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Chad, Sustainable Agriculture

## **How Zai Farming can Improve Soil, Water, and Quality of Life in Chad**

Chad is the 5th largest country in Africa. Landlocked with the northern half of the country in the Sahara Desert, Chad struggles to feed all of its population. Currently, desertification is taking potential farmland and turning it into desert. This is being caused by unsustainable farming practices. A new practice could return the barren desert into productive farmland. Soil quality is also very poor in some areas of Chad, and the current practices to improve the condition of the soil are not producing enough food. The people of Chad are suffering and we need solutions on how to improve their condition. The following includes information about the average family in Chad, the problems they must face, and the potential solutions to these issues.

Families in Chad face many similar issues. To understand these issues, we must first try to understand what the average family in Chad is like. Location is a huge factor in the dynamic of these families. For example, A family in the north of Chad is much more likely to be a rancher because there is less fertile farmland. While in the South, they receive much more rain and because of this, the farmland is much more fertile and has the ability to produce more crops with higher yields. In all, the country of Chad covers 1.284 million square miles and is the 22nd largest country in the world. Chad is about 3 times the size of California! The population of Chad is about 15 million people with the majority of these people living in rural settings (Major Problems Facing Chad Today, 2019). This makes Chad the 71st most populous country on the globe. So, what does the average person in Chad do? 80 percent of the working population works with agriculture, most likely farming or ranching (The World Factbook: Chad, 2019). Northern Chad is so dry that they only get about 7 tenths of rain per year (Climate - Chad, 2019). They receive all of this rainfall in 3-4 months, June to September. Central Chad receives about 21.9 inches of rain on average per year. Finally, Southern Chad receives about 42.7 inches of rainfall per year (Climate - Chad, 2019). The people that live in the south have fertile farmlands and are able to grow a sustaining crop. The North and Central Chadians are much less fortunate and cannot produce nearly as high of yields. To combat this, people produce more livestock and then they bring their livestock to the south after the agricultural harvest leaves waste which their livestock can graze upon. Irrigation is needed in many situations in Central/Northern Chad which can be very detrimental to the surrounding areas. For example, Lake Chad is the largest lake in the country of Chad and is crucial to many people's lives, but this lake is dramatically dropping in size, but there is more information about that later. Chad has the lowest life expectancy on Earth. So much so, that a male in Chad lives to about the age of 55.7 years old and a female lives to the age of about 59.3years (Cia.gov, 2019). The median age for males is 15.3 years and is 16.3 years old for females. According to CIA.gov, 48.12 percent of the population is under the age of 14. 19.27 percent of the population is between the ages of 15-24. Between the ages of 25 and 54 lies 26.95 percent of the population. And only 5.64 percent of the population is above the age of 55. 65 percent of their total population is below the age of 25 years old. Currently many people in Chad will not

live to the age of 55 and that is because of the unsustainable agriculture that is taking place in the country right now. Chad is in desperate need of new farming methods that can be easily done and as well as produce high yields. The yields produced now are cash crops. Furthermore, Chad also has the 134th highest (61<sup>st</sup> lowest) Gross Domestic Product in the world with \$28.62 billion. The country is currently in \$1.724 billion in debt. Additionally, Chad's main export is petroleum, which accounts for around 93 percent of the country's exports. Also, Chad became independent from France in 1960 and unfortunately it has struggled with conflicts and civil violence ever since. In fact, there has been some kind of conflict or even a civil war in Chad for 35 out of the 57 years of independence (Abdi, 2018). To conclude, over 80 percent of the country works with agriculture, most of Chad gets very low amounts of rainfall per year, current irrigation practices are ruining one of the country's most valuable resource, and Chad has an astoundingly low life expectancy which is the lowest in the world.

Chad, as a country, also goes through many struggles. Most of Chad's problems stem from its poor economy and the weather. Throughout Chad, many people do not have access to potable water. In rural Chad, there is virtually no proper waste disposal system. This means people have to invent ways to get rid of their garbage and almost none of these ways are safe for the environment. Harmful farming practices cause many problems as well. Current practices turn over the soil and leaves it exposed and vulnerable to erosion. This erosion is causing desertification which leads to many more problems in the future (Major Problems Facing Chad Today, 2019). Hot, dry, dusty winds constantly plague the country of Chad. The people of Chad struggle from these winds because it is erosive and harmful to many plants and can affect other people in the communities. Droughts occur often in Chad. These reoccurring droughts cause serious harm to people and to the farmlands of Chad; these droughts cause less rain for the already dry plants and the people of Chad. These droughts harm plants which worsens the winds that were stated earlier substantially. Even plagues of locust cause harm to the country. Because of the lack of rain, Lake Chad is dramatically dropping in size. In the last 50 years, Lake Chad has shrunk to only 1/10 of the size it used to be (Abdi, 2018). Lake Chad shrinking is a direct effect of unplanned irrigation which can account for at least 50 percent of the dropping water levels (NASA/Goddard Space Flight Center--EOS Project Science Office, 2001). There are proposals in place to replenish the lake but they will be for nothing if the demand for irrigation is not dramatically reduced. These plans are difficult and will take time to raise the water levels of the lake to the height of what it once was. Additionally, the current practices of agriculture are unsustainable as it is destroying the largest lake in the country of Chad. Also, the people in Chad suffer from these conditions that they have no control over. In the cities, only 31.4 percent of the population has access to a sanitation facility and only 6.5 percent if you live in a rural area. In America, 100 percent of the total population has access to one of these sanitation facilities. Only 12.1 percent of the population gets their water sanitized. Chad has an extremely high mortality rate with the world's lowest life expectancy. 40 percent of Chad lives below the poverty line and 87 percent of the people in Chad are considered "poor." This poses major problems because only 50.8 percent of the total population have access to drinking water (CIA.gov, 2019). Diseases still affect Chad in many ways too. For example, malaria is widespread in southern Chad. Aids is also a problem with more than 210,000 people living with the disease. Diseases also with the other problems such as poor farming practices, lack of water, and poverty; lead to Chad having this high mortality rate. But in all, the lack of sustainable agriculture is one of the biggest problems. Due to the poor yields grown, almost 1 out of 3 kids are chronically malnourished (CIA.gov, 2019). Sustainable agriculture could bring Chad through these hard times and improve. Sustainable agriculture influences almost every aspect of Chad, including Chad's economy and politics. Chad's economic and political problems are more likely to improve once there is an efficient way to grow more food and higher yields. Chad's main export is cotton, and that is purely a

cash crop. Cotton can grow in Chad but it cannot feed the starving population. There needs to be more of a focus on sustenance crops such as grains, oilseeds, tubers, and legumes (Chad - Agriculture, 2011). The major staple in the average Chad family are millet and sorghum which are the grains grown in Chad. Millet is like a rice that is grown in poor quality soil. This works for Chad because they do not have great soil quality. Sorghum is used for syrup here in the U.S but in Chad, it is like a sugar. These two crops are also used for alcoholic beverages which are drunk in Chad. For all of these crops, it is common to till the soil by hand or with cattle. When farmers till the soil, they dig into the ground and overturn the topsoil. This practice produces average yields but is susceptible to erosion. Erosion is a huge problem in Chad and with the current desertification and farming practices, these practices are not sustainable and is hurting the country.

With all of these problems, there desperately needs to be a new way to farm in the country of Chad. The current practices are not productive enough to meet the demands of the starving population. One practice currently in use is fallowing. Fallowing of the soil is where a plow drives through the dirt stirring it up. This practice also requires a lot of water because more water just seeps through into the water table rather than into the plant. And when you fallow land, you grow a crop every other year, so that means you would not produce a yield for an entire year. When you fallow land, the soil quality improves rather than if you plowed the field every year. The purpose of fallowing is that during the off year other nutrients will refill in the soil so that will improve yields. But improved yields every other year is not better than higher yields every year which is what Zai farming can offer for the people of Chad. Fallowing is also too impractical for densely populated areas because it does not produce a high enough yield for the tightly compacted population (Zai System Overcomes Desertification, 2014). The new technique that can solve these problems is Zai. Zai, or "Tassa," is a method of farming where each plant has its own hole about 15-60 cm wide and 10-30 cm deep. These pits focus the minimal rain that falls, straight to the roots of the plant. The base of the stem would begin at the bottom of the pit below ground level instead of at ground level. With each plant having basically a funnel directing any rain to the roots. This improvement can raise yields anywhere from 100 percent to 500 percent! This system is excellent at being efficient even when there is not much rain. (Zai System Overcomes Desertification, 2014). When it rains, the water runs to the base of the plant and most importantly it stays there longer than traditional farming methods. It remains there longer because of organic materials that is put into the pits for this purpose. In sum, digging these holes makes the rainwater funnel into the plant's roots and it keeps it there. Zai farming turns the previously unusable ground into very effective farmland. This works when the ground is not permeable or just dry. Zai farming originated in Ghana and West Africa. They discovered that this practice is very labor intensive but can improve yields anywhere from 100-500 percent! Another benefit of Zai is that it offers farmers a proper way to use manure and other compost. One Zai pit can use about 300 grams of compost a year. Zai farming meets the three categories of conservation set by the United Nations Environment Program; soil conservation, water conservation, and erosion protection (United Nations Environment Programme, 1.1.1 Planting Pits (Zai)). The UNEP also says that Chad is very suitable for Zai farming. Other attempts, such as agroforestry to prevent erosion and desertification, efforts are beneficial, but not nearly as Zai farming could be. Increasing each plant's yield by at least 100 percent would produce much more crops and effectively save many lives. There are few disadvantages to Zai however. Zai pits need constant work and care. Each dry season, a farmer has to dig out excess soil in the holes with a pickaxe and/or a shovel and then fill in more compost before the wet season comes. Another disadvantage is that if it rains too much in an area. The plants in the pits are vulnerable to becoming waterlogged and dying. Flooding would not be concern for many people in Chad as they barely measure an inch of rain every year. Desertification is a huge problem in Chad because the amount of

farmable land is reducing. Zai farming has been proven to stop desertification in nearby countries. The process of zai farming is simple and requires minimal capital to start. First, a farmer would dig a pit 15-60 cm wide and 15-60 cm deep (Nyamu, 2016). Next, the farmer would fill the bottom of the pit halfway with organic materials such as dry leaves or corn stalks to help keep in the water. These materials will eventually decompose which helps improve the quality of the soil. Then, top soil and manure are mixed and placed in the pit. In all, the purpose of these pits is to raise yields. How does this happen? The pits harvest rainwater more efficiently than traditional practices. The organic matter will also slow the water and keep the soil moist much longer and more effectively than just pure dirt. This combats the droughts which are very common in Chad (Climate - Chad, 2019). Another benefit is that all of the nutrients that are in the soil are utilized and focused. When a farmer plants crops, they can now focus exactly where to put the fertilizer/manure and it will stay there. There is no runoff or drifting because it will stay in the sunken pit. Another benefit is that there is less competition from weeds because the most fertile of the soil is only where you are trying to grow your crops. And if weeds do grow, it would be much easier to pull them out when they are focused in the pits. There is the obvious benefit of vastly increased yields. When yields increase 500 percent there is much more food produced to help feed the community. There are also proven food crops that can be grown in Chad. One potential crop to feed people is sorghum. Sorghum can produce human food, feed for livestock, molasses, and pasturage. This crop is already grown in Chad and Zai farming can improve yields and make this already important crop very productive (Hayes, 2011). Corn and maize produce quite a bit of edible food that is able to grow where there is a little more rainfall. Sweet potatoes and other tubers can be grown to produce food for the people that need the food. Some legumes are also well suited for the harsh environment of Chad. Watermelons originated in Africa, but only the seeds were edible but now there are also some varieties that can grow in the desert and produce life sustaining fruit to people. There are many foods that can be tailored to survive in the desert. The main focus of changing the arid landscape into farmable land is to reduce hunger. Zai farming is a way of farming that is very labor intensive and susceptible to flooding but can improve soil quality, reduce desertification, requires less need for irrigation, and most importantly improve people's lives and supply them with food. In all, the benefits of Zai far outweigh the negatives of this practice.

To conclude, this is information about the average family in Chad, the problems they must face, and the potential solutions to these issues. Food insecurity is a problem almost everywhere but many countries do not have the infrastructure or ability to combat their hunger crisis. Chad is one of these struggling countries. Chad is suffering from not only hunger, but also from political unrest, desertification, and the world's lowest life expectancy. Sustainable agriculture is the tool that can all around improve people's lives in Chad. Zai farming is one promising way that can improve soil quality, feed more people, and even help reverse the effects of desertification. Zai farming is a breakthrough in the world of sustainable agriculture for desert climates. This practice has the promise to solve many problems that plague the country of Chad. This is much bigger than Chad however. It has already been proven to work in other nearby countries, but this can go globally, to every area that has poor soil quality or that does not get adequate rainfall for other crops. Zai farming can be the future for Chad because if they don't change something soon, Chad might not have a future. To conclude, Zai farming improves soil quality in Chad, it requires less water and reduces the need for harmful irrigation, and it improves the quality of life in Chad because it can increase yields up to 500 percent, feeding more of the starving population.

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