

Growth and Nutrient Uptake of *Ulva lactuca*: Theoretical Nutrient Removal and Fertilizer Reuse Potential

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Introduction

- Eutrophication is a major problem in the Indian River Lagoon (IRL)
- One natural response to eutrophication is increased algal growth
- Previous studies identified *Ulva lactuca* as one of the fastest-growing macroalgal species in the lagoon (Whitehouse and Lapointe, 2015)
- *Ulva lactuca* also has potential use as a fertilizer, creating a link between nutrient removal and beneficial reuse
- This study aimed to quantify nutrient uptake rates of *Ulva lactuca* in order to estimate how much nutrient load could theoretically be reduced through large-scale cultivation



Figure 1. Mesocosms during trial



Figure 2. Dry algae fertilizer demonstration

Methods

- 9 mesocosms were established using sterilized simulated lagoon water (Ahajan et al., 2025) (Figure 1)
- Experimental duration was 72 hours (Whitehouse and Lapointe, 2015)
- Water samples were collected at 0 and 72 hours for nutrient analysis (Ahajan et al., 2025)
- Measured nutrients included ammonium, and orthophosphate.
- Growth rates were calculated from changes in algal mass
- A non-experimental fertilizer demonstration was included to highlight potential beneficial reuse (Figure 2)

Results

Graph 1: Average *Ulva* Weight Before and After 72 Hours

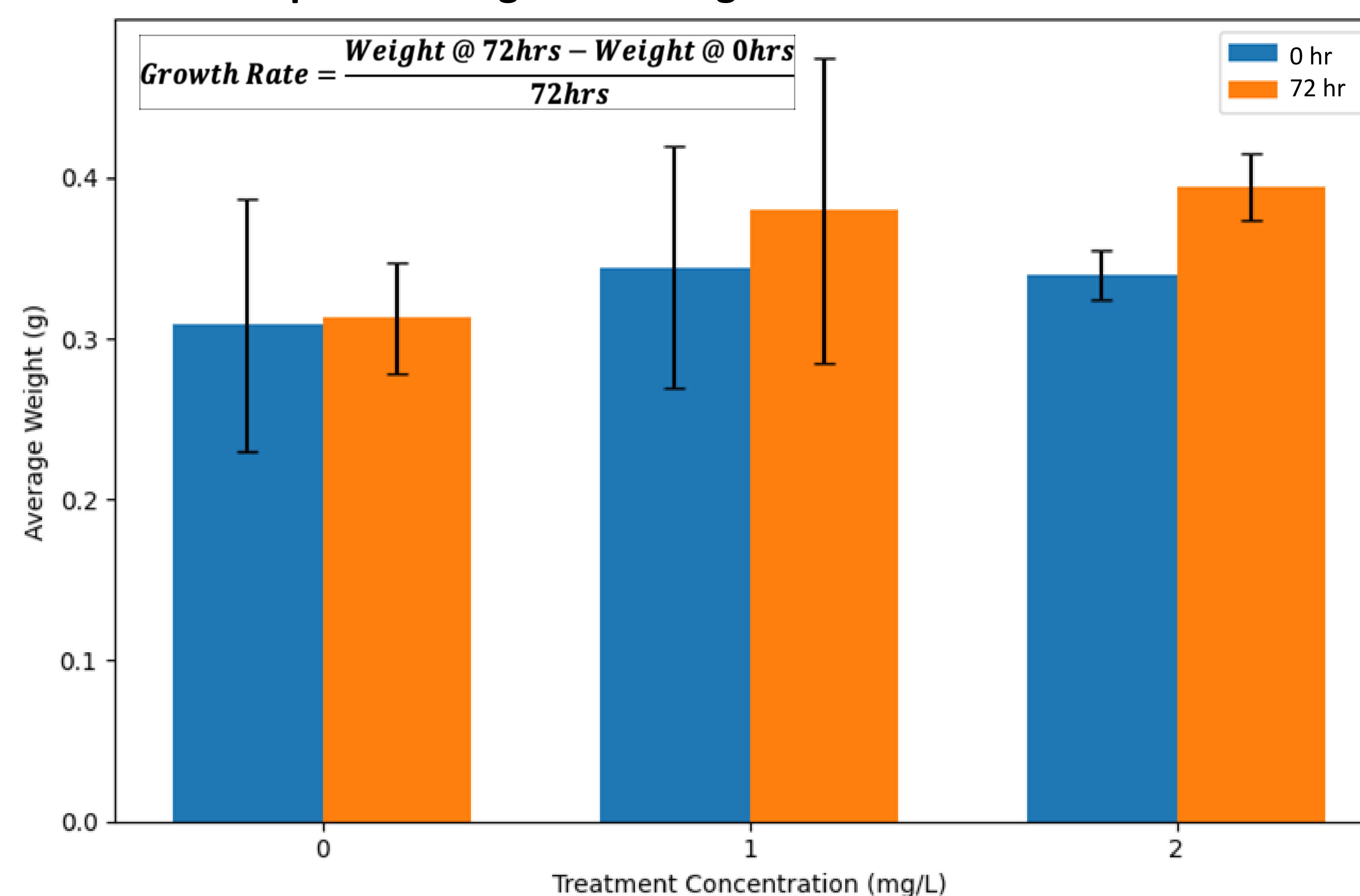
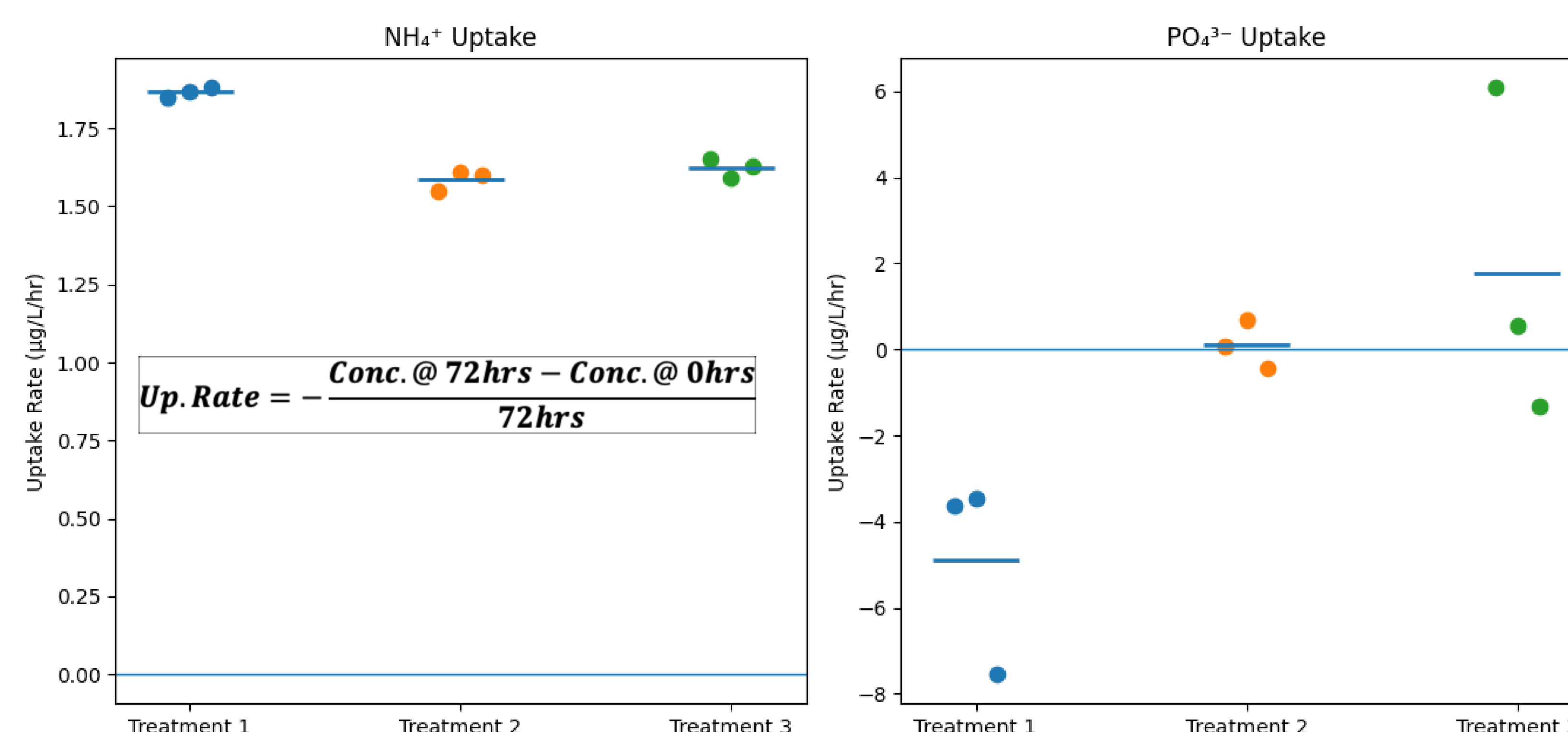


Table 1: Summary of Nutrient Uptake by Treatment

Treatment	Start NH_4^+ ($\mu\text{g/L}$)	Avg NH_4^+ Uptake Rate ($\mu\text{g/L/hr}$)
1	151.6	1.87
2	135.3	1.59
3	135.4	1.62

Treatment	Start PO_4^{3-} ($\mu\text{g/L}$)	Avg PO_4^{3-} Uptake Rate ($\mu\text{g/L/hr}$)
1	6.6	-4.87
2	1067	0.11
3	1930	1.78

Graph 2: Replicate Nutrient Uptake Rates by Treatment



Discussion and Conclusion

- *Ulva lactuca* exhibited positive growth across treatments (Graph 1)
 - Highest average growth rate observed in the 2 mg/L treatment
- Nutrient uptake across treatments based on changes in water-column ammonium and orthophosphate concentrations between 0 and 72 hours, providing an estimate of nutrient removal by *Ulva* during the experiment (Table 1/Graph 2)
- Initial results show it is theoretically possible to remove nitrogen and phosphorus from system
- This theoretical removal estimate is important because it shifts *Ulva* from being viewed only as a symptom of eutrophication to being evaluated as a possible nutrient-management tool
- The fertilizer demonstration strengthens this concept by showing a plausible beneficial reuse pathway for harvested biomass (Figure 3)
- Future studies should test fertilizer performance and assess contaminant risks

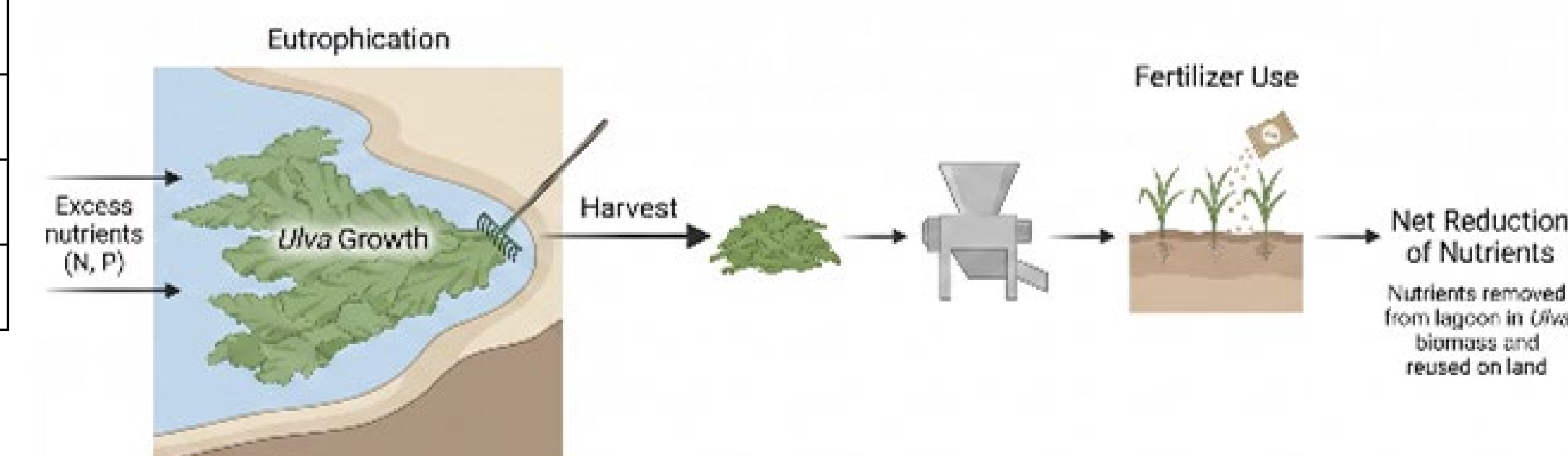


Figure 3. Algae reuse pathway (BioRender, Crews 2026)

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