

Green without ground

Hydroponics and wastewater reuse

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Introduction

During the semester, we develop and realized a functional hydroponic system. The system allows the simultaneous testing of three nutrient flows. Each layer of the system contains its own grow light, pump, water reservoir, and measurement system, enabling automatic monitoring of water pH, electrical conductivity, and temperature. The system was tested in the research for cultivating lettuce on wastewater and assessing the value of adding a biostimulant. Various sub-studies were conducted, including the chemical analysis and biological testing of the nutrient streams.

Process



Figure 1: Process description from start to final setup

Results



Figure 2: First hydroponic system layer

Figure 3: Second hydroponic system layer

Figure 4: Third hydroponic system layer

With standard nutrients from TriPart Terra Aquatica

With standard nutrients from TriPart Terra Aquatica + biostimulant Kaumera

With effluent, the final product of the BluElephant.

AAS measurement of the nutrient flow

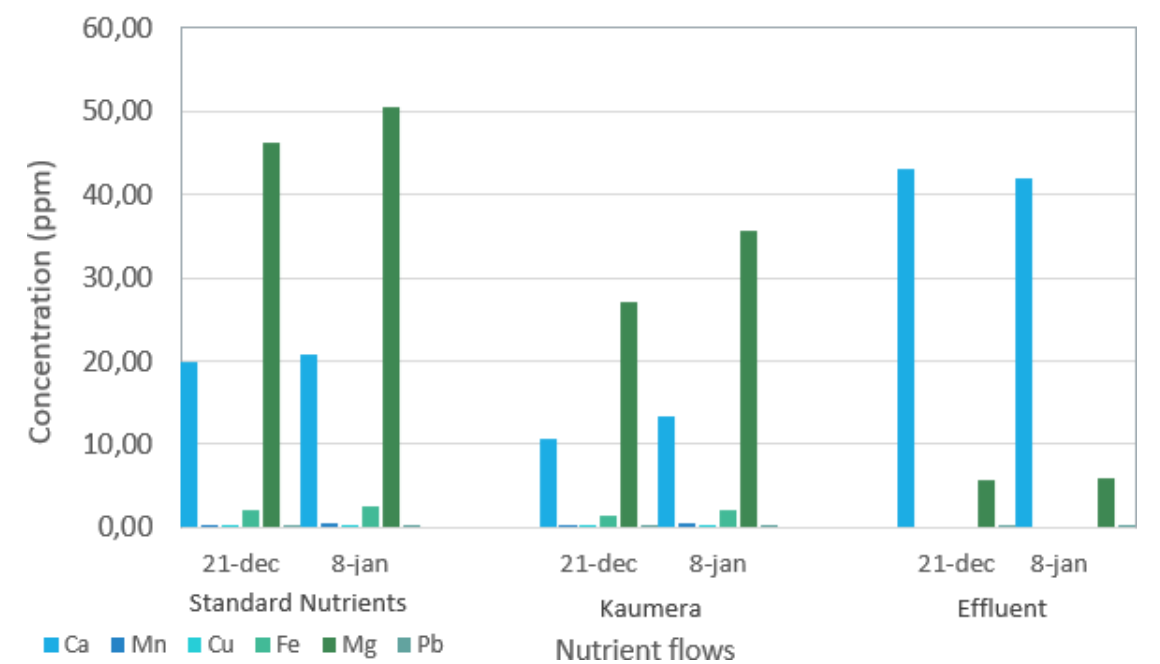


Figure 5: AAS measurement of metal ions in the nutrient flow

Lettuce leave count

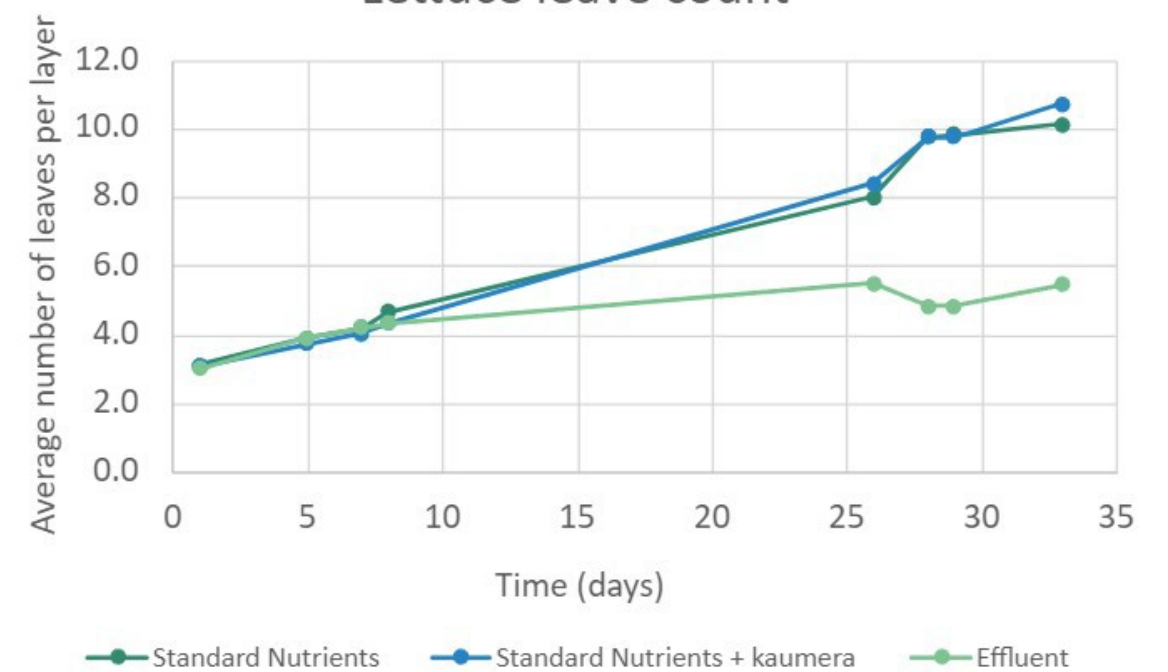


Figure 6: Lettuce leave count of 33 days

Conclusion

A functional hydroponic system has been developed and realized, in which the pH, electrical conductivity, and temperature of the nutrient flows can be automatically measured. The system has been tested to grow lettuce using wastewater, with the additional benefit of the biostimulant. Lettuce grown on the effluent grows significantly slower than the standard growth solutions, likely due to the lack of nutrients in the effluent. Moreover, the effluent layer contains a large amount of bacteria that could compromise food safety. Further research is needed to assess the suitability of effluent as a nutrient stream for hydroponics. No additional benefit has been observed in the use of the biostimulant.

Recommendations

New water pumps	Functional water pumps that better suit the system
Optimize measurement system	System that automatically adjusts values according to the needs of the plant
More testing	Research into alternative nutrient sources as surface water containing pharmaceutical residues
Food safety	Research on the number of bacteria and vitamin content
Plant hormones	To investigate the stages of growth and plant hormones

Acknowledgment

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