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Malawi: Country Growth and Agricultural Needs

Malawi is a country in Southern Africa that has, in its relatively short lifetime, been one of the countries that suffers from food insecurity the most, being ranked 88th out of the 125 censused nations according to the Global Hunger Index (2023). Malawi's agriculture is almost entirely dedicated to cash crops to sell to other countries for profit, and thus suffers a lot from the lack of self sufficiency and food production. The most common of these crops to be produced are mainly tobacco and tea, with some other notable outputs being cotton, coffee, ground nuts, and cane sugar (Agriculture in Malawi, 2023). Now this isn't to say that Malawi doesn't produce some of its own food at all, but almost all the food produced is tubers and grains, with some amount of livestock which is typically goats and sheep. Despite being a totally landlocked country, Malawi is also very dependent on fishing as, despite not being near any oceans, a lot of fishing is possible due to its famous Lake Nyasa to the East and its Elephant Marsh to the South. This agricultural profile for the nation is a massive issue as Malawi, like most central-southern African countries at the moment, has one of the highest rates of population growth worldwide. Malawi had a population of approximately 16 million in 2010, and with a projected growth rate of 3.32% annually, will triple its 2010 population to 45 million by 2050 (World Bank Group, 2023). Forty-five million will be entirely unmanageable if the current agricultural trends stay true and action has to be taken by the end of the decade.

One of the most crucial and useful resources to a country that needs to make a transition out of long term starvation is rice, it is reliable, versatile, cheap and easy to grow and can be stored for long periods of drought. Malawi has excellent facilities to begin the process of integrating more sustainability crops instead of just focusing on cash crops, and the best way to start is with rice paddies. Malawi does produce some rice, but the major issue is that Malawi almost exclusively uses rain fed rice farms. This is a major issue as Malawi is a relatively dry country when it comes to precipitation. It is certainly not a desert, but it isn't enough to make big production of rain fed farms viable. Malawi is a very swampy country, it has many marshes and wetlands and has the massive Lake Nyasa, as well as the notable Elephant Marsh in the southern side of the country, the latter of which makes up 615.56 square kilometers (0.5% of Malawi's total area) during the wet season according to the Ramsar Information Sheet published in 2017. The Elephant Marsh "Elephant Marsh" (2017) in particular is already in use for food production as it is a very common fishing spot for the country. According to that same Ramsar Information Sheet, over 1500 small scale fisheries operate out of the Elephant Marsh. If that land can be utilized for agriculture and isn't under any restrictive legislature preventing it from being taken advantage of, then it should be entirely possible to begin planting. Even the Rice For Africa (CARD,

2024) organization pointed out specifically that Malawi only using rain fed rice farms is a massive missed opportunity with the huge amount of wetlands present. The new farming would not only have rice paddies to start, but also other crops that utilize wetlands for their growth. Many kinds of berries and some members of the Brassica genus which would be excellent for diversifying the produce available to the people, helping people fill in certain kinds of nutrients and vitamins that are severely lacking from their diet. Fishing can and still should occur in the Elephant Marsh and the inclusion of fish within the environment would be excellent as fish excrements are excellent fertilizers for crops which would replenish the soil so there's less risk of ruining the balance of the ecosystem. With lesser need for crop rotation and Malawi being year round warm and optimal growing conditions, the growing season can be endless, and Malawi can be an incredibly powerful producer of rice and other aqueous crops. The best part is that rice is already frequently grown in Malawi, it's just that it can be put into different places and resources, so there is a lesser concern over introducing new crops to the region and the issues that might cause with invasive species.

The other most valuable asset that Malawi has going for it is its acceptance of genetically modified crops. Being one of only 30 countries in the world that is willing to allow the growth of GMOs on their soil (Genetic Literacy Project, 2024) is a huge opportunity as now Malawi can work with international labs to help design crops specifically for any issues they may be facing. Genetic modification is a very young technology, and a very rare one, but also one of the most adaptive and powerful. I believe that it is appropriate to be used in the situation regarding Malawi because it is one of the very few countries willing to accept GMO crops to be grown on their soil. If they are willing to be open to it then we should take advantage of the rare opportunity, and if there is a great success with GMO crops in Malawi, then other countries will recognise that it can be useful and will open up to GMOs themselves. GMOs are an amazingly adaptive technology that can be applied almost anywhere in the world. For instance, if there is a high rate of a vitamin deficiency in their country then crops they grow there can be enhanced to have more of that nutrient in it like how golden rice was made to combat vitamin A deficiency. Genetic modification can also be used to simply increase the amount of product that a single crop plant can generate. One of the simplest methods of doing this and one of the ways that scientists learned how genetics worked in the first place was through MADS-box genes and the "ABC model of flower development" (2024) with Sources Soltis, etal (2006) and Wolpert, etal (2002). MADS-box genes, similar to HOX genes in animals, determine the formation of structures in the organism. MADS-box genes determine where structures on a plant will grow, like roots being at the bottom of a tree, how many will be produced, the size and shape of those structures, and more. The genes are often codependent, meaning that when only one is expressed something happens, but when two different genes are active at the same time then they will cause a unique effect which is different than if either of those two genes were active independently. ABC flower development is a system where the A gene by itself will result in the formation of the hard, protective sepals, the C gene will result in the formation of the female reproductive organ, pistils, and the B gene combines with the A gene to produce petals or the C gene to produce the male organ of anthers. Of course this model is true for perfect or bisexual plants that have both male and female organs in each flower, but that is crucial for this idea to work. When mutation is induced by mutagens, one or more of these three genes can be turned off. This method of genetic modification can be utilized to increase the yield of flowering plants as having extra pistils means that more pistils can be fertilized, and when pistils are fertilized they become the fruit or grain. By turning off the A gene, then no sepals or petals are formed, meaning not only will only pistils and anthers form, but several more pistils and anthers will be created compared to the normal amount.

Normally this would be an issue for plants that fertilize using insects that select flowers by color, but there are also several other methods of pollination. Examples include insects that select by smell or nectar, birds, bats, wind, water, and even self pollination. So the A gene deletion method is viable for something like rice, which is a self pollinating plant, and rice serves as one of the best crops for the country in the situation that it is currently in. But these methods would work on almost any flowering plant, and especially fruits. Plants like blueberries, elderberries, cranberries, and most apple or citrus trees can all be subjects of this process of pistil multiplication, and wouldn't suffer too much from the loss of their petals and sepals. This is because bees are attracted to most fruit bearing bushes and trees by the scent and the shelter provided for their hives rather than just the appearance of the flowers, especially for apple and citrus trees. Fortunately, many of the types of Brassica plants mentioned above, which would be perfect for the warm and marshy environment in Malawi, are self pollinating, namely cabbage.

Cabbage and other Brassica genus plants are also easily and commonly pickled, which like rice, would let there be stores of hearty food ready for long droughts. This allows for a massive head start on the crop production of the region, allowing for people to get a lot more work done on developing the region. Dr. Norman Borlaug, the creator of the World Food Prize organization had dedicated his life to the genetic modification of crops and proving that they can be used to help people around the world with his massive Green Revolution in India. The World Food Prize using GMOs to help Malawi in this way would be an excellent way to live up to hislegacy.

Malawi has already done a large amount of the work necessary to get it to where it needs to be for improving food security and quality of life. Malawi has accepted GMO crops, so far having allowed modified bananas, cotton, and cowpeas in their country (Alliance for Science, 2016), and being part of the "African Union" (2024) is a major benefactor towards it. Being able to accept foreign help will open venues for discussion with companies like Corteva, which already has a subsidiary in Malawi and Corteva (Corteva subsidiaries) is known internationally for its ability to help improve agriculture with genetic modification as well as insecticides, fungicides, and more scientific improvements. Another great venue for helping Malawi would be the Lilongwe University of Agriculture and Natural Resources, aka "LUANAR" (n.d.), which is almost entirely dedicated to the cause of improving agriculture in Malawi and goes out of its way to look for international assistance with their quest, a perfect place for the World Food Prize to get its foot in the door regarding this subject. Other examples of areas that Malawi can begin working on its agricultural proficiency is introducing better infrastructure regarding the storage and transportation of large amounts of crops, especially grain elevators and train lines.

Overall, it would be a very simple process to open up discussion with the United Nations and the African Union as the middlemen for the discourse between Malawi and any agricultural science companies as it has already happened to a slight degree. Leaning towards these companies and techniques more, as well as utilizing the arable land in the Elephant Marshes for rice paddies and taking a slight detour from cash crops to focus a bit more on self sufficiency will do the country wonders when coming to its development and elevating it from being one of the most food insecure nations in the world. With rice paddies being one of the simplest and cheapest farming techniques in the world and GMO crops having the turnaround in profit of just one growing season most of the time, the goal of being able to meet the population growth model by the end of the decade is entirely realistic.

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