



**CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY**

Name(s) Shivali Gowda; Preeanka Mazumder	Project Number S1998
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Project Title
Difficulties of Farming in Alkaline Soils: Absorption of Iron in Spinach Grown in the Presence of Marble

Abstract

Objectives/Goals
The experiment was conducted to determine the difference in the iron intake of spinach in the presence of marble (alkaline soil) versus regular soil. If the marble increases alkalinity in soil and causes the precipitation of iron, then there will be an indirect relationship between the amount of marble in the soil and the amount of iron absorbed by the spinach plants.

Methods/Materials
There were ten experiment groups. Each had ten cups. For groups 1-5, only iron was added to the soil in increments of 0.5 grams starting from 0 going to 2. In groups 6-10, 20 grams of calcium carbonate was added to each group, and again the iron was added in the same increments. Two months later, before extracting the iron from the plants, standards were created. The purpose of these standards was to compare the iron absorptions of the spinach samples to the linear graph of the standards to find the concentration of iron in the spinach samples. To extract the iron, each of the ten samples was massed and burned to create ash. Then this ash and 10 ml of HCL were put in a beaker on a magnetic stirrer for ten minutes to break open the cell walls and extract the iron. This was repeated with each of the ten samples. Then the excess ash was filtered out and 5 ml of potassium thiocyanate was added to each sample to show the color of the iron so the spectrophotometer could accurately read the absorption. With this absorption, the concentration was found and mathematical analysis was performed to find the mg of iron in the spinach plant.

Results
The cups that contained 20 grams of CaCO₃ absorbed less than the cups that did not contain CaCO₃ 3 out of 5 of the times. There was also a general trend of as the amount of iron in the soil went up, so did the amount of iron absorbed into the spinach plant.

Conclusions/Discussion
The results had a tendency to prove the hypothesis. If there was a larger sample size, this trend would be more obvious. Alkaline soils cannot produce plants with a high concentration of iron because the iron is precipitated in the soil as iron hydroxide. The marble decreased the absorption of iron in the soil due to the fact that it causes precipitation of iron, making it difficult for the iron to be absorbed into the plant.

Summary Statement
This project analyzed the impact of calcium carbonate on the ability of spinach to absorb iron from soil.

Help Received
Mrs. Hampton (teacher) helped provide lab equipment; Father helped put together board.