

Hydroponic Farming: A Prospective Compromise Between Industry and Sustainability

As the consequences of global warming begin to emerge, the conservation of water has proven a crisis of global concern. Climate volatility is surging, and natural hazards like drought are becoming more common and more severe. Every year thousands of lives and millions of livelihoods are claimed by drought, and the poorest countries are hit the hardest (“Drought Disaster Statistics”). Sustainable Development Goal 6, clean water and sanitation, is vital to the uplifting of the 3rd world. But like many of our problems, getting water to those who lack it is fully within our reach. It has simply failed to materialize due to a lack of economic incentive. Hydroponic farming presents a rare compromise: conserving water without slowing economic growth. I believe that through non-profit incentivization of this technique, industry and sustainability can be aligned, and the fight against drought will be won.

Cape Town, South Africa is undergoing its worst drought in a century. Starting in 2015, the city has faced three consecutive dry winters caused by the El Niño weather pattern and climate change (“Cape Town’s Water Crisis”). The drought is now so bad that it could end in Day Zero, when municipal water supplies will be shut down and 149 distribution sites rationing 25 liters (6.6 gallons) per person per day will be the only sources of water in the city. To put that in perspective, the average American uses 100 gallons a day (“How much water does the average person use at home per day?”). In a country where over 60% of water goes to agriculture, there is no better field to conserve than agriculture, and farmers are certainly interested (“Water Situation in South Africa”). It is estimated that the Cape Town drought has lost the agricultural industry 14 billion rand (1.17 billion USD) and over 50,000 jobs (B. Phakathi). While researching ways to conserve water in agriculture, I discovered hydroponics, the growing of crops in soil-less basins of nutrient-water. Hydroponics gives farmers much more control over their growing environment,

and chiefly their usage of water. Of the two greatest water inefficiencies, water seepage is eliminated and water evaporation is drastically reduced, combining to lower water consumption by over 70% (“Hydroponic Systems”). If the entire South African agriculture industry used hydroponics, total water consumption could be reduced by a staggering 40%. It is likely that hydroponic agriculture could have largely negated the Cape Town drought, saving billions of dollars and thousands of jobs.

If hydroponics is so great, why isn't it already commonplace? There are three problems with hydroponics that dissuade farmers from transitioning. It has a higher initial cost, a steep learning curve, and it's more labor-intensive (Trev). Many technologies utilized by hydroponics are recent developments, such as climate controls and LED lighting, and upfront costs can be very expensive. Then, farmers must learn how to manage these complex technologies. And even after they have acquired these skills, hydroponics remains more labor intensive with so many additional operations to perform. Combined, these issues have largely limited hydroponic farming to 1st world countries. Overcoming them will be the primary objective of my project.

Given a grant of 10 million dollars from the Gates Foundation, I would create a non-government organization (NGO) to accelerate the development of hydroponic agriculture. Starting in Cape Town, South Africa, my non-profit would not fully convert farmers, but provide them with enough of a starting point that they could independently continue expanding their hydroponic business.

First, I would dedicate 1 million dollars to raise awareness among local communities about sustainable agriculture. Through work-places, schools, and the internet, the various benefits of hydroponic agriculture would be demonstrated with a focus on its connection to water

conservation. This campaign would also establish contact with people interested in hydroponic agriculture.

Next, I would use \$500,000 to design a hydroponic starter kit capable of producing at least 2 metric tons (2.2 tons) of produce per year. The company Freight Farms has designed a hydroponic farm from a shipping container that can yield 1-4 tons per year for \$85,000 (“Leafy Green Machine™”). By establishing partnerships with local manufacturers, NGOs, and communities, I believe such a kit could be produced for less than \$50,000. These kits would be given to farmers interested in hydroponics with no down payment, negating the high initial cost. The expense would be recuperated with just 10% of their profit, and stopping after \$60,000. This would allow my non-profit to continue expanding with minimal cost to the farmers.

I would then split 8 million dollars between 5-10 teams of volunteers and hydroponic experts each working in a part of the Western Cape province. These teams would spend 1-2 weeks working with each farmer, installing a starter kit and teaching them to use it. In consideration of the intensity of hydroponic farming, teams would attempt to make each project a cooperation between multiple farmers or several members of a farming family. This would be challenging, but I believe that work could be divided in most cases such that no one person works over 10 hours per week above their existing workload.

The final \$500,000 would go to an international fund-raising campaign. Ideally, the money raised combined with the 10% share of profits would provide several million going into the second year. Each year more farmers would be introduced to hydroponics, and my non-profit would have more resources for the following year. I believe that within 10 years, as many as

5,000 farmers could gain access to hydroponics. In the long term, my NGO could expand to other provinces, nations, and even technologies, stamping out drought once and for all.

Drought affects millions of people every year, and if something isn't done about it, it will only get worse. But difficulty arises due to a lack of economic incentive to solve the issue. Hydroponic farming can conserve water without slowing economic growth. Drought-ridden Cape Town is in desperate need of sustainable agriculture, and I believe that with a grant from the Gates Foundation, hydroponics can make this necessity into reality.

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