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Biology planning exercise

Introduction

As seeds germinate they use stored food reserves for growth and respiration. Due to this the dry mass of the seedlings progressively decreases in the early stages of their development.
I must carry out an investigation comparing the rates of the utilisation of food reserves during the germination of seeds of two different species.

Health and safety

The main health and safety factor that needs to be addressed is the oven. As it can become extremely hot. To prevent one from getting burnt, gloves must be used always when extracting things from the oven. Wear plastic gloves preventing spread of plant diseases caused by fungus and bacteria on your hands.

Constant and Variable

During the experiments there are several constants and variables to consider. I will keep the amount of seeds constant, the water given to the seeds constant, the temperature constant to preventing the enzyme inside the seed from being denatured and the light source constant as we don't want the seed to carry out photosynthesis (which will total darkness)

What is seed germination?

Seed germination is the reactivation of the metabolic activity of seeds. It is the point when the roots come out of the seed. For germination to occur the seed must:

- Be viable
- Must be dormant

Germination occurs in 3 phases:

- Activation
- Digestion and Translocation
- Seedling growth

Phase 1: activation

This is sages is where water uptakes occurs. The moisture increases to 50% in the seed. The uptake of water of the seed is a balance of osmotic potential in the soil and osmotic potential in the seed.

Phase 2: Digestion and Translocation

At this stage respiration occurs, this is because Oxygen can now penetrate the seed because the seed coats have split. Oxygen enables energy to be produced and it is also required for enzymes synthesis. Enzymes specific for germination are produced and cell elongation occurs.

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Phase 3: Seedling growth

The cell increases. The weight of the new seedling increases and there is a decrease in the fresh and dry weight of storage tissue.

What is dormancy?

Dormancy is a period in an organisms life where:

- Growth stops
- Metabolic activity is reduced to a minimum

This process allows the organism to survive when there is inadequate water and food supplies. It usually occurs when seeds dry inside.
In most seeds the outer coat appears to promote dormancy and inhibits its germination. By breaking dormancy the plant can grow and germinate.
Factors that can trigger germination and growth are:

- **Water:** the seeds require water so that it can use the food reserves, which are stored inside it.
- **Light:** Can trigger germination, which follows after water uptake.

Preliminary work

Preliminary work was carried out to find out which seed might be used:
Horticulture science

Plant	Time it takes for seeds to germinate (days)	Temperature in degrees Celsius	Light/Dark requirements
Ageratum	5 to 10 days	21.1	Light
Alyssum	5 to 10 days	21.1	Either
Aster	5 to 10 days	21.1	Either
Begonia	10 to 15 days	21.1	Light
Browallia	15 to 20 days	21.1	Light
Centurea	5 to 10 days	18.3	Dark
Cucumber	5 to 10 days	29.4	Either
Eggplant	5 to 10 days	21.1	Either
Larkspur	5 to 10 days	12.7	Dark
Muskmelon	5 to 10 days	29.4	Either
Pansy	5 to 10 days	18.3	Dark
Pepper	5 to 10 days	26.6	Either
Phlox	5 to 10 days	18.3	Dark
Snapdragon	5 to 10 days	18.3	Light

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I have chosen to use Pansy seeds and Phlox seeds this is because:

- Both these seeds take 5 to 10 days to grow
- Both seeds grow in the dark
- Both seeds optimum temperature is 18 degrees Celsius

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I did not choose plants such as the Snapdragon and Browallia because they needed light to grow, and my experiment needed to take place in the dark to prevent the plant make food sources through photosynthesis. Again I did not use seeds such as the Muskmelon and cucumber because they required higher temperatures to grow and it was harder to create an environment of higher temperature without adding light or heat.

Hypothesis

I hypothesise that as the rate of germination increases the food uptake will increase and its mass will decrease as it is using up more of its food reserves. This happens because Gibberellin, which is synthesised when water is absorbed by the seed, stimulates the synthesis of amylase. The amylase hydrolyses the starch molecules converting them to soluble maltose molecules. They are teen converted into glucose providing a source of energy. So by using the energy resource the mass will decrease.

Apparatus

Cotton wool
Dishes
Batch of 70 seeds from the Pansy (Viola) plant
Batch of 70 seeds from the Phlox plant
(These seeds are being used because they can grow in the dark and the conditions will be dark)
Oven
Measuring cylinder
Distilled water

Method

Stage 1:

1. Take a 5 seeds from each batch, dry them in the oven and weigh them
2. Record their weight
3. Separate your seeds so that you have batches of 5 seeds of all 65 of the Pansy and Phlox seeds
4. Label each batch 1-11 and add to the label whether they are Pansy or Phlox
5. Set up 26 growing environments for the seeds by placing moist cotton wool onto dishes
6. Place the dishes in a cupboard away from light

Stage 2:

1. On day one place 2 dishes labelled number 1 (1 lot of Pansy and 1 lot of Phlox seeds) into an oven.
2. Heat until completely dried out
3. Remove from oven and weigh
4. Record your observation.
5. Continue this for day 2 up until day 11

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Results table.

Day	Mass of Pansy seed mg	Mass of Phlox seed mg
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		

How would I make my experiment more accurate?

To make my experiment more accurate I would:

- Use 3 different types of seeds making my results more precise deleting any anomalous results
- Carry out similar tests with seeds that grow only in light. This way I would be able to see if I would obtain similar results to the seeds observed in the dark.

Bibliography

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