

Marisol Garfias Garcia Torres
Colegio Williams
CDMX, Mexico
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Sustainable Agriculture using Maguey to feed the livestock in the Arid Zone of Cañitas, Zac. Mexico

Mexico is a country with a tropical climate facing problems in the north regarding arid zones, it has a population of approximately 127.5 million people being as of 2010, 78% of it destined to urban areas and its remaining population being 22% can be found in rural areas. But recently we can still find in our population an increase of 2.9% regarding poverty issues. And among its vast land we can find a place called Zacatecas which is located in the center north of Mexico. “Seventy five percent of the entity has a dry and semi dry climate with a temperature of about 18 degrees Celsius and annual precipitation of 800mm”(Explorando Mexico,2016)



Fig.1 : Using Google Maps, Location of the Municipality of Cañitas in Zacatecas Mexico.

Within Zacatecas we can find 58 municipalities, but one in particular known as Cañitas caught my attention since it is very little known mainly because of the amount of people leaving in the area. As of 2010 there were 6,166 people. But this number has decreased over the years since in 2005 the population consisted of 7,893 people. (INEGI)¹

I decided to choose Cañitas as my example since it is a very little known town in such a vast state. Which usually happens all around Mexico, small places with not that many people tend not to be included in our governments radar, decreasing their possibilities of help. Because politicians tendency is to use the resources in order for them to be re-elected. So when there isn't that much people they use them elsewhere in order to benefit from a larger impact having more exposure. If i could demonstrate a system that is relevant in arid zones showing their usefulness; I believe i could help little villages providing them with work and uniting them through agriculture being recognized by our government.

Cañitas is an arid zone with no main agriculture, since Zacatecas main income comes from mining, being one of the main silver producers in the world. It has a high rate of migration elsewhere because of lack of work opportunities since their isn't mining in that area despite the land that surrounds it.

Their regular diet consists of beans, vegetables such as pumpkin green, spicy chile and maize which is used in the daily consuming of tortillas. All of these extracted from agricultural practice.

¹INEGI : National Institute of Statistics and Geography in Mexico.

As of 2014, 54.89% of lands were said to be cultivated being Mexico's major crops and exports: maize and wheat mainly used in grains, this got a huge increase because of the CIMMYT² association. The Mexican territory includes 198 millions of acres though only 30 are destined to cultivation. The labour force regarding agriculture is 18% , industry is 26% and services 56%. Being the available land a 12%.

And within agriculture, the current situation with women reflects that 11 of 100 farmers are women. Gaining approximately a farmer an average wage of 18 pesos the hour. (INEGI,2014) And among this some people don't even receive a wage.

Because of this most families with in Mexico lack the possibility to access standard education in most of our rural areas , rarely do children attend schools in order to receive proper education because of the financial needs to help their families, and those who attended tend to receive a pore education.

Being briefly explained Mexico's typical family size varies between three and four children which gives a bigger ratio of poverty and lack of jobs which impacts ones dwelling. And regarding Health Care though it may be affordable, it may also be hard to attend a center since there may be none close.

Not all family's have the chance to access clean water, toilets, electricity , telephones , roads, and local markets mainly because of lack of urbanization and resources.

Some of the major barriers family's in Mexico face surround the fact that one most earn a living and pay certain appliances that go beyond main needs.

Furthermore, Mexican public transportation doesn't reach most rural areas which makes someone who can't afford a car walk for hours to gain a very low income.

The area of study I have chosen is sustainable agriculture but my solutions also include topics such as: plants, water scarcity, climate volatility, animal agriculture, spoilage and waste, populations and education.

Regarding the lack of job opportunities and of agriculture in arid zones such as Cañitas, many tend to migrate because of the main problem being the huge need of sustainable agriculture to counteract erosion among many other environmental degradation issues. Mainly because there is not enough agricultural production in arid areas. Which is were i believe my proposed solution best applies.

Due to the lack of water and the fact that trends seem to be worsening because there is no food and if we do not have the needed amount of water to take care of crops in general agriculture may not be possible forcing people to leave. Having a high decrease in the population and a prospect to ignore agriculture as a top solution. By affecting marginalized populations there is a decrease in progress because of the lack of work.

Eventually people living in marginalization tend to see an increase in the need to survive being clearly present a lack of access to education, health, general appliances, resources, among others.

This problematic affects rural and urban areas because when rural citizens face a lack of food mainly because of poverty regarding the fact they have no work having to migrate to give in to financial aid for their families. Most of the time they tend to go from rural to urban areas in search of employment sources, by doing so they tend to cause overpopulation with in urban areas increasing a need of food and water in cities. Facing also the main problematic which is a lower preparation because of lack of studies or education opportunities, causing a decrease in their adjudgment to city life.

Mostly men tend to migrate to the city in order to maintain a financial income, since in Mexico 73.6% of families tend to have a man as the head of the family and 26.4 % have woman as the head of the family. (INEGI,2016) Being 85 % of men financially active while women have a 53.4%.

This forces men to leave in order to provide; leaving woman to stay back at home taking care of the children, and the elderly are affected also since they feel the need to contribute to the income situation, to a large

2CIMMYT: The International Center for Maize and Wheat Improvement

extent we find a higher percentage of elderly working in jobs related to field work by taking care of the crops.

The index of woman working in the fields is very low, which allows us to conclude that agriculture is not a job they tend to see as an alternative in arid zones. Which leads to them seeking job elsewhere normally tending towards industry. But also the need of money forces children to help their parents financially, leaving school as a consequence. (INEGI,2016)

Primarily what contributes to this is: water scarcity because of the lack of it to help crops grow in arid zones; climate change with a high impact because of the major heat waves. And also bad politics have impacted because of the lack of our government focus regarding agriculture in desert zones.

But this can change by bringing a higher income with the use of *Agavoideae* in order to provide animal agriculture through the alimentation of goats eventually with the intention to be sold, giving small communities food and jobs.

In most arid areas there has been no use of the land ,which causes us to see an impact in the environment regarding soil erosion due to lack of harvest, giving little chance of something growing. Since it mainly consists in the destruction done by wind and other natural agents.

My proposal as a solution consists in the fact that we make use of this arid zones by cultivating plants that can withstand high temperatures and adapt, such as : Maguey which uses a low percentage of water by which it can withstand little rain. Zacatecas has mostly either dry or semi-dry areas because of the Mexican tropical climate.



Fig.2 : Maguey being cut leaving the hallowed heart pieces on the floor,
Photo taken from Pamela Garcidueñas.
(2015). URL: <https://www.expocnuevas.com/empresarios-que-uso-del-agave-que-no-es-tequila/>

Magueys “ Are plants that adapt where conditions are arid, with shallow and branched roots, thick cuticle, succulence, sunken stomata, photosynthetic metabolism and crassulacean acid metabolism (CAM) are some of the attributes that allow them to settle in areas lacking water” , (Granados, 1993), with an average annual precipitation of less than 700 mm and in large extensions is between 100 and 400 mm. The rain, in addition to being scarce, is usually irregular in arid zones. Calculating on average, the number of dry months generally varies from 7 to 12 per year (Rzedowski, 1978).

Highlighting the ideas that Maguey is perfect since it can adjust despite lack of water since it can tolerates average temperatures of 26 oC or extreme daily temperatures of up to 35 oC. And they are consider noble plants since they can be harvested in mostly every single piece of land without the need of rich soil to cultivate it.

This plant will also benefit the environment bringing less carbon dioxide into the atmosphere and less erosion having a positive impact to the area reflecting a high percentage of water uptake in the ground. And it is very cheap.

Maguey has been used approximately for 2500 years. Its species have been used to satisfy and complement a series of basic needs such as food, fibers, fodder, medicine, construction and production of alcoholic beverages (Rafael Duran M., 2003).

Among its uses we can see it in crafting techniques such as the making of fences to protect livestock as well as a forage alternative, due to the high efficiency in the use of water and the adaptation of the resource to different habitats, especially in semi-desert areas.

In the agave, the leaves and even the pineapple are used to give it as a supplement to the animals such as goats providing them with: high levels of digestible energy, minerals and water, which cover the maintenance nutrients and livestock production.

By chopping it and feeding it to the livestock its mortality rate is reduced, water consumption is reduced, the purchase of forage is reduced. Being able to have greater animal load in the farms, as well as a better distribution and consumption of mineral salts which results in a better physical condition of the cattle.

Also the agave used as fodder for ruminants, is important for its high productivity. Its use in critical periods of the year (low water) and its nutritional advantages, such as its high content of sugars, mineral material and crude fiber, can be provided as regular basis of livestock feeding throughout the year. (Antonio Narro,2013)

Though this idea takes time since the maguey has to grow to a certain length being this approximately a year for it to be useable in order to harvest its hallowed heart and feed the goats, but to increase this process we could cultivate it in rainy seasons because of the present humidity, which might be troubling but can be fixed with Irrigation solution techniques such as the innovative system: the hydraulic gates which are cheap and effective since it can reduce water consuming at a 60% rate.

Another problem faced with this is that goats are not the first main consumed meat, but it still is consumed occupying Mexico the 22nd position in the world. Actually, Zacatecas is the main goat meat producer in Mexico(Alejandro C. Torres .D,2017),showing that Goats as livestock is optimal with in the region.

They have many uses with in food production giving not only meat, but market income all the way from milk to cheese. Like this farmers have a higher market than the one used only with meat.

This will manage to bring a high income which will benefit the current state of agricultural income in Mexico, having a 5% GDP . “Approximately one quarter of Mexico's 100 million people live in rural areas, and depend primary on agriculture”(New Agriculturalist,2002) Though because of the income tend to make it a par time job unless we show Citizens that it is viable and productive eventually generating money.

If we cultivate 1 acre of Maguey (which cost approximately 1,021 dollars) , once the hallowed heart of the plant is tall enough we will cut them using machetes while we gain an income to buy a proper equipment which if we show the efficiency of the project government will contribute. At the beginning it shall be needed because but once the investment is done they can use the machinery and increase production saving time instead of using machetes to chop.

This acre will manage to feed approximately 10 goats bringing income in poor zones being able to pay for health care, education, clothes and food.

Having to invest initially a total of 1,430 dollars with out the proper equipment to cut the hallowed heart. Initially it can be replaced with a machete as previously mentioned, though with in the year the income would race exponentially and goats would reproduce as well as the maguey being auto-sustainable. And the National registry of livestock organisms managed by the SAGARPA³ which allows farmers to begin livestock prospects by giving them money; sometimes this loans go to farmers who have large lands eventually with more money but by connecting local farmers through the proper paperwork to subsidies they can progress. In this case it would be used to buy Goats which are animals that can be kept in confined spaces, facilitating farmers with little land not only agriculture cultivating but livestock keeping .

Initially a non profit organization will be needed to demonstrate its viability, eventually bringing the government in making it possible in arid zones across Mexico. Providing the proper equipment and for future prospects they could invest in teaching farmers within Mexico mainly woman who are the ones lacking presence in lands that agriculture can be seen as a work opportunity besides industry. By speaking to farmers about the maguey they could have a proper background being able to better harvest it and expand its uses teaching people to break the pre-established cultural idea that it only works either for medicine prospects or

3SAGARPA: Ministry of Agriculture, Livestock, Rural Development, Fisheries and Food

alcoholic beverages such as tequila. People tend to ignore its potential since we can find it mostly everywhere. Teaching them not only how to use it but what each type can provide.

Currently with in the country techniques regarding arid zones have been implemented mainly low budget hydraulic techniques for irrigation in arid zone such as the use of drip irrigation systems and micro tunnels in order to gain water supply in crops, having 61,000 sq km as of 1993 of irrigated lands. Mexican governments have pursued collateral loans, and have payed farmers twice the international price for maize, subsidizing heavily inputs of irrigation and fertilizers. Putting programs such as Procampo⁴ in place to increase production.

And regarding the use of maguey to feed the stock, farmers usually chop it in the field or in the corral and combine it with other sources of food such as crop residues.

In other countries we can also find techniques regarding irrigation to produce crops in arid zones, but in order to un-marginalize the population in such areas they have brought means or different work opportunities.

To close I would like to restate that by implementing the use of maguey to feed life stock in arid zones would not only decrease erosion and promote agriculture in such areas but also bring a new job opportunity found in the land not only as a cultivation prospect or craft use but also feeding they're animals eventually selling them either for meat uses or lactose related markets. I believe this solution can be implemented in many parts of the world which have problems regarding poverty, water scarcity, agricultural sustainability, and who are currently facing increases of temperature in arid or dessert zones such as : The Sahara dessert, Australia, etc. Whom consume such animals and lack a high rate of agriculture because of erosion. Bringing rural areas the chance to gain income and receive common day appliances we all deserve.

Also since I was little I have collaborated in my family ranch in Huimilpan, Queretaro Mexico actually experiencing country life related to livestock feeding our bulls and cultivating the proper stock to sell. Giving me a wider range of perspective by speaking to our helpers I have noticed how most of them despite having a job within my fathers ranch , feel the need to migrate either to other regions or to the USA. I would like to change this by showing them that agriculture can be not only a business solution but an opportunity to progress with in their home town.

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