Investigation Planning and Result Sheets

Student name: Shane Sanders

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| * **Investigation** **Purpose** (your aim, testable question, prediction or hypothesis)

The aim of this test was to see which fertilizer assists a growing mustard plant best out of no fertilizer, General Garden fertilizer and Calcium Nitrate. Which fertilizer is best for a mustard plant growing from seed? Which fertilizer is best for a germinating plant? I hypothesise that that General Garden fertilizer will grow best because it is the only one to add phosphorus to the soil which assists the growth of plant roots so the plant will be able to get roots down faster and absorb nutrients better. |
| **Collect and Record Data****Independent Variable*** Fair Test

Which variable will be changed? (E.g. the independent variable?)The variable of this experiment that will be changed is the fertilizers used for the plants. I will have Group A with no fertilizer to be used as a control test so that I can see what happens to germinating and growing mustard plants with no assistance in the form of fertilizer. Group B with General Garden Fertilizer which should grow the best as it has the three main essential elements that plants require to grow without being in too high of a concentrate. Group C with Calcium Nitrate which has a high concentration of nitrogen/nitrates which assists in the production of leaves and chlorophyll the pigment used by plants to photosynthesise which is one of the main sources of energy for a plant. How will the independent variable be changed?In each group I put a quarter of a teaspoon of the different fertilizers in their respective groups to see the effect that it had on germinating and growing mustard seeds with one group having no fertilizer to be used as a control group so that I can have something that I can compare the other two groups to once I collect the results and make a conclusion based on the comparison between the three different groups results to see what is the best fertilizer to use for growing mustard seeds.Give a suitable range of values for this variableMy range was be 3 punnet groups of 6 cells, each containing 3 seeds (18 total per group). Group A having no fertilizer. Group B having General Garden fertilizer (5-5-5). Group C having Calcium nitrate (15.5-0-0). This is so that I will have a controlled group and two groups with different fertilizers that should give me 3 different sets of results so that I can compare them and then conclude which fertilizer is best for the growing mustard plants. The difference between the groups is the minerals/elements in the form of fertilizer that will be added to the soil of each group to see what effect they each have on the germination and growing of a mustard seed.(N-P-K) |
| **Dependent variable*** Fair Test

Which variable will have to be measured or observed in order to get some data or information from the investigation? (the dependent variable) I will measure the average height of the plants in Millimetres from each group once a week throughout the whole experiment and I will also measure the weight of each group collectively including the root system including the root system at the end of the experiment.How will the dependent variable be measured or observed? The dependent variables that I measured were the height in millimetres of each plant over the whole experiment which was averaged out for each week and the collective mass of all the plants in each group at the end of the experiment. I will also make visual observations about how that plants are growing.How many samples will you need to take to get reliable data?I took samples of 18 plants in total for each group so that is any plants died I would still have a good range of plants to collect data from. |
| **Other variables that need to be controlled to make your results more accurate** |
| **Variable** | **How will this variable be controlled or measured?** |
| Water amount | I will control this variable by putting 20ml of water into a measuring cylinder and then pouring it into one of the cells. |
| Sunlight/light | They will all be growing in the potting shed side by side so that they get exactly the same conditions. |
| Temperature | Because they will be placed side by side they will have the same air temperature which will mean they have the same soil temperature. |
| Seed Depth | I will measure down 1cm when I put the seeds in to that they are all at the same height and it is even across all groups. |
| Plant type | I will plant all mustard seeds so that I don’t have different types of plants that may germinate and grow faster than others. |
| Diseases | I will plant all seeds from the same packet so that they will all be from the same place and won’t have any diseases that will impair the growth of the plants. |
| **How will you make sure that your results are reliable?**To keep my results of this investigation reliable I will make sure that the only variable that is changed is the independent variable and be sure that I keep all of the controlled variables the same to that I don’t give one group a growth benefit or disadvantage which would alter the data that I collect throughout and at the end of this investigation. I will also measure the data (plant height and weight) as accurately as possible so that I don’t get incorrect results that could affect the results and conclusions of this investigation. |
| **Notes from your trials**Week 1:Group A is starting to grow quite well being around 3cm high.Group B is growing a slower and is around 1cm high.Group C isn’t growing.Week 2:Group A is growing well and is around 6cm high, some of the taller plants can’t stand up straight.Group B isn’t growing very fast still being only around 2cm high and are looking yellowish brown.Group C still isn’t growing.Week 3:Group A is growing well and is about 8cm high but looked dry and needed more water to sustain the growth of these bigger plants. Some plants have died.Group B is still only about 2.5cm high and are looking very unhealthy. Group C is only just starting to show signs of growth but the growth hasn’t left ground level yet.(heights are averages to the closest 0.5cm) |

Method

Use the information on your planning sheets to write a detailed step-by-step method.

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| **Step 1**Get some seeds from a reliable supplier so that you can ensure that the seeds don’t contain weeds, unwanted rubble, other types of seeds or any diseases or infections that will affect the growth of the plant or those around it. |
| **Step 2**Get 3 punnets each with 6 cells and fill with potting mix up to 1cm from the top of each cell, that is worked up to a fine tilth because this will ensure that the plant can easily get its roots down, use a potting mix because this is usually the best to use for young plants as it contains lots of organic matter, it is well drained and if you have a reliable supplier it won’t have any other seeds or plants that you don’t want so that the plant has no competition with foreign plants for the nutrients in the soil.  |
| **Step 3**Measure a hole down (the diameter isn’t that important but preferably around 0.5cm) 1cm, this distance will ensure that the plant can securely anchor its roots into the ground while still being close enough to the surface to emerge and grow, in each cell and drop three seeds in as this will give you enough seeds in each group so that the results will show if they are consistent and there is also not to many plants competing for the nutrients in the soil which could have negative effects such as stunted or killed plants. |
| **Step 4**Add a quarter of a teaspoon of General Garden Fertilizer and Calcium Nitrate in each cell of groups B and C respectively and stir gently in with the top 0.5cm of potting mix but make sure that you don’t disturb the seeds as any movement in height could alter your results and make this an unfair test. Leave Group A with no fertilizer as this will be your control group which you will use to compare the results of the other groups to so that you can see how each fertilizer effected the plants. |
| **Step 5**Water each cell with 15ml of water Tuesday to Thursday as this will give the plants enough water to grow well without being so much that the plants get waterlogged and start to rot. On Mondays and Fridays water each cell with 30ml of water as the plants will need extra water for the weekend so that the plants don’t get dried out and possibly die. Continue this for every week of the experiment. |
| **Step 6**Once every week measure and record the height of the plant and make any other major observations about the plants. This is so that you can compare your results at the end of the experiment as best as possible so that you can conclusively tell which group did the best with the different fertilizers. Average the height for each group across every week. |
| **Step 7**After continuing to do steps 5 and 6 for 3 weeks measure and record the height a final time before carefully pulling each plant out of the ground making sure not to break the root system. Then run each plant under a tap so that all excess dirt is washed off before weighing the mass of each group collectively and recording it so that a comparison can be made between each group. Analyse data and show results. |
| Changes made to the method- |

Findings Report Sheet

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| Recorded dataGroup A heights week 1:39mm, 45mm, 28mm, 36mm, 40mm, 5mm, 19mm, 42mm, 56mm, 61mm, 22mm, 35mm, 67mm, 7mmGroup B heights week 1:3mm, 7mm, 6mm ,23mm, 11mmGroup C heights week 1:-Group A heights week 2:68mm, 87mm, 54mm, 63mm, 72mm, 13mm, 46mm, 77mm, 81mm, 92mm, 54mm, 60mm, 94mm, 25mmGroup B heights week 2:12mm, 15mm, 19mm, 31mm, 19mmGroup C heights week 2:-Group A heights week 3:112mm, 73mm, 56mm, 84mm, 55mm, 110mm, 114mm, 72mm, 96mm, 73mm, 20mmGroup B heights week 3:16mm, 21mm, 25mm, 39mm, 27mmGroup C heights week 3:0.01mm, 0.01mmEnd weight:Group A: 0.67Group B: 0.21Group C: 0.05 |
| Processed data  |
| Interpretation of dataFrom the data collected we can see that the higher the concentration of the nitrogen (in the form of Nitrates) in the soil, the less the plants grew as group A with no added Nitrogen grew the best and Group C with the most added Nitrogen grew by far the worst. This is partially due to the fact that when plants get too much nitrogen the plant tries to grow leaves that are too large for the plant to handle which stunts the growth of the rest of the plant which will ultimately cause a lack of water and the nutrients required for the plant to grow. Although Group A grew the fastest and was the heaviest, some of the plants grew so fast that they couldn’t support themselves and ended up tilting over which isn’t good for the plant to do because if the plant had been growing in the wild or somewhere that it would have competition then it may become smothered whereas if it had grown a little bit slower, then it would have taken more time to strengthen itself it would have produced a better plant in the long run. |
| ConclusionFrom my results we can see that Group A which had no fertilizer and the lowest concentration of Nitrogen grew the best as it didn’t have any of the negative effects of the nitrogen in the soil. This is also shown by the fact that the Calcium Nitrate which had the highest concentration of Nitrogen grew the least possibly because one of the effects of having too much Nitrogen in the soil is that the Nitrogen in the form of Nitrate salts were drawing the water away from the seeds making it think that it didn’t have the right conditions to germinate. Another reason why this group may have grown the least is that the plant may have not been receiving enough water for the plant to grow well. It could also have been because when nitrogen in the form of Nitrate salts are in the soil and the water gets sucked away from the roots of the plants it will cause the plant to be unable to get as much water into it as it needs which will then give the leaves and stem a dried ‘burned’ look. |
| Evaluation of the method and dataI cannot see any flaws in the method used except that the application rate of the fertilizer may have been too high causing many of the negative effects from adding too much nitrogen into the soil to be present and I may have had a far different result if I had decreased the amount of fertilizer used for groups B and C. Otherwise I think that this test went well and gave consistent results. |

<http://www.ehow.com/info_7933372_effect-nitrogen-lawn-seed-germination.html>.