

activity 11



Age 10-12



Time

8 days (see below)

Seed fixation - 30 minutes;
glue drying - 3 days;
water immersion and soaking - 6 hours;
stand in black bag - 4 days;
observation - 30 minutes or longer if required

Materials

Growth tank, growth tank lid and growth tank sheet.
Teacher worksheet 5.
All purpose adhesive glue.
Blotting paper.
Black bags.
PVC/Freezer tape.
Pencil and ruler.
OHP pens (optional).
Paper clips.

Through these activities children can learn:

- that plants need certain conditions to germinate
- that different varieties of plant have different germination rates

Skills developed:

- prediction
- hypothesis
- observation

How to begin:

Plant scientists use growth tanks as a method of examining the early stages of growth (see Fig1). Following the instructions provided, set up some tank trials. Remember to allow three days for the seeds to adhere firmly to the paper and a further six hours or more for the seeds to soak in water. Note: to allow the children to make measurements easily after the seeds have germinated, you may wish to rule the front of the 'tanks' (plastic bottles) using water soluble OHP pens or rule pencil lines onto the blotting paper.

Key questions

Q1. What do you think will happen to the seeds?

Possible recording options

- Teacher-led floor book - recording predictions.
- Allow the children to sketch the seeds and indicate on their drawing from which area of the seed they think new growth will appear and what they think this new growth might look like.

Tank trials - measuring germination

Extension activities:

- 'Tanks' may be used to study the effects of gravity. Invert the seed sheet (the plastic with blotting paper and seeds attached to it) when the shoots on the seedlings are around 2 or 3 cm long. The roots of the seedlings will curve towards the source of the gravity, the shoots will curve away from it.
 - For multiple experiments - using different varieties of seed, or to examine the effect of temperature or light on growth, several 'tanks' may be used.
 - 'Tanks' may be used to study non-seed reproduction. e.g. from rhizomes*.
Dig up a rhizome of either *Couch Grass* or *Mint*. Attach a section of the rhizome root to the blotting paper by stitching a cotton loop through the paper and over the rhizome, and repeat the tank trial instructions as before.
- * A rhizome is a horizontal, underground stem. Through branching out and/or being broken up, the rhizome acts as an agent of vegetative reproduction.

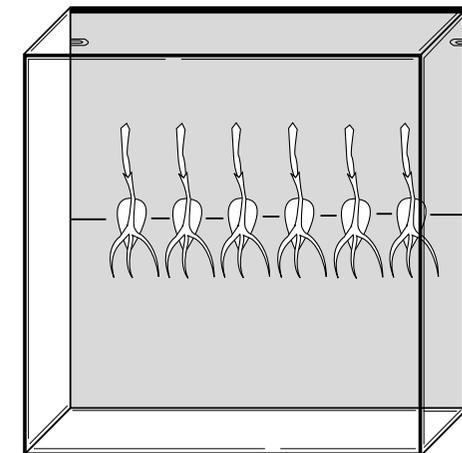


Fig.1: A typical growth tank.

Activity 11: Teacher worksheet 5

Activity 11: Tank trials - measuring germination. Children should watch their teacher complete steps 1-7.

1. Take a piece of blotting paper cut to the size of the growth tank (pre-cut pieces are provided). Place it on a clean surface. Draw a pencil line half way down the paper and mark this line at six regular intervals with small vertical pencil lines as shown in diagram 1. (Do not use a ballpoint or water-based pen.)

2. Using an all purpose adhesive glue (in our trials we used UHU glue), place a small drop of glue on the first of the vertical pencil lines. Select a *Sunflower* seed and place it directly onto the glue, making sure that the grooved side of the seed is pressed onto the paper and that the most pointed end of the seed (the embryo end) is facing the bottom of the paper. Use the same method to fix two more seeds onto the blotting paper. A pair of forceps can help to position the seeds, but be careful not to squeeze the seed too much. Use diagram 2 as a guide.

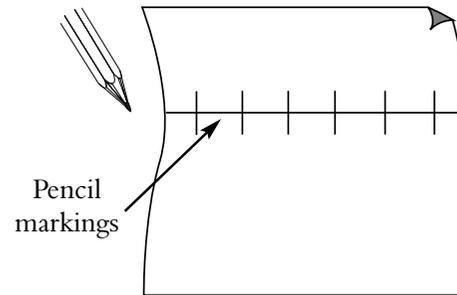
3. Now select another variety of seed. Employing the same technique you used with the *Sunflower* seeds, gently press the seed (with its embryo end facing downwards) onto a drop of glue. Repeat this exercise with two more seeds.

You should now have six seeds fixed onto the blotting paper at regular intervals along a pencil line, each with its embryo end facing downwards as shown in diagram 3a. (To help you remember which are the embryo ends, pencil in a small arrow somewhere on the blotting paper.)

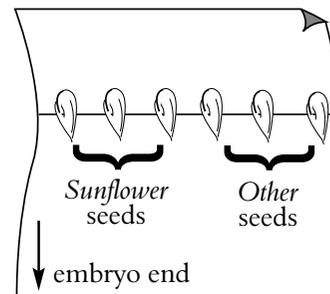
Allow the glue to dry for a few hours so that the seeds are firmly attached to the paper. Then, using another sheet of blotting paper, cut out a long thin strip of the paper (around 1 cm in depth) and put this over the line of seeds – fixing it in place using small drops of glue in between each of the seeds (see diagram 3b). Allow the glue fixing down the strip to dry and then loosely cover the seeds and the whole sheet with a clean sheet of paper to keep everything clean and dry.

Leave the seeds to dry fully onto the paper in a well-ventilated, dry area for around three days.

1.

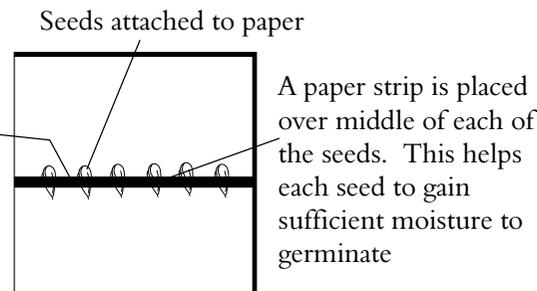


3a.

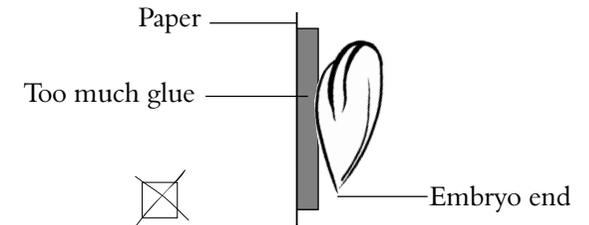


3b.

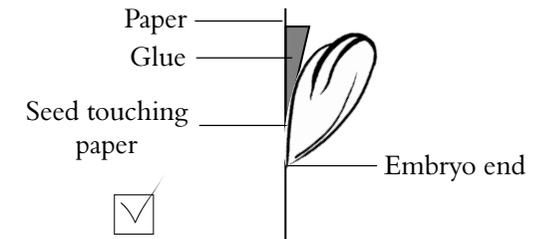
Small drops of glue in between each seed fix the paper strip in place.



2. Q: How much glue is too much glue?



Too much glue prevents the seed from making contact with the filter paper and therefore with the source of moisture needed for germination.



This is correct: The glue is not preventing the seed from touching the filter paper.

Teacher worksheet 5 - continued

4. Find two clear plastic bottles, one should be a couple of centimetres larger than the other. Rinse, clean and dry the bottles. Cut the top and neck off both bottles.

5. When the glue has thoroughly dried, place the blotting paper and seeds on top of an identical sized sheet of blotting paper and clip the two layers (seed layer on top) onto the outer edge of the small plastic bottle using large paper clips. Slide the small bottle into the larger bottle to form your 'tank', making sure that the embryo ends of the seeds are facing downwards towards the bottom of the 'tank' (see diagram 4).

6. Place the 'tank' in a sink or washing-up bowl and slowly fill with water as shown in diagram 5). Leave for around six hours so that the seeds are thoroughly soaked.

After six hours, lift the smaller bottle out of the larger bottle and place upright on a clean surface, being careful not to dislodge the seeds. Drain the water from the larger bottle and rinse it. Add a small amount of water to the large bottle (enough to rise to around 1 cm - 2 cm) and then gently replace the small bottle and its *seed sheet*, making sure the embryo ends of the seeds are pointing downwards (see diagram 6).

7. Wipe the open ends of the 'tank' with a tissue and then cover them with perforated cling film or foil. Keeping the 'tank' upright, place it inside two black polythene bags – making sure no light can get in by sealing each bag with PVC tape (see diagram 7). Maintaining its upright position, place the 'tank' in a safe area and leave for four days.

8. After four days, remove the bags and examine the seeds. To help you examine the seeds, you may lift the small bottle and its *seed sheet* out of the larger bottle and very gently remove the thin strip of blotting paper covering the seeds taking care not to damage the new growth.

9. Once the seedlings have been exposed to light the coleoptile sheath will stop growing and shortly afterwards the first leaves will emerge from the sheath (see diagram 8).

