AgriCos e-Newsletter
ISSN: 2582-7049
AgriCos e-Newsletter
Open Access Multidisciplinary Monthly Online Magazine
Volume: 05 Issue: 03 March 2024 Article No: 10

Aqualife -The Role in Vegetables

B. Nithya Sri[1] and K. Nirosha[2]
[1]M.Sc. 2nd year, [2]Assistant Professor, Department of Vegetable Science, CoH, SKLTSHU, Rajendranagar, Telangana

SUMMARY

Aquaponics offers a solution to several sustainability issues, such as, limited water availability, environmental pollution, increasing fertilizer cost, and depletion of fertile soils. Commercial aquaponics will face difficulty growing high value flowering crops such as sweet peppers, tomatoes or cucumber, as a result of suboptimal nutrient ratios in aquaponic solution, specifically the reduced K+, Mg+, and Ca+. Considering plant growth promoting microbes are likely the cause of aquaponic plants being able to achieve yields, future research in this field can be paramount to the beneficial use of microbes in all plant production systems. Combining aquaculture with hydroponics can obtain a new innovation named aquaponics which respects principles of sustainable agriculture (wastewater bio filtration by plants) and gives the possibility to increase economic efficiency with an additional production (organic vegetables) to produce the nutrient rich food.

INTRODUCTION

More than 258 million people across 58 countries and territories experienced acute hunger requiring urgent food, nutrition and livelihoods assistance (IPC/CH Phase 3 or above) in 2022 (Food Security Information Network (FSIN), 2023). In front of this reality, it is necessary to look for alternatives to solve this problem. The agriculture industry is the world's largest user of water ,70% of the water is wasted throughout their different processes (Kloas et al., 2015), (Murad et al., 2017). The sustainable development strategies have become a global trend, and a circular economy is the general trend of sustainable development and the best mode of economic development (Wei et al., 2019). Aquaponics is known as a form of sustainable agriculture because it imitates natural systems, where the efficiency of the water is dramatically increased, and has fewer environmental impacts (Blidaria and Grozea, 2011). In developed countries concerns about waterpollution have raised interest in aquaponics system as a valid option to get rid of aquaculture wastes through production of high value vegetables.

Aquaponics:

Aquaponics is a combination of Aquaculture and Hydroponics. It is a bio-integrated system that links recirculating aquaculture with Hydroponic vegetable, flower and/or herb production. Introducing fishes in a system it produces nitrogenous compound ponds mainly ammonia which is hazardous to fish, even in small respectively and toxicity increases in relation to pH and temperature in the water column. On the other hand,

Nitrosomonas bacteria break down ammonia to NO Nitrobacter convert the nitrite into nitrate which is food for the plants

Types: It is based on type of Hydroponic system used

1) Media Based Bed 2) Floating Raft 3) Nutrient Film Technique

Materials Used:

Fiberglass, Polyethylene tanks are best and very popular for rearing tanks, sumps and filter tanks. Use rain water or ground water. Always maintain TDS (200 to 400 ppm) or EC (0.3 to 0.6 mmho/cm) and PH around 7. Phytotoxicity occurs at TDS concentrations above 2,000 ppm or EC above 3.5 mmho/cm. Nitrate nitrogen levels can be regulated within a range of 1 to 100 mg/L. To maintain a low cost and minimize pipe losses PVC piping was used.

Parameters for Aquaponics

pH	6.5-7.0	Alkalinity	50-150 mg/L CaCO3
Temperature	17°C -30°C	Total Ammonia-Nitrogen	<2 mg/L
Water Level	.02 kg/L	Nitrites	50ppm-100 ppm
Dissolved Oxygen	>4 mg/L	Flow	1-2 liters/min
Electro-Conductivity	100-2000 µSiemens/cm	Air Temp	18°C -30°C
Total Dissolved Solids	<1000 mg/L	Relative Humidity	60%-80%
Salinity	0-2 ppt	CO_2	340 ppm-1300 ppm
Water Hardness	50-150mg/L $CaCO_3$	Light Intensity	600 PPFD -900 PPFD

How to Establish:

Initial stage: The cycle begins when fish are introduced to the aquarium. Their feces, urine, as well as any uneaten food, are quickly broken down into either ionized or unionized ammonia. The ionized form, Ammonium (NH_4), is present if the pH is below 7 which is not toxic to the fish. The unionized form, Ammonia (NH_3), is present if the pH is 7 or above and is highly toxic to the fish. Any amount of unionized Ammonia (NH_3) is dangerous and it will be fatal for the fish once the concentration reaches 2 ppm. Ammonia usually begins rising by the third day after introducing fish to the system.

Second stage: During this stage, Nitrosamines bacteria oxidize the ammonia and change it to nitrite, which is also highly toxic to the fish. Nitrites levels as low as 1 mg/l can be lethal to some fish. Nitrite usually begins rising by the end of the first week after introducing fish to the system.

Third stage: In the last stage of the cycle, Nitrobacter bacteria convert the nitrites into nitrates. Nitrates are not highly toxic to the fish, in low to moderate levels. Established tanks should be tested for nitrates every few months to ensure that levels are not becoming extremely high.

With the nitrogen process established, plants will consume nitrates and provide the system with clean water. In order to maintain this dynamic system, the growing environment for both fish and plant must be balanced. To ensure this, temperate, pH, and chemical components of the system must be monitored. If the pH levels become too acidic, nitrifying bacteria will suffer. Conversely, if the water becomes too basic, nutrient uptake of many micronutrients in the plants will be stopped. Additionally, the fish are going to need to be fed regularly and the plants may need to be monitored against harmful pests.

Fishes suitable for Aquaponics

Species selected for aquaponics must show tolerance to both high densities and high levels of total suspended solids and dissolved nutrients, should be rustic, tolerate high concentrations of macro and micronutrients which are often added to the water as a supplement for plant growth. Fishes like Catfish, Talipia, Yellow Tail Lambari, Pacu, Tambaqui, Snook Fish etc are generally used

Plants grown under Aquaponics

Many types of vegetables have been grown in aquaponic systems. However, the goal is to culture a vegetable that will generate the highest level of income per unit area per unit time. So, Leafy greens, Lettuce, Tomato, Beans, Cucumbers, Eggplant and Okra etc are suitable

CONCLUSION

Aquaponic systems carry great potential to overcome several sustainability challenges in the agriculture sector; primarily the ability to produce high yields with minimal added nutrients, while also greatly reducing nutrient discharge and water loss from aquaculture

REFERENCES

Rakocy, J.E. & Masser, Michael & Losordo, Thomas. (2006). Recirculating aquaculture tank production systems: Aquaponics-Integrating fish and plant culture. SRAC Publication. 454.

Salam, M. A., Hashem, S., Asadujjaman, M., & Li, F. (2014). Nutrient recovery from in fish farming wastewater: an aquaponics system for plant and fish integration. *World J. Fish Mar. Sci*, *6*(4), 355-360.

Surnar, Sharad & Sharma, O & Saini, V P. (2015). Aquaponics: Innovative farming. International Journal of Fisheries and Aquatic Studies. 2. 261-263.

Yanes, A. R., Martinez, P., & Ahmad, R. (2020). Towards automated aquaponics: A review on monitoring, IoT, and smart systems. *Journal of Cleaner Production*, *263*, 121571.

Yep, Brandon & Zheng, Youbin. (2019). Aquaponic trends and challenges – A review. Journal of Cleaner Production. 228. 10.1016/j.jclepro.2019.04.290