

Effects of Different Fertilizers on Algal Development

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Abstract

This experiment is designed to observe the effects of different concentrations of fertilizers on algae samples. Each fertilizer used is either balanced in nitrogen, phosphorous, and potassium, or contains a majority in one of those categories. Four grams of algae and 4 L of water is added to each of the 15 containers and 10 mL of fertilizer stock solution is added to each container. At the end of a twelve day period the algae was removed, filtered, and weighed. The results showed that the phosphorous rich fertilizer caused the most growth, while the nitrogen and potassium based fertilizers did not provide sufficient nutrients to keep the algae living. In conclusion this demonstrates that phosphorous in fertilizer causes the most algal growth. This superfluous growth can use up nutrients in the pond and end up being detrimental to the ecosystem.

Introduction

Algae are a large group of organisms which flourish in fresh water places such as the wetlands. During the day, the algae produce an excess of oxygen for other organisms. High levels of agricultural runoff can cause large quantities of nitrogen, phosphorous, and potassium to enter aquatic systems (Fried *et al.*, 2003). When added to a water body such as the Lake Waco Wetlands, these nutrients can cause large fluctuations in environmental conditions. This experiment measured the effects of four different combinations of nitrogen, phosphorous, and potassium concentrations on algal growth. It was hypothesized that if fertilizers rich in nitrogen, potassium, and phosphorus were added to algal samples, then phosphorous rich fertilizers will cause the most algal growth.

Materials and Methods

- Initially 15 containers were set up with 5 mL of 7-7-7 fertilizer and 4 L of water in each
- Four stock solutions were created by dissolving 40 grams of each specific fertilizer: nitrogen based (21-0-0); phosphorous based (4-12-0); potassium based (0-0-60); or 7-7-7 concentration in 200 mL of water per stock solution
- Five different concentrations of N-P-K were set up with 3 trials each (Figure 1)
- On day 5, 10 mL of each stock solution and 4 grams of algae were added to the corresponding containers
- The algae was monitored throughout a twelve day period (Figure 1, Figure 2, and Figure 3)
- At the end of the twelve days the algae was filtered and weighed



Figure 1. Algae 4/5/11

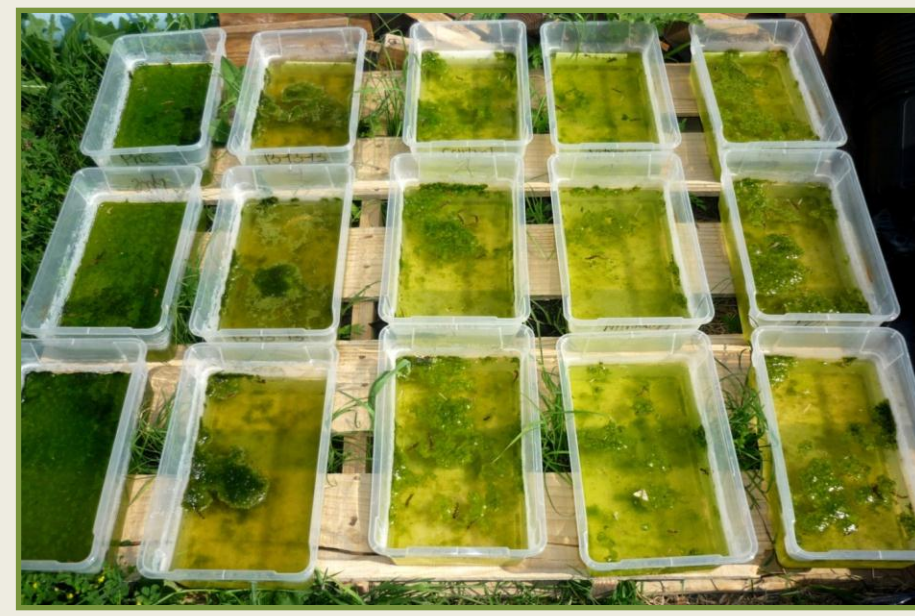


Figure 2. Algae 4/8/11

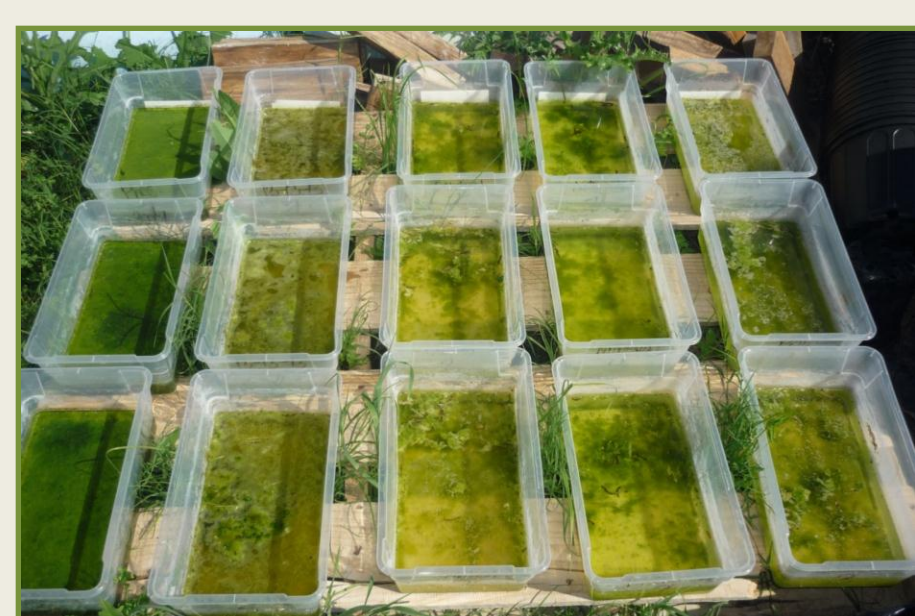


Figure 3. Algae 4/12/11

Results

The experiment revealed phosphorous rich fertilizer to have the greatest algal growth with an average weight of 14.3 grams. Behind it was the control with 11 grams and the 7-7-7 concentration with 10 grams. Nitrogen rich and potassium rich fertilizer had the lowest average weights of 1.67 and 0.33 grams (Figure 4). All of the algae were in string-like dense mats except for the phosphorous container which had algae with a foam consistency with a darker green coloration. Differences in pigmentation can be seen in Figures 1, 2, and 3.

Growth of Algae Per Trial

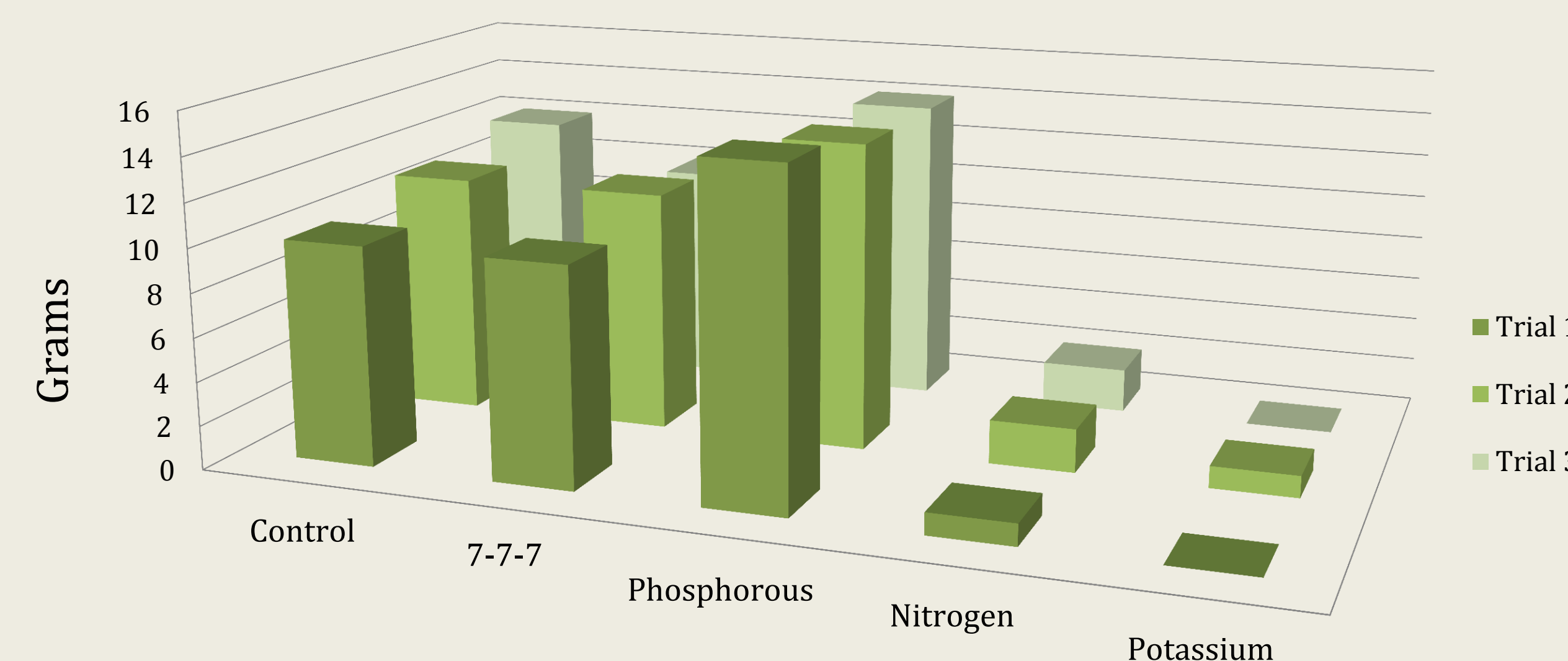


Figure 3.

Average Growth of Algae

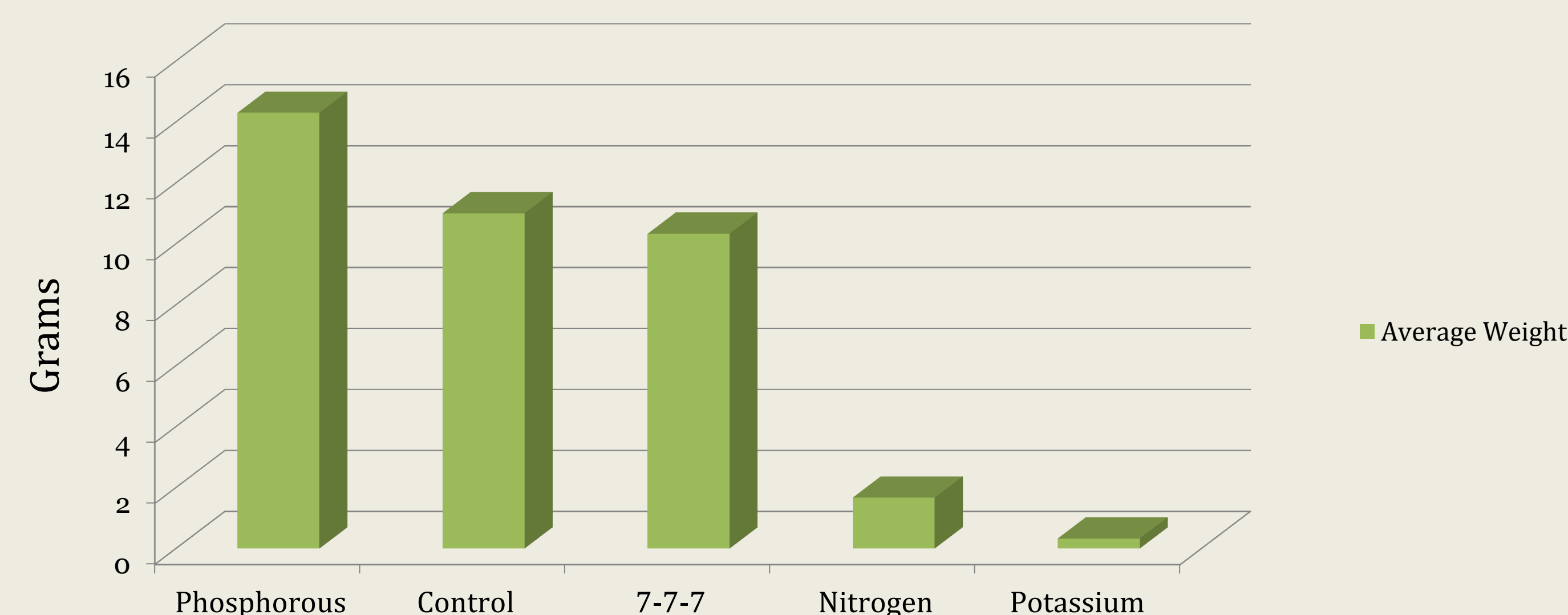


Figure 4.

Conclusion and Discussion

As hypothesized, the phosphorous rich fertilizer significantly grew the most algae. This result is supported by the Schindler (1977) and Fried(2003) study findings. However, their results showed both phosphate and nitrate levels had the most algal growth. In this study, the nitrogen rich fertilizer had very little algal growth. Although the Fried (2003) study contradicted this current study, their algae samples had a constant exposure to light allowing for more photosynthesis and growth while this experiment experienced only about twelve hours of daylight. The potassium rich fertilizer was found to have the smallest amount of algal growth.

According to Brunson (2004) algae is essential to marine life, for it produces dissolved oxygen via photosynthesis and takes up nitrogenous waste products from the water. Run-off from nearby farmers using nitrogen rich and potassium rich fertilizers leads to little algal growth and organisms cannot get the oxygen they need. Farmers using phosphorous rich fertilizer are also detrimental to wetland marine life because their run-off causes the overgrowth of algae blooms. As the blooms become denser, there is an increase in competition for nutrients. Eventually the algae uses up all the nutrients and dies. The dense algae blooms shading can also result in the accumulation of toxic wastes in bottom of wetlands, killing organism populations and creating physiological stress.

This experiment shows that farmers near wetlands should use a fertilizer with equal amounts of nitrogen, phosphorous, and potassium in order to keep algae at a constant controlled level of growth. The run-off from the 7-7-7 fertilizer would keep the algae at a healthy amount for marine life.

Literature Cited

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Fried, Steffii, Brendan Mackie, and Erin Nothwehr (2003) Nitrate and phosphate levels positively affect the growth of algae species found in Perry Pond. Tillers 4: 21-24

Schindler, D.W (1977) Evolution of Phosphorus Limitation in Lakes, Science 195: 260-262.

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