

# **An Investigation To Show What Different Factors Affect The Growth & Germination Of Cress Seeds**

## Introduction

*There are many different factors that could affect the germination of a plant. Here is a list of a few:*

### CO<sub>2</sub> concentration:

*This will affect both germinating seedlings and growing plants. Different concentrations of CO<sub>2</sub> can cause plants to grow at different rates. Plants need CO<sub>2</sub> in the air in to respire in the same way, as we need oxygen. Without it they would not be able to create energy so they couldn't grow. The problem with trying to monitor the affects that different amounts of CO<sub>2</sub> would have on the cress seed is that it is hard to control the level of CO<sub>2</sub>. In school we do not have the equipment.*

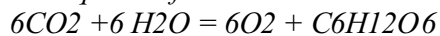
### Amount of water in the soil (assuming that it is grown in soil):

*This will affect both germinating seedlings & growing plants. Plants need water for the transportation of different molecules such as glucose. It is essential for growth. They do this by osmosis. With out water they would dry out & die. Water also makes germination easier because it softens the shell.*

### Amount of light (Intensity, wavelength):

*Only growing plants need light in order to grow. Seeds don't need light because they are usually under ground when they germinate. Plants need light because this is how they get food. The sunlight gets trapped in the plants leaves by chloroplast cells and turned into energy. The reaction by which this takes place is called photosynthesis.*

*The equation for this reaction is*



*Sunlight is not only vital for the plants growth but also vital for us because without light all plants would die meaning no oxygen in the air. Different wavelengths reflect off the leaves, only certain wavelengths get absorbed.*

### Competition:

*Competition can affect germinating seedlings and growing plants. Competition is caused by a dense population of animals or plants in the same area competing for the same resources. The more competition there is then the less the plants will grow. This is because the minerals, nutrients and sunlight (in plants case) have to be 'spread out more thinly' or shared out amongst a higher number of plants. In some cases plants will die due to a lack of nutrition.*

### PH:

*Can also affect both germinating seedlings and growing plants. Cress needs a neutral PH level to grow at their best. Some plants like camellia can grow in acidic soil because they have adapted to the soil over many years. Some plants like herbs benefit from alkaline soil. Different plants grow best in different soils.*

### Minerals/nutrients:

*Minerals and nutrients are essential because they are needed as energy. They are absorbed with water through the roots by osmosis. They are then transported by the xylem up around the plant. Different nutrients are needed for different uses e.g. Iron for strengthening the stem.*

*The factor that I wish to investigate is how different minerals affect the germination and growth of plants.*

### The aim

*The aim of my experiment is to see how 3 different solutions lacking 3 different minerals affect the growth and the germination of a plant. The different solutions I am going to use are:*

*Lacking Nitrogen*

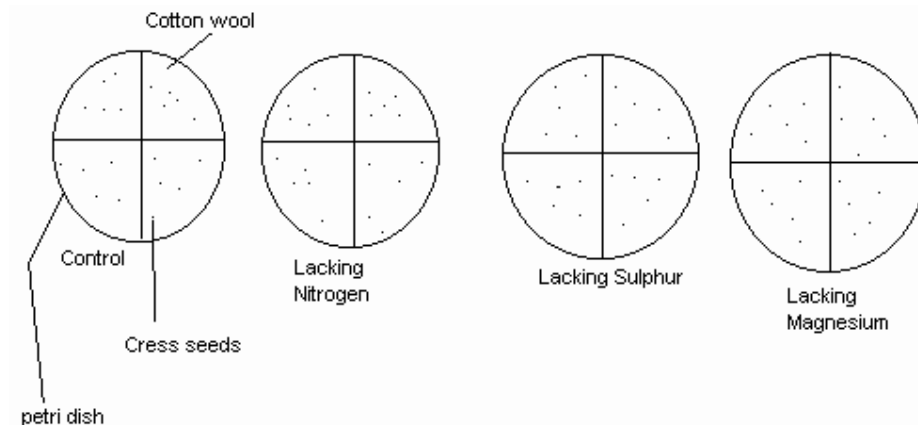
*Lacking Sulphur*

*Lacking Magnesium*

*I am also going to have a control test, which has all the nutrients a plant would have in normal soil. This is so I can compare the experiments to it allowing me to see what changes the absence of the minerals has.*

### The Method

*To do this I am going to have 4 different petri dishes, 1 for each solution. In each dish there will be 4 different sections each containing 5 seedlings. The reason I am doing this is to make it a fair test. By having 4 different sections I am essentially repeating the experiment 4 times. Every day I will water the cress seeds using their own solutions. To create the appropriate solutions I did a pre-test using a replicate of my actual experiment and to I watered the 20 cress seeds over a week. I used a normal Sachs solution to water them. From the experiment I found that 1.5 ml cubed for each section was too little because although the seedlings germinated the plants did not grow very quickly. I decided to use 2ml cubed for each section. The solutions I made were 1/3 Sachs and 2/3's water.*



*This is a diagram of my experiment. It shows the 4 different petri dishes.*

*In order to be able to monitor the cress I will draw up a table. For each day that I water the cress I will observe:*

*How many seeds have germinated,  
The height of the seedlings,  
No. Of leaves on seedling,  
And any other observations.  
All this will do is make it easier to analyse my results.*

### Prediction

*I predict that nitrogen is going to have the most devastating effect on the germination and growth of a plant. The reason I think this is because it converts sugars made by photosynthesis into protein. Protein is needed for growth. I think that they will be short and have yellowing leaves due to facts from my research.*

### Research

<u>Mineral</u>	<u>Used in</u>	<u>Deficiency</u>
Magnesium	Chloroplast	Yellow leaves
Nitrogen	Chlorophyll cells and Amino acids	Reduction in growth and yellow leaves
Sulphur	Amino acids and proteins	Reduction in growth and yellowing leaves

### Fair test

*To get my results I watered my plants over a period of 2 weeks. An important aspect of my test was getting reliable results. This will help me to me evaluate my experiment fairly. To make my test as fair as possible I made sure all of my petri dishes were in the same conditions as each other. This meant that any effects could only be caused by the factor that I am experimenting with. We watered them all as regularly as each other, placed tem all in the same spot, made sure that they were all in the same temperature, light etc. I must also take into consideration the fact that anomalies could occur in my results or some of the effects could be caused by natural causes. For example the heaters in school could stop running, some seeds may be infertile or there could be an abnormally cold or hot day.*

## Obtaining evidence

Day	Solution	No. Of germinated seedlings	Height of seedlings (cm)	No. of leaves on seedlings	Other observations
Thursday	Normal	0	0	0	No germination/growth
	Nitrogen	0	0	0	No germination/growth
	Sulphur	0	0	0	No germination/growth
	Magnesium	0	0	0	No germination/growth
Friday	Normal	0	0	0	No germination/growth
	Nitrogen	0	0	0	No germination/growth
	Sulphur	0	0	0	No germination/growth
	Magnesium	0	0	0	No germination/growth
Monday	Normal	13	1.5	4	Growing best, green leaves
	Nitrogen	16	1	4	Most have germinated but are short and have yellow leaves
	Sulphur	8	0.5	4	Few have germinated, short, yellow leaves
	Magnesium	11	1	4	Second best growth, green leaves
Tuesday	Normal	13	2	4	No change since Monday
	Nitrogen	18	2	4	No change since Monday
	Sulphur	10	2	4	No change since Monday
	Magnesium	14	2	4	No change since Monday
Wednesday	Normal	14	3	4	Green leaves
	Nitrogen	18	2.5	4	Light green leaves
	Sulphur	10	2.5	4	Light green leaves
	Magnesium	14	2.5	4	Green leaves
Thursday	Normal	14	4	6	Green leaves
	Nitrogen	18	3.5	6	Light green leaves
	Sulphur	10	3.5	6	Light green leaves
	Magnesium	14	3.5	6	Green leaves
Friday	Normal	15	4	6	Green leaves
	Nitrogen	18	3.5	6	Yellow stems, green leaves
	Sulphur	12	3.5	6	Yellow stems, green leaves
	Magnesium	16	4	6	Yellow stems, green leaves
Monday	Normal	15	4	6	Green leaves
	Nitrogen	18	4	6	Green leaves
	Sulphur	12	3.5	6	Green leaves
	Magnesium	16	4	6	Green leaves, slightly darker than the other ones
Tuesday	Normal	17	4	6	Green leaves
	Nitrogen	18	4	6	Green leaves
	Sulphur	13	3.5	6	Green leaves
	Magnesium	16	4	6	Green leaves, slightly darker than the other ones
Wednesday	Normal	17	4	6	Green leaves
	Nitrogen	18	4	6	Green leaves
	Sulphur	15	3.5	6	Green leaves
	Magnesium	20	4	6	Green leaves, slightly darker than the other ones

### **Conclusion/evaluation**

*Overall I think that the lack of nitrogen in the solution has not caused much difference to the growth and germination to the seedlings. I expected them not to grow as tall as the any of the others, to have yellow leaves and only a few of them to have germinated. The first thing that I noticed about my results was that they contradicted my prediction. The seedlings lacking Nitrogen were the fastest to germinate (this includes the control). I found this strange because Nitrogen is the most vital nutrient of the three we experimented with. Judging by the results I have collected it seems that plants do not need Nitrogen to germinate but it is needed for growth because the seedlings in the Nitrogen solution are described as yellow leaved and short. I can see this because the seeds that lack nitrogen germinate more quickly than the seeds in the control test. I also noticed that the seedlings in the solution that lacked magnesium ended up with the darkest leaves.*

*My research shows that a sign of a plant with a magnesium deficiency has yellow leaves. The cress seeds in my experiment that are in a solution that lacks magnesium have the darkest leaves. This could be caused because the plants found that the Sulphur in the solution counter acted the effects of the lack of magnesium. Also it seems that the solutions did not effect the growth of the plants, they all seemed to grow to the same height at the same rate. This is proven by the control test also growing to this height. Sulphur had the greatest effect on the plants overall. By the 4<sup>th</sup> day into the experiment, the solution lacking sulphur was the only solution in which few seeds had germinated and had yellow leaves and short seedlings. I think that it is because sulphur is used in both germination and growth. It is used in proteins and Amino acids (the building blocks of protein). These are both vital nutrients as they are used as energy in the plant.*

*Overall I think that if I had carried out my experiment for longer, the effects would have been greater. I could have also chosen more diverse nutrient/minerals. This would have caused fewer problems with 'which mineral caused which effect' and I would have seen greater effects. I did find out that magnesium causes a decrease in energy due to fewer chloroplast cells. Sulphur causes short term and long term effects in growth and causes yellowing of leaves and Nitrogen does not cause short term effects but I predict will slow growth and cause yellowing of leaves in the long run.*