



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

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Project Title Symbiosis: Always There to Help	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The objective of our project was to determine how usable forms of nitrogen and symbiosis inhibit or encourage plant growth. We believed that plants with usable nitrogen would grow better and also that plants with nitrogen-fixing bacteria would have an edge over plants with none. We thought that plants with neither would have a disadvantage against other plants.</p> <p>Methods/Materials For our experiment, we used alfalfa. We used it because it is a quick-growing plant. The first thing that we did was creating four groups of plants. Group 1 was made of alfalfa seeds in soil, with no extra nitrogen. Group 2 consisted of alfalfa seeds plated in soil, but unlike group 1, it was given extra nitrogen. Group 3 consisted of alfalfa planted in sand with extra nitrogen added, and finally, group 4 was made of alfalfa planted in sand with no extra nitrogen.</p> <p>Results We found that group 1, our control group, seemed to have grown without anything hindering its growth. We do not state its height here because it is our control and it is the group we compare others to. Group 2 seemed to be about the same as group 1. Group 3 seemed to grow like groups 1 and 2. Group 4 was the only one with different growth. It grew little. We found that our results contradicted our hypothesis a lot.</p> <p>Conclusions/Discussion Based on our data, we concluded that nitrogen encourages plant growth. Also symbiosis between nitrogen-fixing bacteria and plants is only efficient when there is competition for nitrogen. Our experiment brought up many questions. We asked ourselves if terrain affected the plants' ability to absorb nitrogen. Also we asked if terrain would affect root growth. The last question was could abnormal amounts of nitrogen encourage growth beyond nutrient availability. We hope that if this experiment is done again, then the experimenters keep these questions in mind. We always thought that photosynthesis is the only big process plants need for survival, but now we understand that the symbiosis with the nitrogen-fixing bacteria is also very important to most plants' survival.</p>	
Summary Statement Our project is about the effects of nitrogen and symbiotic nitrogen-fixing bacteria on plant growth.	
Help Received	