Holst, 2000). Since this tree is so easy to grow and does not require much water, a typical family in Mexico is able to plant their own Moringa tree and make use of all its benefits, and in consequence, they can change their diet and get a better nutrition. Holst (2000) presents a table that sets the values that a 100 grams of edible portions provide. That table presented is the next one:

Table 1: Nutritional Values of the Moringa

Per 100 grams of edible portion	**Pods**	**Leaves**	**Leaf Powder**
Water (%)	86.9	75.0	7.5
Calories	26	92	205
Protein (g)	2.5	6.7	27.1
Fat (g)	0.1	1.7	2. 3

[1] Check annex 1 for more information about it.

Carbohydrates (g)	3.7	13.4	38.2
Fiber (g)	4.8	0.9	19.2
Minerals (g)	20	2. 3	-
Calcium (mg)	30	440	2003
Magnesium (mg)	24	24	368
Phosphorus (mg)	110	70	204
Potassium (mg)	259	259	1324
Copper (mg)	3.1	Eleven	0.57
Iron (mg)	5.3	7.0	28.2
Sulfur (g)	137	137	870
Oxalic acid (mg)	10	101	1.6
Vitamin A - Beta carotene (mg)	0.11	6.8	16.3
Vitamin B - Choline (mg)	423	423	-
Vitamin B_1 - Thiamine (mg)	0.05	0.21	2.64
Vitamin B_2 - Riboflavin (mg)	0.07	0.05	20.5
Vitamin B_3- Niacin (mg)	0.2	0.8	8.2
Vitamin C - ascorbicacid (mg)	120	220	17.3
Vitamin E - tocopherol acetate	-	-	113
Arginine (g / 16g N)	3.6	6.0	1.33%
Histidine (g / 16g N)	Eleven	21	0.61%
Lysine (g / 16g N)	Fifteen	4.3	1.32%
Tryptophan (g / 16g N)	0.8	1.9	0.43%
Phenylalanine (g / 16g N)	4.3	6.4	1.39%
Methionine (g / 16g N)	1.4	20	0.35%
Threonine (g / 16g N)	3.9	4.9	1.19%
Leucine (g / 16g N)	6.5	9.3	1.95%
Isoleucine (g / 16g N)	4.4	6.3	0.83%
Valine (g / 16g N)	5.4	7.1	1.06%

The highest height of the Moringa tree is about 37 feet (10,675 meters) tall, but that height isn't very helpful because what we want is that the products (leafs, pods, seeds, and flowers) that the tree produces are within the reach of people. In about two to three months the seed planted may grow about three feet (91.5 cm) and in five to six months it can grow to six feet (1.83 meters), which is more or less the perfect height to create a perennial crop, so farmers could get the best use of it. After eight months of its planting the branches begin to bloom and we can start to make use of all the properties that this magnificent tree has (Holst, 2000).

Conclusion

As I mentioned throughout this paper, the Altiplano Este of San Luis Potosi is affected by water stress, which causes another problem: the low agricultural production. That is why I proposed that small-farmers implement the usage of the Driptech irrigation system and the growth of perennial crops of Moringa, which have many benefits for people. By 2012, the Driptech irrigation systems were already being used in China and India, because of its low cost and because it saved 70% of water used in the previous years. Ancient Indian civilizations, on the other hand, used the Moringa because of its fast growth, and because its products (leafs, pods, seeds and flowers) can be exploited for consume and for medicinal uses. These two solutions are connected to the Millennium Development Goals (MDG), established in September of 2000, by the United Nations. There are eight MDG's, but the solutions that I am proposing are directly connected to the first and the seventh MDG, which is to eradicate extreme poverty and hunger, and to ensure environmental sustainability, healthy lives, and the wellbeing for everybody. The post-2015 sustainable development agenda will be adopted by the Member States at the Sustainable Development Summit in September, 2015 in New York.

While researching the problem in the Altiplano Este, I was shocked to realize how little our population knows about the sad reality many unfortunate people suffer in rural and urban areas, because most of Mexican population is locked up in a bubble: a bubble that doesn't let them do anything about it.

Although I have been dismayed during the investigation, when concluding it I felt that this is the beginning of a project that can help people not only in Mexico, but in many countries around the world that suffer from the same or similar problems that are lived in Mexico.

ANNEX 1

In around 8 months the tree produces all of the products we can use, which are the leaves, the pods, the seeds, and the flowers.

The Moringa tree has many beneficent properties for humans.

It's said that it has nutrition and energy boosts, serves as an antibiotic, serves as anti-inflammatory, and many other medical properties.

It can survive with 10 inches of rain per year, and up to 120 inches a year.

One ounce of it, it has the calcium of four glasses of milk, the Vitamin C of seven oranges, and many other nutrients.

If it is harvested, it can grow around 10 feet (3.05 meters) in one year.

The highest height of the tree is around 37 feet (10.675 meters) tall.

The powdered from the seeds can purified dirty water, without using any chemicals.

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