CALIFORNIA STATE SCIENCE FAIR
2006 PROJECT SUMMARY

Name(s)
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Project Number
S1607

Project Title
Difficulties of Farming in Karst Topography: Adsorption of Iron in Collard Greens in Limestone

Abstract

Objectives/Goals
To analyze the absorption of iron in collard greens in the presence of limestone.

Methods/Materials
Collard greens were grown in silica sand with varying amounts of steel wool. Half of each cultivar contained 5 grams of calcium carbonate after 8 weeks 5 grams of plant material was harvested, ashed in HCl, filtered and bonded to potassium thiocyanate. Solutions were placed into a scectrophotometer. The absorptions were compared to a known set of standards. From a standard graph the grams of iron per gram of plant were calculated.

Results
The control absorbed the least iron from the steel wool followed by the 0.5 g steel wool cultivar. There was a large jump from the 0.5 g steel wool to the 1.0g and the 1.0g to the 1.5g. The greatest amount of iron was found in the 1.5 g cultivar containing 0.0000100 grams of steel wool per gram of collard green. The 2.0g cultivar contained slightly less iron than the 1.5 g. It was found that 1.5 grams of steel wool produces the most iron in the plants.

The cups that contained the limestone chips yielded less iron in the plants even though they contained the same amount of steel wool as the cultivar they were in. There was no difference in the amount of iron absorbed in the control plants with and without limestone. The greatest variation was found in the 1.0 g plants. There was 7.5 x 10-6 of iron per gram of plant. There was a significant decrease in the amount of iron with calcium carbonate: 5.1 x 10-6 grams Fe/ 1.0 g plant. There was no difference in the 2.0 g cultivar when grown with limestone.

Conclusions/Discussion
There very little iron recorded in the control. The cups containing 0.5 grams of steel wool had significantly more iron absorbed than the control simply due to more iron in the sand. The data proves the hypothesis correct that growing plants in soil with limestone greatly decreases the amount of iron absorbed by the plants. This is shown through the 0.5, 1.0, and 1.5 gram cultivars. Limestone produces carbonate in the soil which hydrolyzes water to produce hydroxide.

$$CaCO3(s) \;\#\#\; Ca+2 + CO32-$$

$$CO32-(aq) + 2\ H2O(l) \;\#\#\; H2CO3(aq) + 2\ OH-(aq)$$

The hydroxide then bonds to the iron making an insoluble solid that cannot be absorbed by the plants. The bar graph shows this in that the plants grown in limestone chips produced less iron.

$$Fe+3\ (aq) + 3\ OH-\ (aq) \;\#\#\; Fe(OH)3\ (s)$$

Summary Statement
To find the affect of limestone on the absorption of iron in collard greens.

Help Received
Mother helped with project.