



The Effect of Red Wiggler Worms (*Eisenia fetida*) on Aquaponics Nutrient Solution Properties and System Stability Across Solution Temperature

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Overview

This project begins to quantify the potential benefit of red wiggler worms as a low cost input for aquaponics producers to increase nutrient concentration available to plants and thus increase subsequent yield. Through regular testing and analysis of the system's nutrient solution, it was found that worms had no immediate, consistent, and demonstrable benefit as far nutrient concentration, system stability, or plant yield, and that fish species had more of an effect on system solution. This study does not rule out other benefits of worms to the system, in particular to the reduction of waste build up. Inconclusive results suggest that this study should continue over a longer duration.

Methods



- *Red wiggler worms (Eisenia fetida)* were added to the biofilters of four of eight floating raft aquaponics systems.
- Tanks contained *Nile tilapia (Oreochromis niloticus)* or *yellow perch (Perca flavescens)*, and were maintained at either 23°C or 26°C.

- Plant crops for all systems were *butterhead lettuce (Lactuca sativa 'Nancy' OG MTO)* and *purple basil (Ocimum basilicum 'Amethyst Improved')*.



- Over *six weeks* tracked major and micronutrient, pH, and alkalinity levels in the four systems with worms, as well as four identical systems without worms. Plant yield was also measured.
- *Evaluated whether there were measurable differences* in nutrient solution composition between the systems with or without worms. Also looked for synergistic differences between worms and other variables of fish species and temperature.

Summary of Treatments

Worms	23°C	Tilapia
		Perch
No Worms	26°C	Tilapia
		Perch

Nutrients Measured: NO3 NH4 P K Ca Mg Na Fe Mn Zn Cu Mo

Findings

- There was no statistically relevant data to support the hypothesis that the inclusion of red wiggler worms in an aquaponic system's biofilter increases nutrient concentration.
- There was a significantly greater output of nitrate and soluble salts in the tanks that contained tilapia than those with perch.
- Iron and zinc levels were higher in the aquaponic systems with worms added to the biofilter.
- The potassium concentration in the aquaponic systems with worms added to the biofilter was lower than that of the systems without the addition of worms..
- In a study measuring nutrient outputs, one must pay close attention to limiting factors that affect the systems composition. Having different types of fish, different crops, and different water temperatures all greatly affected the accuracy of whether or not worms had an effect on the nutrient concentration of the systems.



Recommendations

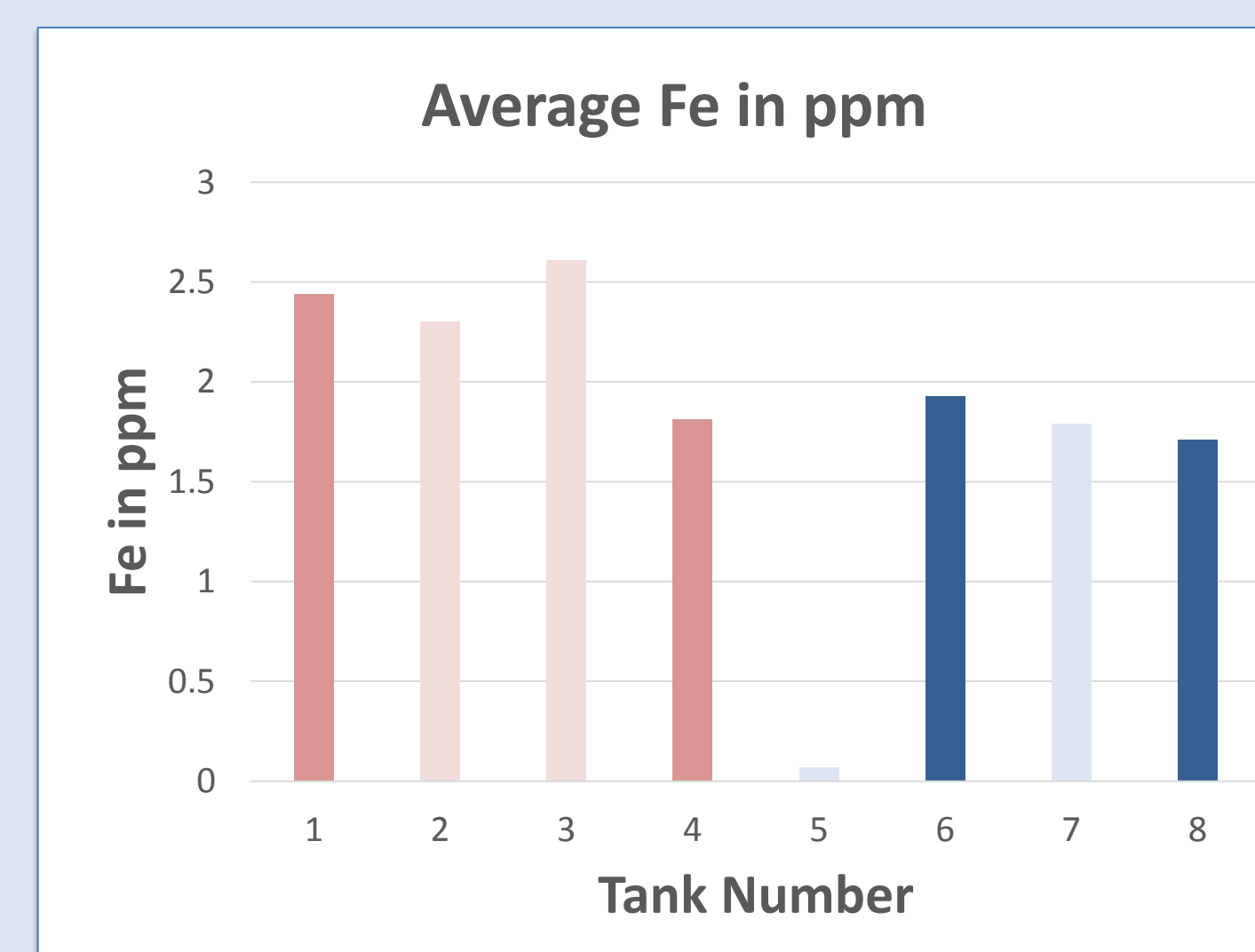
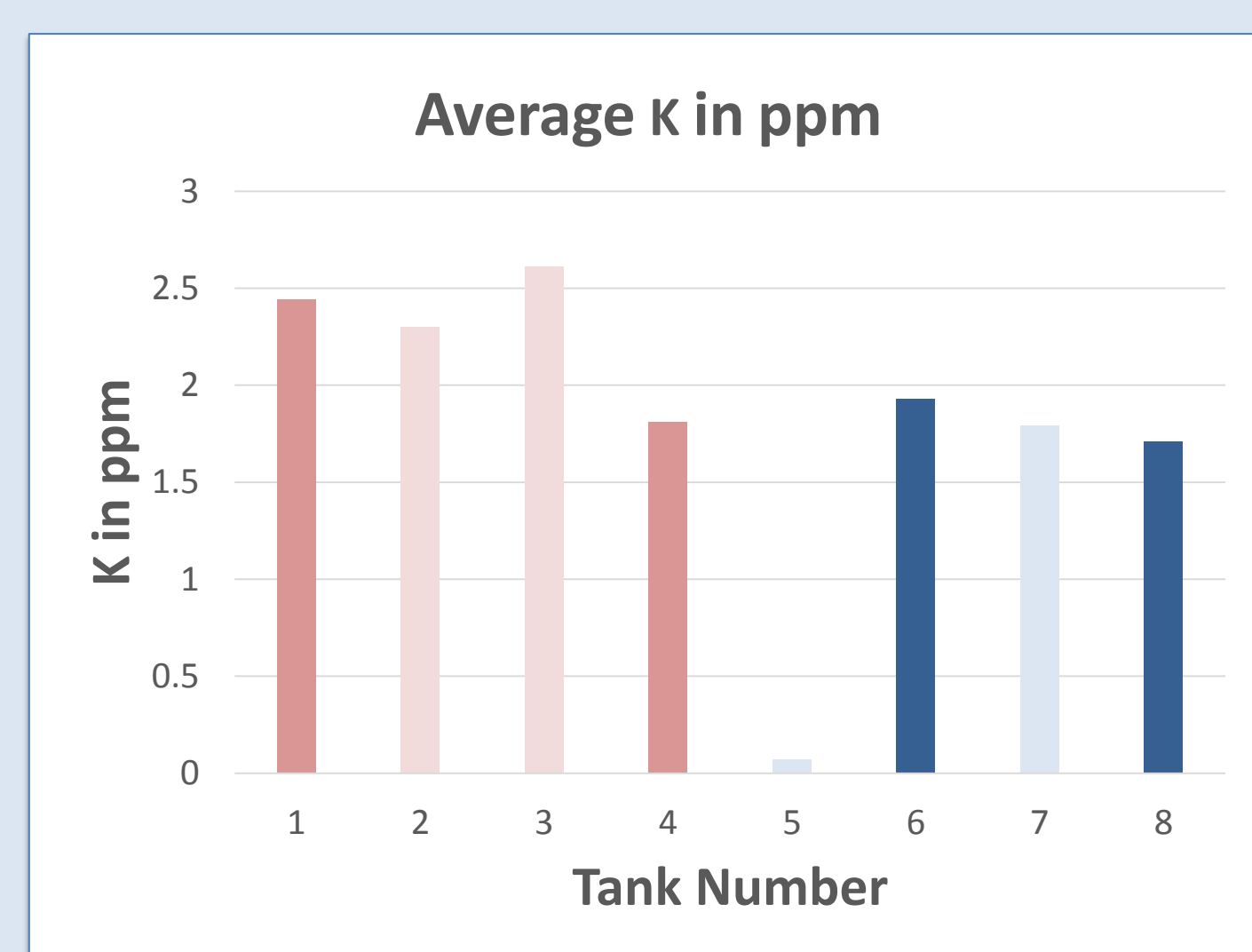
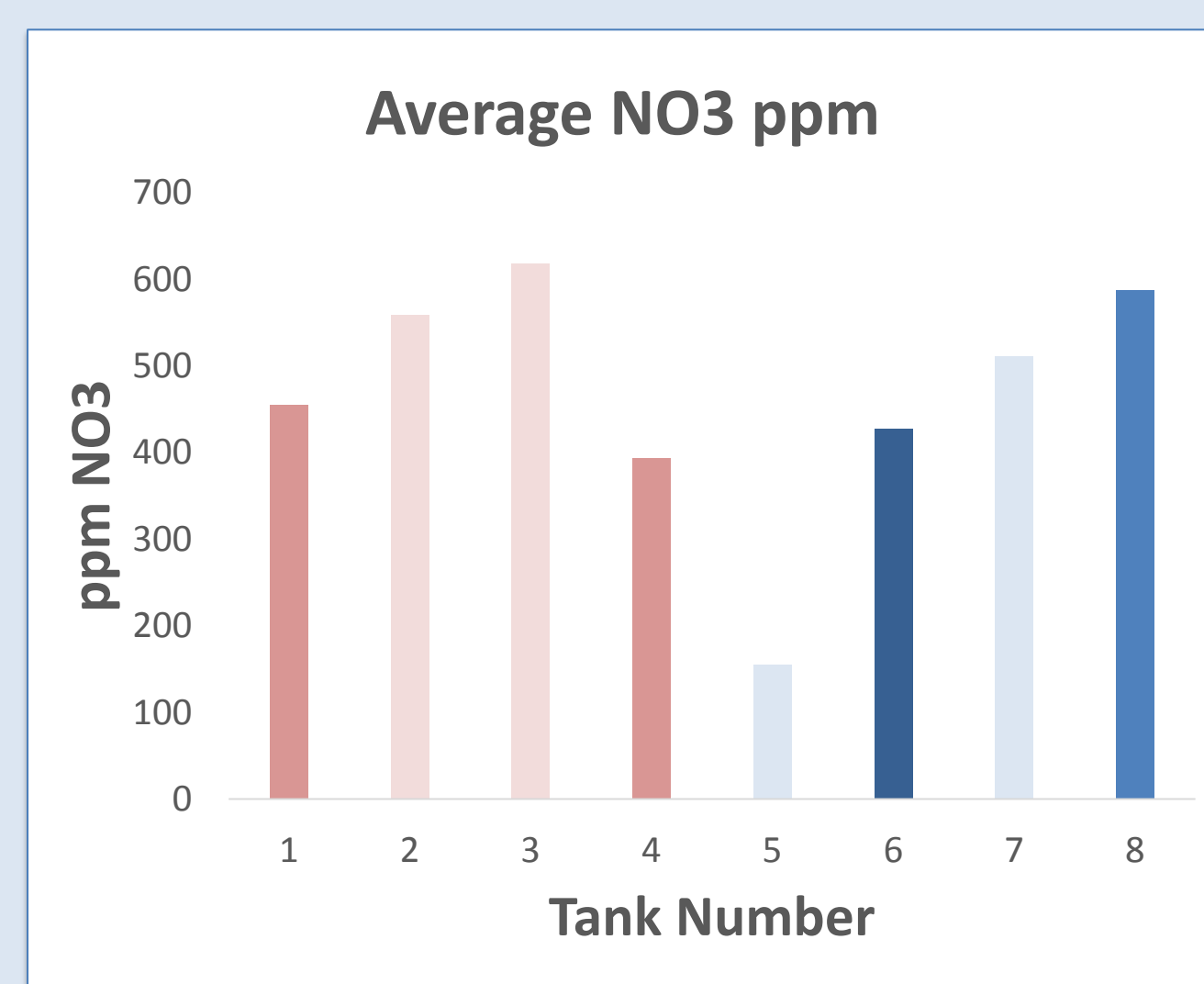


1: Add Red Wiggler Worms to Aquaponic Systems

Although the data did not support the nutrient based beneficial effects of red wiggler worms, they are very inexpensive, and well known for their ability to reduce waste build up in aquaponic systems (Rakocy et al., 2006. Aquaponic growers can benefit from decreased expenses associated with system cleaning.

2: Extend Duration of Research with Improved Protocol

Limiting these variables and extending the duration of the experiment will provide better information on the potential long term benefits of worms.



Orange bars: Tanks with worms. Blue Bars: Tanks without worms. Dark shades: Tanks with Perch. Light shades :Tanks with Tilapia