A Novel Duckweed Cultivation Method to Maximize Its Nutritional Value for Future Sustainable Food Development

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A child dies from hunger every 10 seconds due to the rising global crisis in food accessibility, security, and sustainability. Therefore, the need for a sustainable food source is becoming more urgent. To address this issue, we found out that duckweed (Wolffia globosa), a small angiosperm with high values of complete protein and rapid growth rate, could be a comprehensive solution. However, duckweed accessibility was hindered by systematic cultivation. We investigated environmental factors affecting duckweed growth and nutritional value to identify the optimal conditions for high-quality duckweed cultivation. Our study showed that manipulating limiting factors such as light, water, nutrient compositions, and bacterial symbiosis enhanced duckweed protein production significantly by 8-folds. We developed a novel duckweed cultivation system that yields 3 times more protein than livestock. We were motivated to apply the potential of the optimized duckweed food value not only to address the current food crisis but to pose duckweed as a future universal sustainable food for mankind. One of the applications we were interested in was to introduce duckweed cultivation in other unusual environments such as varied gravitational conditions. We designed a Random Positioning Machine to assess the effects of various gravity levels on duckweed production rate. Our results revealed that microgravity could double duckweed's growth, highlighting its potential as a future sustainable food source in low gravitational environments. Thus, our approach not only introduced an environmentally friendly duckweed production system as a complete protein source, but we also revealed its potential applications beyond Earth.

Awards Won:
Second Award of $2,000