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The Effect of Nitrogen, Phosphorous and Potassium on Plant Growth

Introduction

The growth, development, and reproduction of a plant depend on many factors including sunlight, water, and nutrients. The macronutrients, nitrogen (N), potassium (K), and phosphorus (P) are major components to fertilizer. In fact, nitrogen is found in amino acids; potassium makes up 1% to 2% of any plant's weight and is essential to metabolism; and phosphorus is found in cell membranes[1]. These are necessary to the health of any plant. The purpose of the experiment is to determine which combination of these nutrients will affect the growth of plants positively in regard to more quantities of leaves and flowers and higher length of stem. There will be 5 different quadrants, each exposed to different nutrient variations.

Hypothesis:

The quadrant that contains all three nutrients will flourish the most.

Macronutrient	Some Known Functions	Some Deficiency Symptoms
Nitrogen	Component of proteins, nucleic acids, coenzymes, chlorophylls	Stunted growth; light green older leaves; older leaves yellow and die (chlorosis)
Potassium	Activation of enzymes, role in maintaining water-solute balance and thus affecting osmosis	Reduced growth; curled, mottled, or spotted older leaves; burned leaf margins; weakened roots and stems
Phosphorus	Component of nucleic acids, phospholipids, ATP	Purplish veins in older leaves; fewer seeds and fruits; stunted growth

Methods

We started the plant process with the steps laid out in the packet. We filled each quad with soil, put a wick in each of the four sections, and put three seeds in each section of every quad. However, we did not include fertilizer pellets in any of the sections of any of the quads. Instead, we designated each quad to a different liquid fertilizer. One quad was designated for nitrogen, one for potassium, and one for phosphorus. The fourth quad was a combination of all three of the fertilizers. The fifth quad was our control quad which was fertilized with only water. Once we decided which quad would correspond with which fertilizer, we decided that each section of each quad was going to get three drops of the specific fertilizer. (We used a pipet for the fertilization.) For example, the nitrogen quad was fertilized with three drops of nitrogen per section. The same was done with potassium and phosphorus. The quad with all three fertilizers received one drop of each fertilizer to each section. So, one section of this quad had one drop of nitrogen, one drop of phosphorus, and one drop of potassium. Since the fifth quad was only fertilized with water, each section received three drops of water. Each quad received fertilizer once a week. In addition to the fertilizer they received, we also gave them water as needed. Not every plant needed water every week but we kept all of the quads moist as to maximize the growth potential. We continued to fertilize the plants while they continued to grow in size, develop leaves, and develop seed pods. Once they were done growing, the experiment ended.

Works Cited

"What is fertilizer and why do plants need it?" How Stuff Works. 28 Nov. 2006 <http://home.howstuffworks.com/question181.htm

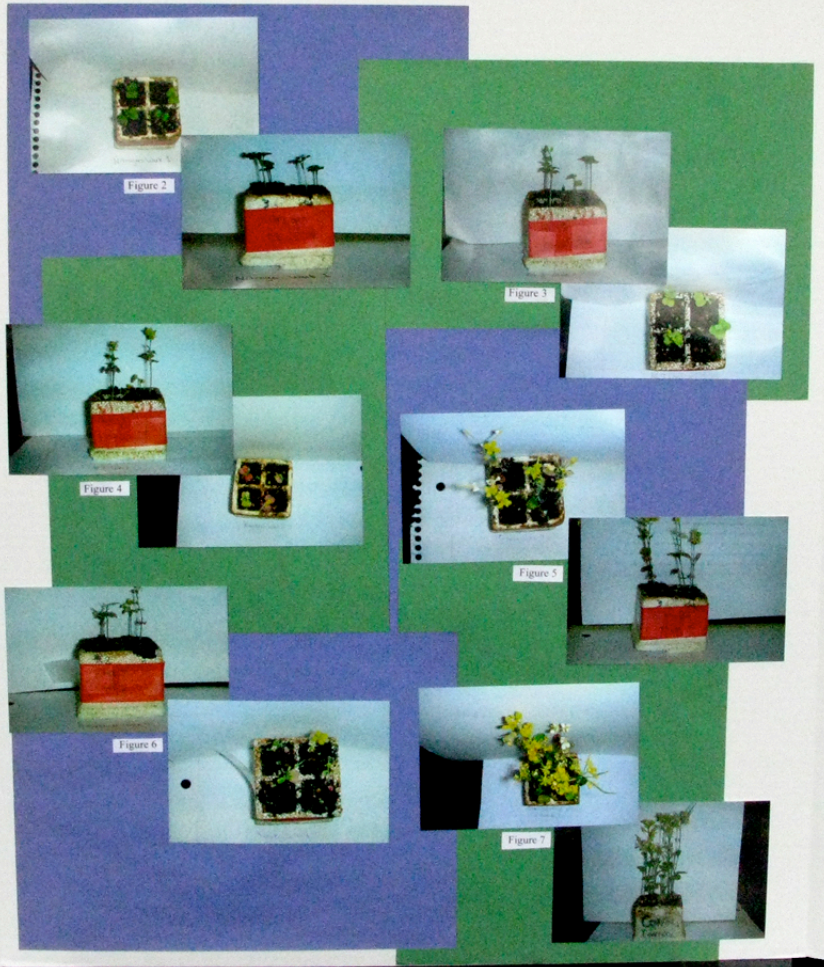

Figure 2

Figure 3

Figure 4

Figure 5

Figure 6

Figure 7

Results

As seen by the graph (Figure 1), initially the plants began to grow at the same rate and basically were identical. The nitrogen plant in Figure 2 is representative of the height and color of all the plants at then end of the first week. However, by the third week there began to be clear differences in size. The plants with nitrogen were growing at a faster rate than the other plants, as seen by the graph. The plants all had two leaves by the first week, all of the plants expect the one containing Potassium only would eventually have four leaves. By the end of the second week and into the beginning of the third week, the plants began to change colors from a healthy shade of green to varying colors of green, brown, yellow and purple as seen in Figure 3. Up until the last week of the experiment, the plants containing only Nitrogen continued to be the strongest, grow the tallest and have the best coloration. The plants containing Nitrogen can be seen in Figure 4 as they appeared in the last week of the experiment. For contrast, the plants exposed to Phosphorous only can be seen in Figure 5 as they appeared during the last week of the experiment. They are considerably smaller than the plants exposed to Nitrogen, and the leaf coloration is considerably different.

The growth of the plants was stunted, as they never achieved the height that they should have reached, as seen in Figure 6. The plant in Figure 6 received 3 fertilizer pellets in its soil when the seeds were planted. However, the plants did flower and develop seed pods, although there did not appear to be any seeds in the pods. The plants began to flower in the third week with the plants containing Nitrogen in the soil flowering first. By the end of the third week, all the plants were flowering, but the flowers in the control quad and in the quad with Nitrogen, Potassium and Phosphorous in the soil looked dry and the flowers were smaller than normal. In the end, the plants in soil containing Nitrogen only, Phosphorus only, Potassium only, and the Control had two seed pods. The plants in the soil containing a combination of Nitrogen, Phosphorous and Potassium had only one seed pod.

Figure 1

Conclusion

All plants we observed suffered visible damage as a result of the experiment. Contrary to our hypothesis, the quadrant that contained all three nutrients did not flourish; rather the quadrant that contained nitrogen (N) grew the most. It grew the tallest throughout and had the most flowers out of all the plants. Near the end of our experiment, all plants had stopped growing, and only sprouted more flowers. While the nitrogen (N) plant was the tallest, it also suffered the most from discoloration as it turned dark purple. The plants without phosphorus (P), as expected, turned a purplish color, while the quadrants with it were green. The quadrant that contained only potassium (K) had stunted growth from early on and did not progress as the others. This was surprising because we knew that a lack of potassium would result in reduced growth, but evidently the presence of it alone is not enough to retain normal growth. The results from the experiment tell us that liquid fertilizer is less effective than pellet fertilizer, even when the same fertilizers are used.