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English 1106

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The Promises and Challenges of Hyper-local Agriculture: Education's Role in Creating Sustainable Food Systems

A paradox pervades the food industry. Food is more abundant now than it has ever been, and yet millions of people around the world are starving, as per a recent UN Report, while our globalized food system is riddled with food waste (Stancu et al.). In this paper, I argue that a solution to food supply mismanagement, inequality, and hunger could be found in community-focused or hyper-local food production models. Hyper-local is distinct from local food, which is more akin to subsistence agriculture, in that the producers are the consumers. These sustainably centered models use micro-scale agricultural systems to increase the availability of food by utilizing negative space, brownfields, and yards in urban and suburban areas. Techniques such as hydroponics and permaculture can put the responsibility of food production in the hands of the consumer, reducing one's reliance on the global food system, and increasing the resilience of the overall local food system.

The adoption of a community-focused food production model comes with its own struggle. Building and caring for these hyper-local systems takes time and money, as well as experience and knowledge of more advanced agricultural practices. Indeed, at present access to these technologies and education is still largely inadequate, constraining our ability to scale down the

food system. A public that pushes policymakers to improve hands-on life science education could facilitate the implementation of personal and hyper-local food systems, but without such knowledge, our ability to transform the habits of the larger agricultural economy will remain minimal.

One approach to scale food production down to a more local level is by using innovative agricultural methods. Hydroponics is a method of growing food that supplies nutrient rich water directly to the roots, allowing people to grow without the use of soil. The absence of soil allows plants to be grown virtually anywhere. A simple Kratky system utilizes a stagnant water solution by suspending the plant halfway into a nutrient solution (Figure 1). In complex hydroponic setups, challenges include managing nutrient levels, sanitation, algae, mites, pH, and system engineering (Barbosa et al. 6884). Limited education and experience in the field may hinder enthusiasts, potentially leading to early abandonment if initial attempts at creating a system prove unsuccessful.

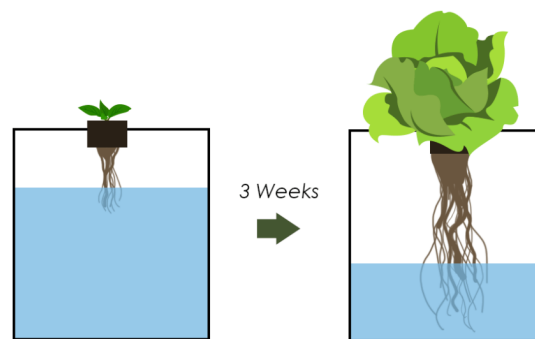


Fig. 1. Youst, Brandon, et al. “How to Start Growing with the KRATKY Method.” *Upstart University*, 1 June 2020, <https://university.upstartfarmers.com/blog/kratky-method>.

Permaculture, on the other hand, is a method that emphasizes sustainable practices to “design sustainable human settlements” (Hemenway 5) by using natural techniques to grow food and focusing on increasing the biodiversity and natural systems of the garden. Unlike indoor hydroponics systems, permaculture gardens prioritize community engagement and ecological coexistence, which makes them more attractive for community projects. While hydroponics offers year-round production with minimal space requirements, permaculture gardens provide an opportunity for suburban and urban communities to build stronger connections among residents while simultaneously improving local biodiversity. Both these hyper-local approaches, however, come with their own set of challenges to achieving sustainability.

Sustainability in food production cannot be achieved without attempting to limit food waste. With regards to consumer food waste, studies conducted in the UK claim that about 14% of the food bought is thrown away without being consumed (“Household food and drink waste in the UK”). This is *preventable* food waste, or food that could have been consumed by someone who really needs it. It is no different in many other developed countries. Denmark, Finland, and of course the US all have a significant amount of preventable food waste (Stancu et al. 8). France is a leading example on reducing food waste by banning supermarkets from throwing out food. According to PBS reporter Christopher Livesay, “The French not only appreciate food, but they are also committed to not wasting it” (Saltzman et al.). France wastes less food not because of regulations and penalties, but because of their culture surrounding food and sustainability.

There have been a lot of changes made in the past decades towards sustainability. Much of this change has been an acknowledgement of the problem, which should not be underestimated in its power to induce systemic evolution. While there could be many people who would love to be completely self-reliant and sustainable, most do not have the resources,

and the impact of a single person is tiny compared to a company or a country. Consumer food waste could drop to 0%, and there would still be food waste at all other levels of the food supply chain (Stancu et al. 12). Therefore, we also need regulations to promote holistic agricultural practices, which ideally would have the most considerable effect on the industry.

The unfortunate consequence of our current form of government is the amount of lobbying necessary to overcome influence from what some call “Big Ag.” Massive conglomerates like Cargill and Bayer-Monsanto are making billions of dollars not by owning agricultural production, but by controlling the importing and exporting of goods to these farmers (Murphy et al. 3). These companies are unlikely to support any change that would harm their profits. This creates a catch 22, as there needs to be systemic change from the top down through regulations, but this change will only come if there is enough push from consumers to change it. One person does not have a lot of power, but combined consumer efforts to participate in local food systems can make swift and meaningful change.

According to the most recent International Panel for Climate Change (IPCC) Report, there are many things that the agricultural sector can do to make the sector more sustainable. Polyculture, agroecology, cover crops, and urban farming all have a “high” confidence rating in their likelihood to positively impact sustainability. To implement these systems, especially urban farming, there needs to be an educational strategy that aims to disrupt traditional agricultural practices. Since Science, Technology, Engineering, and Math (STEM) job opportunities are increasing, schools need to better prepare students for the next generation of jobs, and their governing bodies should especially focus on sustainability-focused careers. Natural sciences, like agriculture, should be more readily taught to introduce young students to STEM topics in a hands-on way (Patchen et al. 286). While it isn’t impossible to learn from the internet how to

grow your own food, or how to implement more ecological practices in farming, most people might not have time to do their own research. Teaching these practices in school not only helps students develop an interest in STEM fields, but it also helps to educate the next generation on food sustainability and security.

Growing your own food seems like a thing of the past. But it is still common to grow plants indoors or in gardens. For those without the space or the knowledge of how to start a garden, growing your own food is hardly worth the time. Hydroponics could offer a solution to supplement your food growth year-round, without the hassle of gardening. Reddit, a popular social media platform, has a group of these hobbyists who share information and ask questions about their systems. It can be tough to find the information you are looking for as a beginner, and a central group like r/Hydroponics is a great place to learn. With a following of about 83,000 members, if you post a question, you can expect a quick reply. An example of how to use an internet community like this is shown below. I asked the subreddits followers how much time they spent monitoring their farming system each week. The overwhelming answer was between 1-3 hours (see Fig. 3. below).

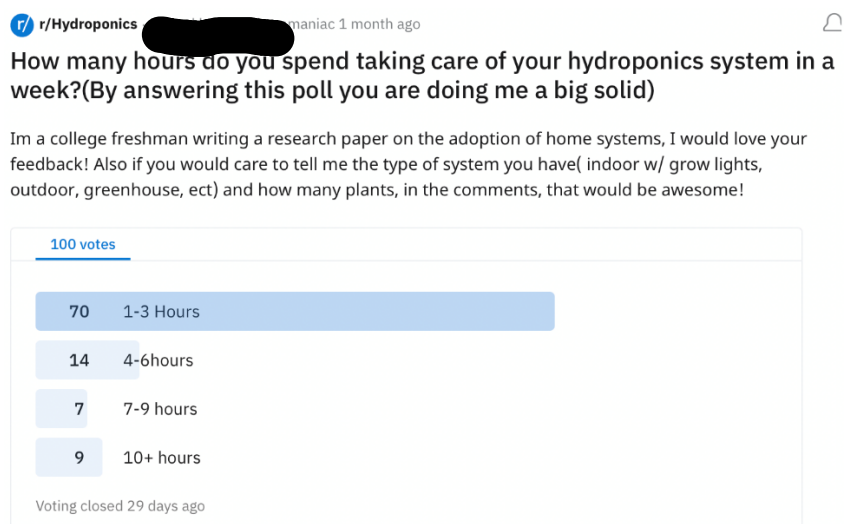


Fig. 3.

According to some of the commentors in the reddit group, the food is fresher, and over time, a system can pay for itself in produce. While the freshness is a guaranteed for a plant you harvest yourself, the net cost of the system over time depends on many factors. Regardless, knowing where your food comes from is something many people haven't thought about for generations, which can have adverse effects on consumers. Not only does your relationship with food become healthier due to dissociation from its origin, but growing plants in your house can make you a happier person (Patchen et al. 290), as it connects you with nature, which is crucial to overall mental health. These are just some of the reasons there has been a push for more urban farming, hydroponics, backyard permaculture, and a more natural lifestyle overall. While hydroponics offers a promising solution for year-round food growth, the hyper-local approach introduces a new set of challenges, particularly concerning food safety.

Hyperlocal food may not be able to keep the rigid quality standards of the current food industry. The HACCP (Hazard Analysis and Critical Control Points) standards set by the FDA are meant to limit the likelihood of a food born illness outbreak. If we adopted a food system where food was grown by your neighbors and/or yourself, it would be hard for a central food safety agency to monitor how each farmer grows and distributes their food. This in turn could result in more food borne illnesses.

In an interview with Dr. Michael Schwarz, the director for Virginia Tech's Aquaculture Research Extension Center and a lead researcher in many federal HACCP guidelines, I asked him what he thought about food safety in local agriculture and about a hyper-local agricultural system. Dr. Schwarz explains the problem behind food safety as follows: "If there was a small community hydroponics garden, it would be hard to know if there is a problem controlling diseases, as it is unlikely to affect too many people, or track it back to the farm" (Schwarz,

Personal Interview). This could also be attributed to the fact that it's common that produce grown in local food systems is less regulated than food sold in grocery stores. Smaller farms are exempt from FDA quality standards if they "have an average annual value of produce sold during the previous three-year period of \$25,000 or less" ("FSMA Final Rule on Produce Safety"). These are not usually farms run by people solely growing food for profit, but could be better categorized more as hobbyist farmers, or hyper-local farms. Larger farms in local systems can also struggle with quality consistency due to regulatory uncertainties (Martinez et al). This can be managed but, to reduce food safety concerns, "growers often need education and training at the local level to meet market requirements" (Martinez et al). Nobody benefits from contaminated food, and our governments need to prioritize food quality education and collaborating directly with local farmers. Developing a standard outreach program for local farmers, will not only increase consumer safety, but farm profitability as well.

The world is changing in many ways, and the consensus is that we need to shift all industry towards sustainability, especially in food production. Agriculture is one of the largest emitters of greenhouse gases, but a lot can be done to solve this issue. According to the most recent IPCC report, hydroponics, permaculture, urban farming, and precision nutrient technologies could pose a massive positive benefit towards sustainability. Personalizing the food system can bring challenges, but the benefits of locally grown produce are worth the effort. We face cultural and industrial resistance to a more equitable food system, and because of this, government intervention is needed. If the cultural intent is to create a more sustainable food system, the industry will adapt and follow the will of the people. Traditional farmers will not lose their jobs to urban farming, but instead both systems will form a more reliable and resilient food system. While we can't predict how this new industry will affect all farmers exactly, we can

assume that the increasing population will keep all farmers employed. We should expect our agricultural systems to change over time. Different ways of living can help us achieve the goals set at the 26th UN Climate Change Council of the Parties (COP26). The world is rapidly changing, and we need to change as a result.

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