Investigation Planning and Result Sheets

Student name: Lochie Bain

|  |  |
| --- | --- |
| **Investigation Purpose**  **Aim:** My aim is to find out the optimum depth for planting ryegrass and clover, and this can be summed up with the following question: How does seed depth affect ryegrass and clover germination and growth?  **Hypothesis:** I believe the seed depth will cause large variations in the rates of germination and growth. I predict that the deeper seeds (20mm) will take longer to germinate or not germinate at all, but when grown may have larger root sytems resulting in better establishment. The standard seed depth (8mm) will grow the best, and the shallow seeds (0mm) will germinate the fastest but will take longer to establish and grow properly. | |
| **Collect and Record Data**  **Independent Variable**  Fair Test  Indipendant Variable:  The variable that will be changed will be the depth at which the seeds are planted. This should create a large varience in germination and growth rates.  How will the independent variable be changed?  The independent variable will be changed by planting the seeds at diffent depths. These will be shallow, meduim and very deep. To keep this fair I will tip the amount of dirt into another icecream container to measure it accuratly. Next I will sprinkle the seeds evenly over the remaining soil, and then put the soil I have taken out back into the original container. This will mean the seed depths will be measured down to the millimetre ensureing an accurate and fair test.  Give a suitable range of values for this variable:  Shallow: Top (0mm)  Meduim: 8mm  Deep: 20mm | |
| **Dependent variable**  Fair Test  Dependant Variable:  For this experiment I will measure firstly the rate of germination, and then the hight of the grass. After the experiment, I will also do a visual obsorvation of thickness and any other notable features of the grass, and then at the end of the experiment I will cut the grass and take the weight when first cut and then dry out to determine the dry matter of the grass.  How will the dependent variable be measured or observed?  I will measure the hight of the plants every second day. To do this I will use the sward stick method, pressing my hand onto the plants until I feel a springy resistance. I will then measure from that point. The germination was measured by counting the plants after first 10 days and the 13 days. The visual observation will take place at the conclusion of the experiment, and will include taking photos and notes about the thickness and other notable features of the grass. At the end of the experiment I will cut the grass right at the base of the plant, and then weigh both the cut weight and the weight after being dryed out in the microwave (drymatter).  How many samples will you need to take to get reliable data?  I hope to measure the grass every two days, but as long as it is measured accuratly it shouldn’t matter if I miss the odd day. | |
| **Other variables that need to be controlled to make your results more accurate** | |
| **Variable** | **How will this variable be controlled or measured?** |
| Water | I will control the amount of water given to each of the groups by measuring it with a container. As long as each group gets the same amount of water it will not matter how much or how often they get water, as it will be the same for all groups. |
| Soil Types | This variable will be controled by taking each icecream container of soil from exactly the same place, this will prevent any varience in the soil type. |
| Soil temperature | This variable will be controled by keeping the groups in the same place throughout the duration of this experiment. This will keep the soil at the same temperature due to being exposed to exactly the same ouside temperature. |
| Soil Compaction & Structure | This variable will be controled by a visual check to make sure all the agregates are the same size, and compaction will be kept the same by not pushing down on any of the groups and putting the soil in the same to make sure they have the same amount of airation. |
| Amount of Seeds | To ensure the amount of seed remains the same throughout my groups I will measure the seed to the nearest milligram. This will ensure none of the groups get more plants growing than the others. |
| Soil Drainage | This variable will be controled by drilling the same size holes in the same place on the bottom of the ice cream containers in all three groups. |
| Light | This variable will be controled by keeping the groups in the same place throughout the duration of this experiment. This will ensure they all receive the same amount of sunlight keeping the amount of potential photosynthisis the same. |
| Diseases | The variable will be controled by using seed from a repuitable brand and from the same packet. This should ensure less diseases in my grass and clover. |
| **How will you make sure that your results are reliable?**  To ensure the results of my investigation are reliable I will make sure the only variable that is changed is the independent variable (seed depth). This will ensure that none of the groups get a advantage or disadvantage that will effect the outcome and reliability of my experiment. I will also need to make sure all my measurements are accurate and kept to the same standards, which will also ensuring the results are kept reliable. | |
| **Notes from your trials**  Visual observations from my trial include the following:  0mm: Very weedy, not very thick  8mm: Very thick and luck, tallest sample, deep green colour  20mm: Not very thick, although quite tall | |

Method

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

|  |
| --- |
| **Materials**  3 Icecream containers  3 grams ryegrass and clover mix  1 Water container  1 Ruler |
| **Step 1**  Thouroghly clean out the icecream containers with hot soapy water. This will prevent any diseases that may remain on the containers afecting the outcome of the experiments. |
| **Step 2**  Drill the drainage holes in the bottom of the containers in a uniformed pattern across all three containers. This ensures the soil can drain water properly rusulting in better soil condtions for the grass to grow. |
| **Step 3**  Measure the same amount of soil from the same place. This will stop any variance that could potentially affact the results of the experiment. |
| **Step 4**  Divide the three grams of seeds into one gram portions. Try to get this as accurate as possible to ensure one group does not get any more seeds than the other. |
| **Step 5**  Sow the seeds at the three different depths (0mm, 8mm and 20mm). Do this by taking out the soil into another icecream container and measure the amount of soil in there. When you have the require amount, evenly spread the seeds across the remaining soil. Then put the soil you have taken out back into the containers. For the 0mm group, just spread the seeds directly on top of the soil. |
| **Step 6**  Water with the same amount each day. Keep in mind the seeds will need more water in order to germinate. Once germinated, you can gradually increase the period of time in between waterings. |
| **Step 7**  Measure the time the seeds take to appear (germination time) and also the amount of individual plants present. Then measure the growth at regular intervals (2 days). |
| **Step 8**  At the end of the experiment cut the plants as close to the base as possible and measure both the cut weights and dry matter. The dry matter can be found by drying the plants in the microwave until the weight stops decreasing. This shows the nutritional value of the grass. |
| Changes made to the method  None |

Findings Report Sheet

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Recorded data   |  | | --- | | **Hight of Grass** |  |  |  |  |  | | --- | --- | --- | --- | | **Day** | **0mm** | **8mm** | **20mm** | | **10** | **1cm** | **2cm** | **1.5cm** | | **13** | **2cm** | **3cm** | **2cm** | | **15** | **3cm** | **5cm** | **4cm** | | **17** | **4cm** | **5.5cm** | **5cm** | | **19** | **2.5cm** | **3cm** | **5cm** | | **21** | **4.5cm** | **5cm** | **5.5cm** | | **23** | **5cm** | **7cm** | **6cm** | | **25** | **5.5cm** | **7cm** | **6.5cm** | | **27** | **6cm** | **7cm** | **6.5cm** | | **34** | **6.5cm** | **8cm** | **7cm** | | **41** | **7cm** | **9cm** | **8cm** |  |  | | --- | | **Number of Germenated Plants** |  |  |  |  |  | | --- | --- | --- | --- | | **Day** | **0mm** | **8mm** | **20mm** | | **10** | **13** | **22** | **7** | | **13** | **15** | **25** | **9** |  |  | | --- | | **Macintosh HD:Users:Student:Pictures:iPhoto Library.photolibrary:Previews:2015:05:09:20150509-022823:6vmhKerKSsKIEhcO3bw+Kw:IMG_2607.jpgGrass Weights** |  |  |  |  |  | | --- | --- | --- | --- | |  | **0mm** | **8mm** | **20mm** | | **Liveweight** | **8.16g** | **11.34g** | **9.16g** | | **Dry Matter (DM)** | **0.80g** | **1.57g** | **1.17** |   **From Left: 0mm, 8mm, 20mm**  **Macintosh HD:Users:Student:Pictures:iPhoto Library.photolibrary:Previews:2015:05:09:20150509-022823:Puh86HygQHuKztEWeQjGYQ:IMG_2609.jpg**  **From Left: 0mm, 8mm, 20mm** |
| Processed data |
| Interpretation of data  From the data I have collected over the duration of the experiment, it is clear to see there has been a large effect on the growth of plants due to the different seed depths.  The seeds planted at 0mm germanated the fastest, but could not sustain their growth with many plants dying. They were also the shortest group and were very patchy and full of weeds. When it came to weighing them, the were the lightest group but I weighed all the weeds as well.  The seeds planted at 8mm were by far the best all round group. This was seen in both the hight of the plants, and the fact that they were also visually very strong being thick, lush and a deep green colour. When it came to weighing them they were the heaviest by a considerable margin, this making them the best group weight wise as well.  The seeds planted at 20mm had a much slower germenation time, which resulted in the least amount of plants. Once fully germenated they grew well, and I believe would have kept up with the 8mm plants if it were not for the slow start.  Another notible feature of the hight graph was the sharp decline in hight in the 0mm and 8mm groups between days 17 and 19. This was due to the period of time in between the end of school and the holidays where I did not water the plants for a large period of time. This resulted in them becoming very wilted. I will further disscus this in my conclusion. |
| Conclusion  In conclusion, my hypothesis was correct in that the 8mm seeds would grow the best, and that the deeper seeds (20mm) would take longer to germinate or not germinate at all, but when grown would grow just as well. I also hypothesised the shallow seeds (0mm) would germinate the fastest but will take longer to establish and grow properly.  I will talk about each of the groups individually starting with the 0mm group. This group was the worst of all the groups, coming last in height and weight. When I started this experiment, they were the first to germinate being on the top, but this didn’t last with many plants dying. This could be because whilst being on the top allowed them to germinate quickly, they did not have enough root structure underground to allow them to survive. In a farming context, this would make the plants that survived suceptible to being pulled out by the roots by stock, as although the leaf may be long enough to be grazed, the root system would not be able to withstand this action. Also the fact the the plants took a long time to fill out and were very weedy would make this an unfavorable choice for farmers, as they want their pastures thick and lush. The large amount of weed would also slow down pasture growth due to competition for sunlight and nutrients. The only context I could think of using this seed depth would be just chucking the seeds on unfavorable ground that has been burnt off ect. Even so this method would result in large seed wastage from seeds not germinating, and would also have a lot of competition from pests such as birds eating all the seeds, so would probably only be a last resort.  The 8mm group was by far the best group, having the most seeds germenated, the tallest plants and the heaviest weights. This along with the thickness and lushness of the pasture would make it a very favourable seed depth for farmers. The only problem I could find with this group was the rapid wilting and loss of condition associated with the drought like conditions from the lack of watering. This was also the case in the 0mm group. This could be due to the smaller root depths compared to the 20mm group which showed no signs of wilting at all. The 20mm group would have had a deeper and larger root system from being planted deeper down, which would have allowed them to access deeper water that would have been out of reach of the other groups.  The 20mm group took the longest and had the worst rate of germination of all the groups. Despite this, once they had germinated they grew well, ending up second in hight and weight despite the slow start. The poor germination rate would be attributed to the large distance the seeds had to travel to get to the top. The large distance would have used up all their energy stores in the form of their cotyledons, resulting in the plants dying on the way to the surface of the dirt. Despite this, the plants that did germinate grew well and and were reasonably thick considering the lack of plants at the beginning. This could be due to the larger root systems associated with the deeper seed depths, which would mean the plants that germinated had better means of absorbing nutrients and water, helping it to grow.  I believe 8mm is the optimum depth for planting grass and clover seeds in normal farming conditions. If you are farming in drought prone conditions, a slightly deeper seed depth may be a better option, as it will allow better root establishment resulting in the pasture being less prone to dry conditions. This could be from 10mm to 14mm, as the seeds still need to be able to reach the top. |
| Evaluation of the method and data  Overall, I believe the experiement went very well, as I gathered reliable and relivant results and valid data. My measuring was accurate and there were no obvious flaws in my planning. The only that that went wrong was the irregular watering between the end of Term 1 and the start of the holidays, but even so this resulted in very interesting data which drew me to the conclusion that deeper sown seeds would be better in drought prone regions. If I was to do this experiment again, I would change the the 20mm test group to 15mm. This would mean less varience in the ranges and would provide much closer results. |