Investigation Planning and Result Sheets

Student name: James Preston

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| * **Investigation** **Purpose** (your aim, testable question, prediction or hypothesis) How does tempurature affect the growth of lupin seeds over a period of 4 weeks
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| **Collect and Record Data****Independent Variable*** Fair Test

**Which variable will be changed? (e.g. the independent variable?)** The tempuratue of each group will be changed. This will be measured with a termometre in one of the cells of each group. **How will the independent variable be changed?** The tempurature of each group will be changed by putting each group in a enviroment with a different tempurature. One group will be placed on a heating pad which will have a constant tempurature, another group will be placed in the potting shed which will have a varying tempurature but should be warmer than outside, and the last group will be placed out side in a minurature glass which will have a varying tempurature that is should be colder than the potting shed group but will have a higher humidity. **Give a suitable range of values for this variable:** The heating pad was at a constant tempurature of 24º, the group that was in the potting shed had tempuratures ranging from 14º to 22º and the group outside had tempuratures ranging from 13º to 20º.  |
| **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)** The height and weight of each individual plant after it has been grown for 4 week.**How will the dependent variable be measured or observed?** The height of each plant will be measured with a ruler from the roots to the leaves, then the height of each group will be averaged and recorded. To measure the weight all the plants will be washed to remove any dirt or other things that will change the weight, the all plants in that group will be weighed together and recorded. **How many samples will you need to take to get reliable data?** Each group will have eight cells each with 2 seeds planted in them. Eight cells are the ideal amount to use because say we only had 6 cells and if 2 of the plants died then we would only have 4 plants to record data from which wouldn’t be enough to get fair results.  |
| **Other variables that need to be controlled to make your results more accurate** |
| **Variable** | **How will this variable be controlled or measured?** |
| Water | Each plant will get the same amount of water by measuring each dose out in a measuring cylinder. |
| Soil Type | To keep the test fair each seed will be planted in potting mix which will give the seeds ideal germinating conditions.  |
| Seed depth | To keep the seed depth even, on a stick with a end roughly the size of a lupin seed measure 5mm up the stick and make a mark. Then push this stick into the potting mix until the stick reaches the 5mm mark. |
| **How will you make sure that your results are reliable?** By planting two seeds in each cell so that hopefully at least one grows. Have eight cells in each groups so that we have enough data to record and interpert.  |
| **Notes from your trials**After the first week very few plants had germinated and the soil appeared very dry, so I upped the amount of water each plant was receiving from 10ml to 20ml. About half way through the experiment we discovered that many seeds were not growing and were covered in mold. After some research we discovered that this is because lupin seeds are highly suscetable to fungal infections and the seeds should have been washed in a bleach solution before planting to prevent this. Other people changed the seeds in their expiriment so that they could get reliable data but I decided that I had enough seeds germinated and growing to provide adequate data to reocrd and process.  |

Method

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

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| **Step 1** Plan ivestigation and gather equipment. Decide on a testable question in this case tempurature, decide on each variable and how they will be monitered and looked after to keep the test fair. Find the equipment that you will need i.e. punets or cells, measuring cylinders, termometres, heating pad. |
| **Step 2** Prepare for planting. Find 24 cells all of the same size. Fill one of the cells with potting mix then weigh this cell, fill each other cell until they weigh the same as the first cell. This should mean everything so far is even and fair. |
| **Step 3** Make a hole. On a stick with a end roughly the size of a lupin seed measure 5mm up the stick and make a mark. Then push this stick into the potting mix until the stick reaches the 5mm mark. |
| **Step 4** Plant. Drop 2 seeds into each of the 5mm deep holes and then cover with a thin layer of potting mix. The 2 seeds is to try and ensure that a plant will grow in each cell so we will have plenty of data to record to make sure the test is fair. |
| **Step 5** Water. Using a measuring cylinder measure out 10ml of water and give this amount of water to each plant. Make sure this is done evenly because some plants receiving more or less water can affect growth rates. |
| **Step 6** Placement. Arrange the cells into 3 groups of 8. Take one group of 8 and place this in the potting shed, place one group on a heating pad and place the thrid group in a minurature glass house outside. Give each group a name such as A, B and C.  |
| **Step 7** Observe and look after. Over the course of four weeks water daily making sure to evenly measure out the water dose. Take notes and record observations such as take the tempurature a set intervals like once a week. Observe how the plants are growing and adjust experiment acordingly such as giving the plants more or less water based on your observtions.  |
| **Step 8** Measure and record. Once the 4 week period is up carefully remove each plant from it’s cell making sure to keep the plants in there separate groups. Wash away all potting mix and anything else on the plants. With a ruler measure each plant from the roots to the end of the leaves, add up all the lenghts and devide by the amount of plants in that group to get the average height for that group. Do this with all three groups. Then with a set of scales weigh all the plants in each group to get the weight of each group. Do this with each group. Record all data found. |
| **Step 9** Present. Using graphs and charts present all the data found. Explaining what you have found and why. Right a conculsion going over everything you have discovered and answer your testable question.  |
| Changes made to the method After the first week very few seeds had germinated and the potting mix appeared to be dring out very quickly. Going on these obervations I decided to increase the amount of water given to each plant from 10ml to 20ml. Still measuring out each dose with a measuring cylinder. |

Findings Report Sheet

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| Recorded data

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| Temperature Degrees Celsius  |
| Group A | 16 | 14 | 22 | 17 | 18 | 15 | 20 |
| Group B | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Group C | 15 | 19 | 20 | 17 | 15 | 13 | 18 |

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|  | Weight in g |
| Group A | 2.71 |
| Group B | 3.57 |
| Group C | 4.2 |
|  | Ave Height in mm |
| Group A | 107.6 |
| Group B | 110.5 |
| Group C | 66.6 |
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| Processed data  |
| Interpretation of data The top graph shows the average height that the plants in each group grew to group A and B which had the higher tempuratures group considerably more than group C which were outside and had lower tempuratures. This is because lupins perfer warmer dryer conditions, groups A and B had conditions which closest resembled the conditions which lupins grow best in. Where as group C outside in a minurature glass house was colder and also had more moisture. The second graph shows the mass of all the plants in each group. In this graph group C appears to have grown the most by having the largest mass but in the above graph group C had the lowst average height. This may be because the plants in this group had germinated later due to the colder tempurature and were still bunched up preparing to sprout into full plants. Or maybe in colder tempuratures the plants need to be bigger and stronger to stand up to the colder climate. The third graph shows the soil tempurature of each group and how the tempuratures varyied over the four week period.  |
| Conclusion After four weeks of watching and observing the lupin seeds grow I can conclude that tempurature does afect the growth of a lupin seed. In warmer dryer conditions lupins germinate quicker than seeds planted in cold and wet conditions. From the data I have recorded I would say that the best tempurature is some where around 24º like I had on the heating pad. This group had the tallest average height of 110.5mm and the second largest weight of 3.57 and this despite lossing almost half of the planted seeds to fungal infections. When talking about feeding stock we talk in kgs of dry matter. And from this expiriment group C which was outside had the heaviest weight of 4.2g and the smallest height of 66.6mm so maybe colder conditions grow a stronger hardy to plant with more mass that takes a little bit longer to grow. So if this was a crop we had planted group C would do the best as it would get you more kgs of drymatter. Group A grew randomly with some plants growing very fast and tall and some taking a long time to come up and then not gaining much height. This may be because of the tempurature varying so much, some days it could be quite hot other days the tempurature could drop significantly. But the plants in this group that grew earliest on when it were hottest were the tallest plants, meaning that maybe warmer tempuratures grow taller lupins better.  |
| Evaluation of the method and dataGoing back through the method with the experiment finished and the results in mind, I think that I if I did this again or was advising some one else on what to do I would add another step. Research your seed. If I had of done some research on lupin seeds I would have found out that they were susceptable to fungal infections. If I had this knowledge before I planted I would have been able to prevent lossing many of my seeds and would have had much more data to collect to make sure the results were reliable. The data at the end of the project was relaible but it would have been better to have more data to have a bigger range of data to compare results with.  |