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Implementation of a Hoophouse in the Offinso North District, Ghana

Introduction

Crop yields in Ghana are often limited by the lack of agricultural technology. The biggest issues Ghanaian farmers must tackle without this technology are how to combat heavy rains, heavy winds, and pests. In addition to low crop yields, access to a diversity of crops does not exist in rural settings and is limited to people of higher socioeconomic status in urban settings.

A hoophouse is a proposed solution to crop damage due to heavy winds, heavy rains, and pests. The hoophouse provides protection from these elements as an enclosed area for growing. Because of this, less hardy crops are able to be grown in the hoophouse. This well help supplement the crops that are currently grown in Ghana and diversify a Ghanaian's diet. Additional crops that can be grown include tomatoes, peppers, broccoli, peas, watermelon, and carrots.

If placed in a rural setting, the hoophouse can act as a community garden. Multiple families can work together to grow crops and supplement the typical rice, cassava, and yam diet. The work on this project was completed in the Offinso North District, Ashanti Region, Ghana.

Aims

The primary goal of this project was to increase agricultural yields in a community garden setting by providing a farming technique called a hoophouse. A secondary goal was to provide greater access to produce for villagers in rural settings, which will subsequently ease the burden of buying food.

Methods

Pre-Departure:

Hoophouse designs and blueprints were found during research that took place in the United States. Some materials were sourced in the United States due to concern that it would not be found in Ghana. These materials included the plastic covering, PVC clips, PVC primer and cement, rebar, zip ties, exterior screws, and the shade cloth.

In-country:

When we arrived in Ghana, I purchased or gathered the remainder of the materials that I needed including the PVC piping, the PVC couplers, lumber, wood nails, a hack saw, mosquito netting,

a shovel and a backhoe. On the first work day, I gathered the PVC piping, PVC couplers, and visited a wood mill to have my lumber cut.

On the second day of work, I cut the 2x6" lumber to the appropriate sizes for a frame to create a 10 foot by 10 foot growing area. I screwed the lumber together in a square with a 3 foot gap in the middle of the front piece of lumber for the door. I primed and cemented the PVC piping and couplers into the peaks that would create the roof of the hoophouse. At the point where each PVC pipe would be attached to the ground, I drove 6 inches of a 12 inch piece of rebar into the ground to stake the hoophouse down. The PVC piping can then be attached to the wood frame for additional stability. PVC pipes should be placed about three to four feet apart for the entire length of the hoophouse. I then attached the individual peaks of the hoophouse by adding three more PVC cross pipes. Once the cross pipes were added, the PVC frame was placed over the rebar and planted into the ground. To stabilize the PVC frame, two 2x4" were cut into the shape of a door frame and attached to the PVC frame with screws. An additional 2x4" was cut and placed in the back of the hoophouse and attached to the last peak using screws. An additional 2x4" was cut and placed at a diagonal from the 2x4" in the back and was planted into the ground for additional stability. A final 2x4" was cut and screwed into the 2x4" that created the door frame. This finished the door frame and added additional stability to the hoophouse. The work completed on the second day can be see in Figure 1.

On the third work day, I placed the shade cloth over the peak of the hoophouse and attached it to the PVC piping using zip ties. I then placed the plastic tarping over the peak of the hoophouse and attached to the top lip of the 2x6" using wood nails. To tighten the plastic over the roof of the hoophouse, I attached PVC clips to the PVC piping over the plastic and turned the clip until the plastic became taught. Because of the stress to the plastic from wind, I then covered the top of the 2x6" with wood lathing and screwed it into the 2x6". This removed some of the stress at the site of the nail. At this point I realized I did not bring enough plastic tarping so I needed to brainstorm ideas to rectify this. Additionally, I removed the vegetation inside the hoophouse and began tilling the ground for the garden. The completed work from day 3 can be seen in Figure 2.

On the fourth work day, I attached the remaining plastic on the front and back of the hoophouse towards the bottom to create the sides of the hoophouse. The plastic was nailed into the 2x6" as done on the previous day. The new pieces of plastic that were attached to the PVC piping were incorporated into the clips already containing plastic from the roof and tightened. The solution to the lack of plastic was adding more mosquito netting. This would create a larger ventilation window than originally planned for. I then built and attached the door to the door frame using galvanized metal hinges. The lumber was very warped due to sitting outside of the wood mill so we needed to add shims to expand the door frame. We then added a metal bracket to stabilize the door frame at the point where the shims were added. The garden was then planted and watered. I

placed stakes in the ground labeling where each vegetable was planted. The completed work from day 4 can be seen in Figure 3 and Figure 4.

Post-travel:

After returning back to the United States, I contacted someone from ONDA to check the progress of the hoophouse. He told me that the hoophouse was not being watered but that there was growth in the hoophouse. I asked him to find someone that could water and help maintain the hoophouse moving forward. The growth twenty days after planting can be seen in Figure 5.

Figure 1: Construction completed after work day 2.

Figure 2: Construction completed after day 3.

Figure 3: The completed hoophouse after day 4.

Figure 4: The inside of the hoophouse after it was planted and watered.

Figure 5: Growth inside the hoophouse twenty days after planting.

Conclusions/Barriers

The hoophouse was not built in the target location, a rural village, at the request of the chief. He wanted to pilot test the technology prior to implementing it in a village setting. Now that the technology has proved successful, a reasonable next step would be to figure out a way to move the hoophouse or build a new hoophouse in a rural setting.

Another problem I ran into was that I ran out of plastic before I could cover the entire hoophouse. This is not a sustainable material in Ghana and I was unable to find it in any of the marketplaces. Investigation into a new material to replace the roof with would be beneficial to the sustainability of future projects.

The garden was not being watered after we left Ghana. I should have found a person that was willing to water and maintain it before leaving so as to avoid this problem. The hoophouse still had growth in it so I think it was collecting rain through the mosquito netting or the humidity

was condensing on the plastic and dripping onto the garden. It is important before you leave a project to properly train the people who will maintain it, this was a mistake I made.
The building of the hoophouse was not as efficient as it could have been. The lack of tools slowed down productivity and could have made the building process much easier. Appropriate planning should be done in advance to bring the tools necessary or speak with ONDA ahead of time to make sure they have the tools you need. Also make sure that they will be available for your use when you need them.

Project Continuity and Future Directions

If you are interested in continuing with this project, an appropriate next step would be to introduce a composting project. Ghana also lacks fertilizers which would additionally increase crop yields. Food scraps and other composting materials are abundantly available in Ghana, and a receptacle for compost can be easily found in a major marketplace. An irrigation system could also be introduced to ease the maintenance burden of the hoophouse. An irrigation system will make watering the hoophouse easier and more likely to be completed. Keep in mind the lack of a reliable power grid and investigate other gravity-driven methods of irrigation.

A note to the reader: If you are interested in additional information or for advice in continuing this project, please contact me at mcgovern.105@osu.edu.