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Bisc 131

Fertilizer and its effects on *Ankistrodesmus*

Our hypothesis was that our pollutant, fertilizer, would increase the growth of the *Ankistrodesmus* algae. *Ankistrodesmus* produce food through photosynthesis, which means that they require light and basic inorganic nutrients (Colgan III et al, p. 5-26). Many farms use fertilizer to stimulate the growth of crops, and a portion of that fertilizer becomes runoff that eventually gets into bodies of water. This chemical runoff can pollute the water and cause some organisms to die, and some to reproduce even faster. *Ankistrodesmus* algae are one of the organisms that reproduce even faster when exposed to fertilizer, growing exponentially and stealing all the nutrients that the other organisms need to survive. High concentrations of chemicals such as nitrogen and phosphorus from fertilizer cause algal blooms. These blooms affect water clarity, absorb all the oxygen, crowd out other organisms, and have the potential to create deadly neuro-toxins (Pollution). Although algal blooms are usually considered a bad thing, there have been attempts to harness this ability to help in waste-water treatment (Benemann). *Ankistrodesmus* is usually found in freshwater lakes and ponds and is strong against common forms of algal control (*Ankistrodesmus*). We did this experiment to test how different levels of fertilizer affect the growth of *Ankistrodesmus* algae.

In our experiment, we used the following: 12 tests tubes with caps, a test tube rack, 3 pipettes with pipetters, 2 tubes of starter (the *Ankistrodesmus* algae), 60mL of AlgaGro, 40mL of fertilizer, tape, a Sharpie, and a spectrophotometer. Note that for each of the treated algae tubes (4), we made two of each kind for replication, for a total of 8 tests. We replicated each tube to get redundancy, which increases the validity of the results. In each tube, the amount of starter will be the same, but the amount of fertilizer relative to the AlgaGro is what changes, so the fertilizer is the independent variable,

and growth would be the dependent variable. Once you have gathered the materials, you start out with making the control tubes. To make them, pipette in 5mL of starter and then 5mL of Alga-Gro with a separate pipette, then close the caps and put them back on the test tube rack. These are the control tubes because they have no fertilizer in them, so the amount of growth in these is the "standard" growth speed for *Ankistrodesmus*. To make the 10% fertilizer tubes, pipette in 5mL of starter, 1mL of fertilizer, and 4mL of AlgaGro, then close the caps and put them back on the test tube rack. To make the 30% fertilizer tubes, pipette in 5mL of starter, 3mL of fertilizer, and 2mL of AlgaGro, then close the caps and put them back on the test tube rack. To make the 50% fertilizer tubes, pipette in 5mL of starter, and 5mL of fertilizer, then close the caps and put them back on the test tube rack. After you have made the tubes, put labels with tape on the caps with "1a" and "1b" for the control tubes, "2a" and "2b" for the 10% tubes, etc. After that, make the blank tubes, these will be used to blank the spectrophotometer before taking readings, as the spectrophotometer will not work correctly otherwise. To make the first blank (which corresponds with 1a and 1b), pipette in 10mL of AlgaGro, close the caps and put them back on the test tube rack. To make the second blank (which corresponds with 2a and 2b), pipette in 9mL of Alga-Gro and 1mL of fertilizer, close the caps and put them back on the test tube rack. To make the third blank (which corresponds with 3a and 3b), pipette in 7mL AlgaGro and 3mL fertilizer, then close the caps and put them back on the test tube rack. To make the fourth and final blank (which corresponds with 4a and 4b), pipette in 5mL of AlgaGro and 5mL of fertilizer, then close the caps and put them back on the test tube rack. After you are done, label each of the blanks accordingly. After you are done with this, you go to the spectrophotometer to take initial readings. The first step in that is to put in the control blank and blank the spectrophotometer. After that, tighten the cap on 1a, vortex it, and then take out the blank and measure 1a and record. Repeat this for 1b – 4b, remembering to use the corresponding blanks. After this, you must put your tubes away. The treatment tubes go under the light to give the algae light for photosynthesis, and you must loosen the caps before you put them under. The blanks go

into a dark storage cabinet to kill any growth, and the caps must be tightened. Repeat measurements on Days 3, 7, 11, and 14. Calculate net growth by subtracting the reading on Day 0 from the reading on Day 14 (Day 14 – Day 0).

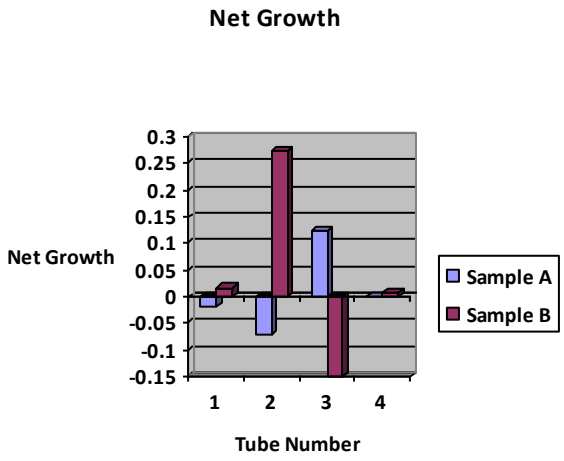
Algal Growth Data

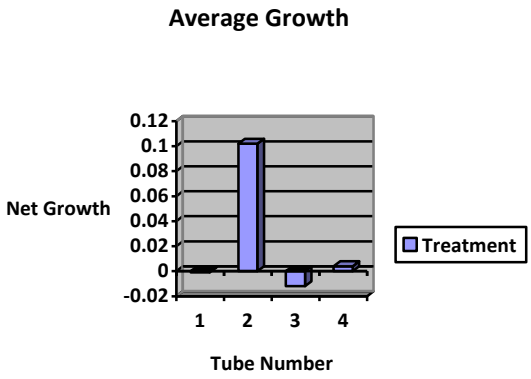
Tube Label	Day 0	Day 3	Day 7	Day 11	Day 14	Net Growth (Day 14-Day0)
1A	0.110	0.068	0.044	0.062	0.091	-0.019
1B	0.123	0.142	0.146	0.256	0.140	+0.017
2A	0.084	0.027	0.012	0.037	0.014	-0.070
2B	0.087	0.062	0.049	0.040	0.360	+0.273
3A	0.060	0.022	0.032	0.080	0.185	+0.125
3B	0.180	0.076	0.014	0.025	0.032	-0.148
4A	0.056	0.036	0.058	0.078	0.057	+0.001
4B	0.077	0.028	0.040	0.090	0.084	+0.007

Note: Units are in Optical Density

Average Growth

Treatment	Average Net Gain/Loss
1 (Control)	-0.001
2	+0.102
3	-0.012
4	+0.004





1A had a net loss of -0.019 and 1B had a net growth of 0.107, leading to a very slight average net loss of -0.001 for treatment group one, the control group. 2A had a net loss of -0.070 and 2B had a net growth of 0.273, leading to an average net growth of 0.102. 3A had a net gain of 0.125, and 3B had a net loss of 0.148, leading to an average net loss of 0.012. 4A had a slight net growth of 0.001, and 4B had a slight net growth of 0.007, leading to an average net growth of 0.004.

The results show that on average the first (control) group had a negligible loss, the second group had the biggest average net gain, the third group had the biggest net loss, and the fourth group had a very small net growth. This shows that adding 10% fertilizer resulted in the biggest growth, adding 30% fertilizer caused the biggest loss, and adding 50% fertilizer caused negligible growth. This basically refutes our hypothesis, which was that adding more fertilizer would increase the growth of *Ankistrodesmus.* Based on the results though, one could conclude that adding fertilizer up to a certain point causes growth, and then after that the fertilizer kills *Ankistrodesmus.* There were many things that could have gone wrong with our experiment. When we were preparing the specimens, we misread some of the measurements so we had to start again, and our test tubes may have been contaminated from this. There could have been contaminants in any number of places, such as the pipettes or the

beakers. Perhaps we even may have grabbed some of the wrong materials. On Day 7, we took out our specimens before the spectrophotometer was ready, so they sat out for at least 15 minutes. On Day 11 and Day 14, the spectrophotometer started giving us inconclusive results, and the measurement would never stop at a number or even a small number range, often bouncing back and forth between numbers 0.200-0.300 away from each other.

To make this experiment better in future attempts, the best thing probably would be to have newer spectrophotometers. Although we may have messed up various parts of the experiment as well, it seemed that a major source of error was the readings from the spectrophotometer. Also, having three or even four total tubes for each treatment group would improve results, as taking the average of 2 readings seems too inaccurate. Finally, though this is more of a preventative measure on the experimenter's part, ensure that the *Ankistrodesmus* is out of its light area only for the amount of time needed to take reading and no longer.

References Cited

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