Environmental factors affecting germination Transcript

The burning of fossil fuels releases harmful products such as sulfur dioxide into the atmosphere. Sulfur dioxide combines with water and oxygen in the air to form sulfuric acid, which falls to the ground as acid rain.

Acid rain has a negative impact on ecosystems.

For example, it can disrupt or prevent the germination of seeds by damaging the seed's sensitive embryo cells. This experiment will investigate the effect of acid rain on the germination of cress seeds.

In this experiment, filter paper will be soaked with different concentrations of acid to represent acid rain collected in the soil. Cress seeds will be scattered on the filter paper, and their germination observed after five days. Cress seeds are ideal for this experiment because the seedlings are easy to grow, and germination can be seen after just one day.

A piece of filter paper is placed into the base of a Petri dish.

The filter paper is soaked with distilled water. This is the control experiment.

15 cress seeds are scattered onto the filter paper.

The Petri dish is then covered. There is a small gap between the lid and the base of the dish so that oxygen can still get in. Oxygen is needed for the seeds to germinate.

The top of the Petri dish is labelled with the letter 'C' for control.

Another piece of filter paper is placed into the base of a different Petri dish.

Using a pipette, the filter paper is soaked with 0.1 molar hydrochloric acid. Hydrochloric acid is used instead of sulphuric acid because it is safer at the concentrations being used in this experiment. Both acids have the same effect on the seeds.

15 seeds are scattered on the filter paper, as before. The number of seeds is a variable that is kept constant.

The Petri dish is covered, as before.

The dish is then labelled.

The same process is repeated for 0.5 molar and 1 molar concentrations of hydrochloric acid, so that there are four Petri dishes, each containing 15 seeds and filter paper soaked in a different solution.

The Petri dishes are placed in a light area. All the Petri dishes are kept in the same conditions so that light, temperature, humidity and access to oxygen are kept the same for each sample. This means that any difference in seed germination will be due to the acid solution on the filter paper and not another variable. The germination of the seeds will be observed after five days. The samples will be watered periodically over the 5 days, so that a lack of water does not affect germination.

The number of seeds that have germinated will be counted; the most common length of seedlings will be estimated; and the appearance of the seeds and seedlings will be observed.

Any seed that has a shoot emerging from the seed coat is included in the count for germinated seeds. The emerging shoot is called a seedling.

The length of a seedling is estimated by putting a 15 centimetre ruler on the lid of the Petri dish, over a seedling, and using this to approximate the length of the shoot into one of a given set of length ranges. The ‘0’ mark of the ruler is placed at the point where the shoot emerges from the seed, and the length of the shoot is estimated based on where the tip of the shoot reaches on the ruler through the lid.

After five days, the observations and results are recorded.

For the control, it can be easier to count the number of empty seed coats than it is to count the number of seedlings. Here, 15 empty seed coats can be counted, meaning that all of the seeds have germinated.

The most common length is over 15 mm. The seedlings are long with green leaves and the seed coats are dark brown.

In the 0.1 molar sample, 11 seeds have germinated.

Eight of these are quite easy to see. It is more difficult to see, but there are three more seeds where just the tip of the shoot can be seen emerging.

The most common length of the seedlings is between 1 and 5 mm. The seedlings are stunted and the seed coat has changed colour to a pale yellow.

In the 0.5 molar hydrochloric acid sample, it is just possible to see the tips of shoots emerging from three seeds. The seedlings are very stunted, they have a length of less than 1 mm, and the seed coats have changed colour to a pale yellow.

In the one molar hydrochloric acid sample, none of the seeds have germinated. The seed coats are pale yellow.

The percentage germination is calculated by dividing the number of seeds that germinated by the total number of seeds, and then multiplying by 100.

For example, the number of seeds that germinated in the 0.1 molar sample was 11. So, 11 is divided by 15 and multiplied by 100. To give a percentage germination of 70 percent to one significant figure.

The data can be plotted on a graph. The concentration of the acid is on the *x*-axis, as this is the independent variable. The percentage germination is on the *y*-axis, as this is the dependent variable. A smooth curve of best fit is drawn through the points.

The curve shows that as the concentration of acid increases, the percentage germination of the cress seeds decreases. The control sample had the highest percentage germination at 100%. The 1 Molar acid sample, which was the strongest acid, had the lowest percentage germination at 0%.

The number of seeds that germinated was clearly affected by the presence of the acid. Notice how the condition of the seeds and seedlings was also affected. The seedlings in the control sample had shoots greater than 15 mm in length with green leaves. The seeds in the acidic conditions changed colour and where they did germinate, the seedlings were very stunted with no leaves.

This experiment shows that acid rain has a devastating impact on germinating seeds. This can disrupt ecosystems and the food chain. To minimise the effects of acid rain, efforts need to be made to reduce the burning of fossil fuels