

Changing Lettuce Growth Methods Could Change the Way We Eat

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INTRODUCTION

Today's current crop system is deeply flawed. As the global population continues to grow rapidly, so do the problems with the crop system. Right now, many of the growing issues include concerns about food miles, food deserts, and food insecurity in the U.S. Among other solutions, urban agriculture is promising.

To increase fresh food access in cities there are options like community gardens, vertical gardens, greenhouses and hydroponics operations that tackle local food issues. However, it is not always feasible to set up hydroponics or greenhouses for example, due to lack of proper available space and the cost. A foreseeable solution is promising research with butterhead lettuce experiments being done by UConn Department of Natural Resources & the Environment doctoral student, Ankit Singh. Through this CAP project, I looked at some of Ankit's research data comparing lettuce grown in a greenhouse and grown using GREENBOX, then comparing them with traditional agriculture for potential solutions to address problems like food miles, food deserts, and food security.

GREENBOX Method and Greenhouses

GREENBOX is a growth box with a hydroponic set-up, artificial lighting source, and environmental controls for crop production. In Ankit Singh's experiments, he used the GREENBOX to grow Rex butterhead lettuce. The nutrient solution was maintained at 5.8 pH and was recycled in the system. The greenhouse is a gable. The ideal condition for it is a level area for a well-drained growing surface. Important for a greenhouse is to set it up to ensure proper light intensity during the winter. This comparison was done to specifically look at how lettuce grows in each condition.

Which method is better for the environment?

The two urban agriculture methods presented in this project appear to outperform conventional agricultural methods that can have adverse effects on the environment. These include large amounts of land to grow crops, water usage, pesticides, and nutrients in runoff. When comparing water usage, Ankit's data shows that the greenhouse, at the end of its growth (800 hours), uses about 120 liters in the summer. His data showed that the GREENBOX method used only around 80 liters in the summer. Also, the lettuce from the GREENBOX weighed more than ones grown in the greenhouse. The water saved and the increase in lettuce head weight are dramatic in the summer compared to the greenhouses. In the summer, after day 30, the lettuce grown using GREENBOX far exceeded 200 grams, while the lettuce in the greenhouse was slightly greater than 200g in the summer with far less of a constant growth pattern.

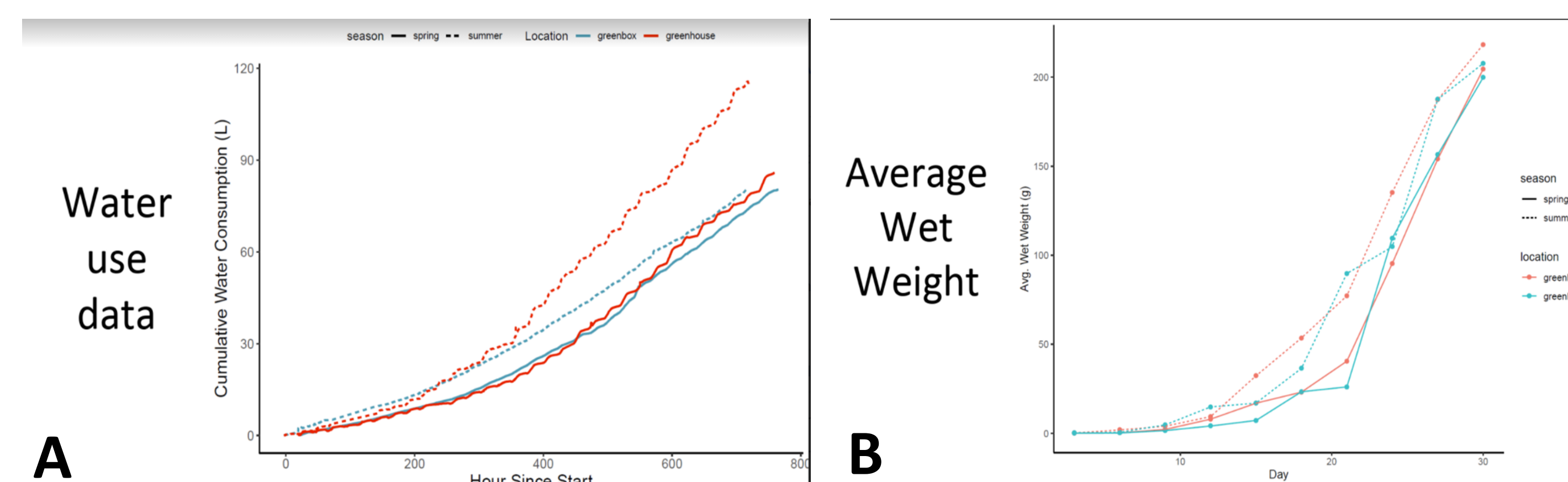


Figure A. Comparison of the water use of lettuce growing a greenhouse versus a GREENBOX
Fig. B. Comparison of the weight of lettuce grown in a greenhouse versus GREENBOX (Singh)

CONCLUSION

The GREENBOX and greenhouses outperform traditional growing methods. Research by Ankit Singh shows that GREENBOX is a superior growing method over a greenhouse for growing butterhead lettuce. In urban areas with limited space, the more widespread use of GREENBOX could help for issues like food miles, food deserts, and food insecurity. GREENBOX can be put in various places so the growing site is local, significantly reducing the miles that lettuce and other crops would go to be sold. Being super-local helps cities that are food deserts because GREENBOX does not need a lot of space with extravagant growing facilities. The GREENBOX lettuce is more compact and has a steady growth pattern which would aid in the food insecurity issue facing America and the world. Overall, there is promise with GREENBOX, greenhouses and hydroponics. This needs to rapidly expand along with our population to help fix our agricultural crop system.

Food Miles, Food Deserts and Food Security

Food miles and food deserts threaten our food security. Food miles refer to the distance that food travels until it reaches the consumer. This distance the food travels is important for calculating the environmental impact that food has on the environment, like its carbon footprint. In 2014 the average food transport was 1,020 miles in the United States.

Food deserts are the geographic areas where residents have restricted access to affordable, healthy food because of the lack of grocery stores at a convenient distance. In 2009, 2.3 million people lived more than a mile away from a grocery and did not own cars (Food deserts). Compounding this problem, economic forces have driven grocery stores out of these urban areas in recent years. Food deserts are more commonly found in black, brown, and low-income communities, while wealthy districts have three times as many supermarkets as poor ones (Food deserts).

Food security is similar to food deserts as it pertains to one's access to food. In 2018, 1 in 9 Americans were food insecure. This is about 37 million American adults and about 11 million children (What is food insecurity in America?). The USDA defines food insecurity as "a lack of consistent access to enough food for an active, healthy life" (What is food insecurity in America?). Through looking at these topics and the problems they cause, we can look to the future to find the solution and reinvent ways we get our food.

What can I do in the future?

My original plan for this project was to create a hydroponic set-up at my high school in our green room. With the help of Ankit Singh, we devised a plan and a budget. Items needed included a hydroponic kit, Teflon tape, pH Meter, REX lettuce seeds, 1 or 2 M NaOH and HCl and a light. My hope for this project was to be able to see the effects of blue and red light of the growth of plants through hydroponics. However, unfortunately my school went fully online during the pandemic and the school had to scrap my idea. In the future I want to try and do this or buy an Aerogarden and grow hydroponic lettuce at home.

REFERENCES

- Barbosa, G. L., Gadelha, F. D., Kublik, N., Proctor, A., Reichelm, L., Weissinger, E., ...Halden, R. U. (2015, December). Comparison of Land, Water, and Energy Requirements of Lettuce Grown Using Hydroponic vs. Conventional Agricultural Methods [Scholarly project]. Retrieved from https://docs.google.com/document/d/1ZAZC_18Z4jR1_UJMj00ZD0vifxcn6IRjytBtKfZJcg/edit
- Food deserts*. (n.d.). Retrieved February 25, 2021, from <https://foodispower.org/access-health/food-deserts/>
- Foodfuelfuture. (n.d.). What is a food mile? Retrieved February 25, 2021, from <https://sustainableamerica.org/blog/what-is-a-food-mile/>
- Singh, A. (n.d.). Research. Retrieved March 02, 2021, from <https://aksapsjb.weebly.com/research.html>
- What is food insecurity in America? (n.d.). Retrieved February 25, 2021, from <https://hungerandhealth.feedingamerica.org/understand-food-insecurity/>

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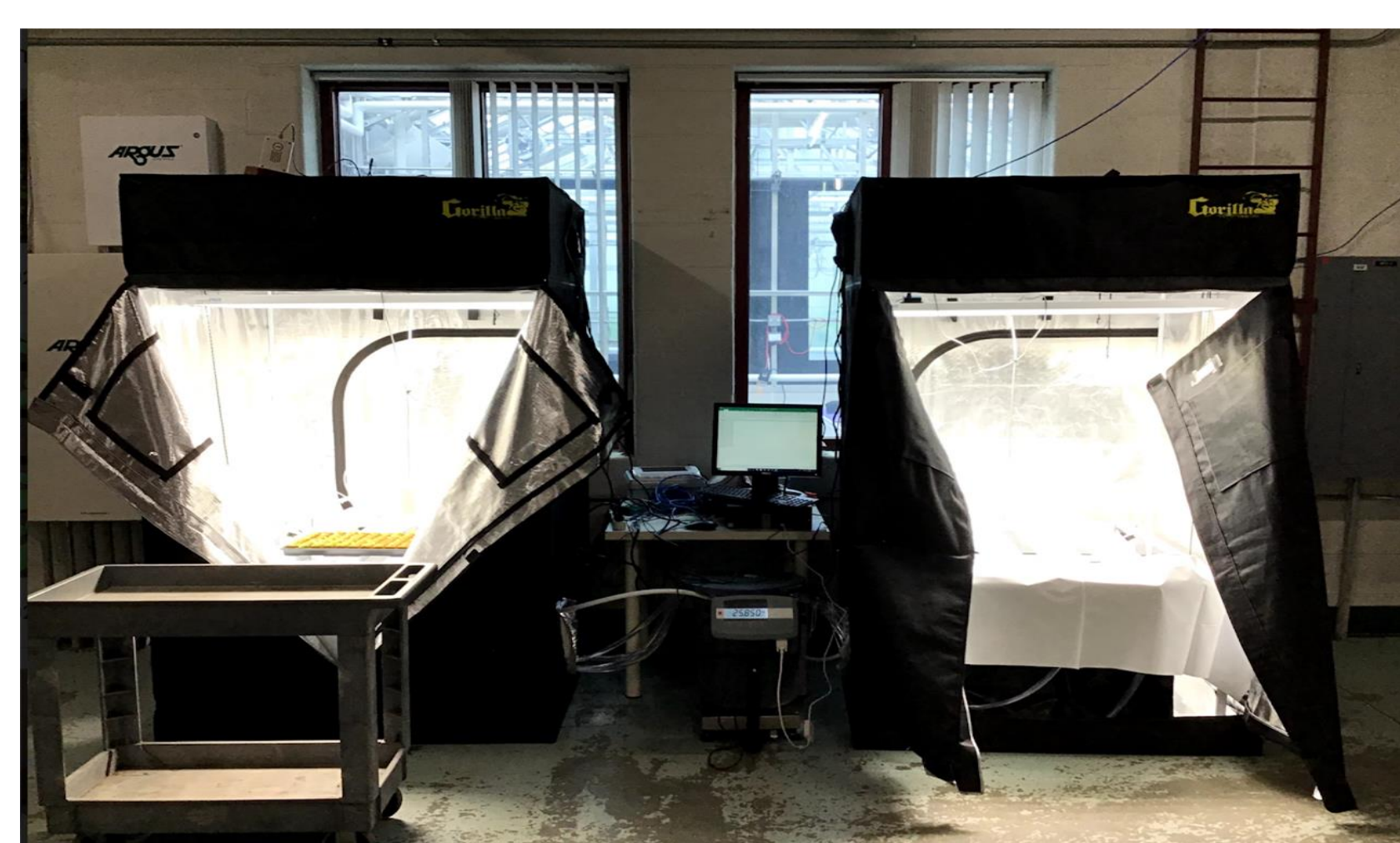


Figure C. GREENBOX set-up that UConn NRE graduate student, Ankit Singh, used

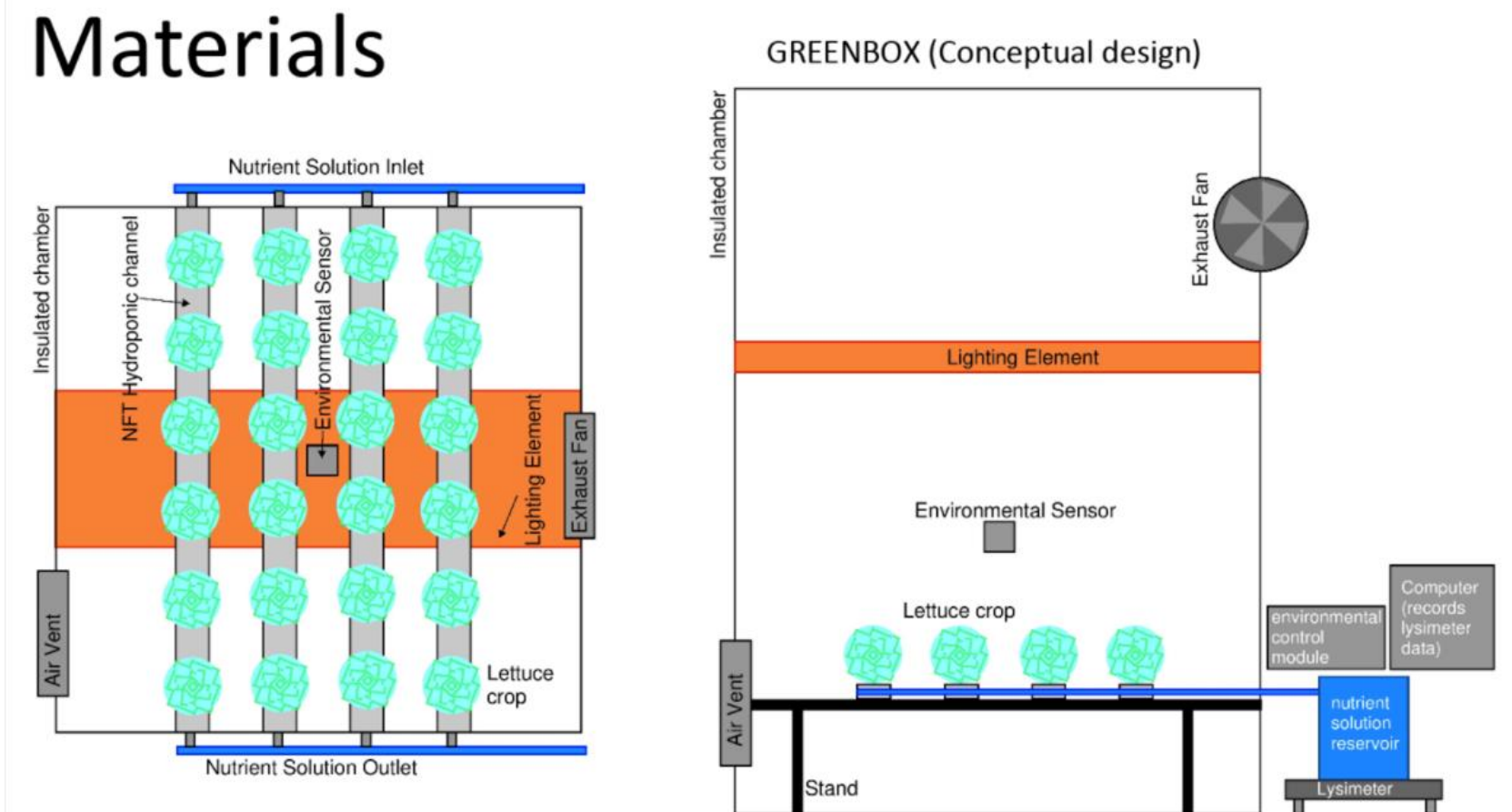
Fig. D. Illustration of the GREENBOX setup shown from the side and a bird's eye view. (Singh)

Fig. E. Greenhouse set-up that Ankit used on 6/5/20



C

Materials



D

Singh, A.

Figure F. Growth of the lettuce in the GREENBOX on 6/1/20



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