

Aquaponics – a modern approach to sustainable agriculture

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Abstract. The following article was done to illustrate that there is different method that can be used to practice plants growing than traditional ones. Due to the different challenges that our planet faces, new approaches are utilized for the better outcome for the environment and other important factors. There are many approaches developed lately for the environment issues and one of them is aquaponics. Aquaponics is a great example of how two ecosystems thrive from each other and can exist without harming the ecosystem. This article will look into aquaponics and what it is. This article will also cover advantages and drawbacks also some future applications.

1 Introduction

It might seem that every new idea or product, method and technology are a byproduct of such unfortunate events that occurred in the near past. These events are well known in the masses and can be named as follows: overpopulation and Global warming. There are other events that negatively effect our planet and these who inhabits it, but they all are somehow hierarchically connected to these two mentioned above. Indeed, one can say that novelties occur due to these events or events that are arising from these [1].

If looking through one event, which is overpopulation, one can see that it directly related to production rate. More people mean more demand for the goods and food, and also other recuses. If narrowing the focus to the only production of food, the obvious problematic areas arise to the surface. Land as we all know is limited same as water and other nutrients. In addition, every day changing planet, due to the hazardous gasses released into the atmosphere, which are adversely influencing the stability of well-established natural events, introduces new regulations that must be followed. Therefore, more sustainable and reliable approaches in food industry must be achieved to meet all the issues that the humankind is facing right now and for the future us too[2, 3].

This work will look into the new approach that is a promising one in the food industry. It is also important to notice that this approach is not the only one to introduce positive outcomes in agricultural sector. The approach is aquaponics. This method occurred a few

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decades ago. As any other innovative solutions, this one has its advantages and disadvantages that can be solved through care and improvement.

2 What is Aquaponics?

Aquaponics is a symbiotic approach of three main components to thrive from each other with the less harmful influence to the planet, as many traditional practices did and are doing right now. Fishes, plants and bacteria work together in a system that benefits each of them and minimizes the waste and rich elements' usage (water and soil). Rich meaning that they are important for the humans to survive and hence taking care of them is a priority.

There are many components needed to build this soilless food growing technique, but the main large components are as follows: fish tank, planting area and sump. Fish tank contains as it is obvious different kind of fish (must be chosen depending on crops and environment). The waste formed by the fish will sink to the bottom of the reservoir and can be used to support growth of the plants. The accumulated waste of the fish contains nutrients that are well suited for plants and therefore for their growth. The waste moved to the second main part (planting area, where cultivation begins) using different techniques (mostly pumps). As it was mentioned before, no soil is utilized in this technique and, hence, other materials can be found in this second area such as expanded clay rocks of different size and quality. The waste is then converted to nitrates by bacteria. The purified waste is then moved to the third part, which is a sump. And lastly, the cycle ends at returning the water from the sump to the fish tank [4, 5].

3 Advantages of the Technique

First and most important side effect of this technique introduces is that it provides eco-friendly approach, which is rare phenomena in modern time. Due to the different challenges, it is hard to keep up with the demands and hence unhealthy methods are used to achieve the goals. Usage of excessive fertilizers to increase the rate of production as well as endless exploitation of the same lands and unrepresented of biodiversity of crops and many other ways are the key factors that forces new ideas to be out. Therefore, this method presents more eco-friendly ways for cultivating different crops using minimum resources and similarly having minimum effect on environment. One of the main aspects of this technique is water usage. Due to different factors such as drought, chemical contamination and lack of access to water becomes economic issues and this approach solves this issue too. Circulation of water from fish tank to vegetables and then to sump after it gets purified by passing through different natural steps and going to point of beginning makes less losses of water and possibility to use it again as circle is in the process [6, 7].

Biodiversity is the key component in the nature to sustain itself within the frames without losing overall control of the system. Humans are the main species that has great influence on biodiversity. As population grows, more lands are used to build infrastructure and for food growth. More landscapes and other natural ecosystems are disturbed or completely eliminated. These events lead to an unstable system that presents future in more chaotic and unpleasant ways. It is well known that growing different crops to each other enriches the land, and it does not deplete. However, modern practices show that farmers use one type of crops that over the time depletes the using land and hence it becomes barren. Aquaponics uses the different species to complement each other without harming the nature. As it was mentioned above, fishes and plants work together and provide the necessity elements to each other by completing the circle. As a result, two different foods can be achieved. In the first case is a vegetable and in the second is fish.

4 Disadvantages of the Method

4.1 Cost-Related Issues

There are few disadvantages that put this method to aside. First and most common one is cost related and complexity of the overall structure. High upfront costs of aquaponics are one of the barriers for farmers for the implementation of practicing more eco-friendly approach. This approach is not just expensive to build, but also it has maintenance and operational cost, which could be another issue as this procedure happens frequently. Due to the use of electronic devices, one could assume there would be energy usage and, hence, additional spending [8].

4.2 Complexity of the Structure

Complexity of the structure if compared to traditional practices is immense. First of all, the overall structure of the system is quite complex and requires high precision. Some parts of the system must be automated due to its specification. Automated monitoring also required as sensors should be working all the time to sense correctness of work of overall system, water passage, filtration, pH, temperature and other factors that will directly influence the growth of the plants and life of the fish if something goes wrong [9].

4.3 Requirement for Diverse Skills

As it was mentioned above, this method utilizes two absolutely different to each other system to work together. Fishes and plants are sits in classification far from each other. They have different approaches and different knowledge to be applied. Henceforth, a well skilled job force is required, that could deal with both systems and understand thoroughly all the necessary steps to sustain the system afloat. Damage to one system could lead to damage to the second one and vice versa.

4.4 System Vulnerabilities

Due to its specification, the system has many weak spots. One mistake in the system could lead to collapse of the overall system. Every step-in aquaponics connected and must work perfectly for the system to thrive from each other. If the fish tank collapses there is no water or nutrients flowing to the second part and, hence, the plants could easily die from deficit of main supplies. If plants don't absorb or filtration goes wrong, the sump will be filled unclean water, and it will go directly to the fish tank. If filters, pumps, sensors and other parts of systems go out or will work incorrectly it could immediately put the system in danger. Therefore, one can notice that the system of aquaponics is fragile and extra care must be put in to sustain the system afloat.

4.5 Plant Limitations

The common issue with these kinds of techniques such as aquaponics, hydroponics or vertical farming and so on that they are limited with the choice of what to be grown. Which puts extra stress to farmer for the technique to be implemented. From one side there is a higher cost for building and sustaining it and from the other side there is a limit of what can be grown. The other issue is that the fishes must be also carefully selected for the chosen plants. This type

of approach makes this technique unreachable for the farmers as it requires a lot of effort and time for the selected plants to be grown with the danger from every corner [10].

5 Future Applications

As it was illustrated in this work, the technique lacks some improvements that would level this method from others and could probably put into the action more frequently than right now. If this technique is about to be used in the future, there must be some rearrangements put in. first think that will be modified or changes, in this case simplified) is the complexity of the structure. Although, there might be more complex structure in future that will further utilize the necessary equipment to result in maximum output of production with minimization of any harm to the surrounding environment. Is it essential to understand that future might bring any possible outcome and, hence, this paragraph could provide vague presentation of what could happen [11].

6 Conclusion

The following article was done to illustrate new practices that are eco-friendlier to our environment and can be adopted to fulfil the modern needs in agricultural sector. Aquaponics is a technique that provides farmers with more option to be chased. This work looked into what is aquaponics and why it is important to implement this kind of methods in today's challenging time. Some of the common advantages of the technique were also covered, as well as drawbacks that this technique lacks. At the end, future applications of the technique were discussed.

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