Dandelion

Saving Seeds and Waking Seeds

Contents

Introduction

This resource introduces seed saving and the key principles and good practises for success. It also gives guidance on successful germination and suggestions for species to try. There are classroom activities and games here too.

This resource complements the 'Sow Many Seeds' resource that focusses on what seeds are, how they are made and their part in our history and culture.

Seed Saving Good Practice

The best time to decide when to save a seed is before you plant a seed.

These are top tips to make your seed saving a success.

Watch the plant grow.

You want to observe the plant during its whole life cycle. The idea is that you only want to save seeds from plants that have been strong and healthy right from the start. Try to avoid harvesting seeds from plants that have just gone to seed if you have not observed them throughout their life. There is often a temptation to harvest seed just because a plant has produced some, but if you don't know how healthy it was when it was growing it might have had a disease and not grown very well. The seeds you save might not be as good as if you were to save them from a healthy plant.

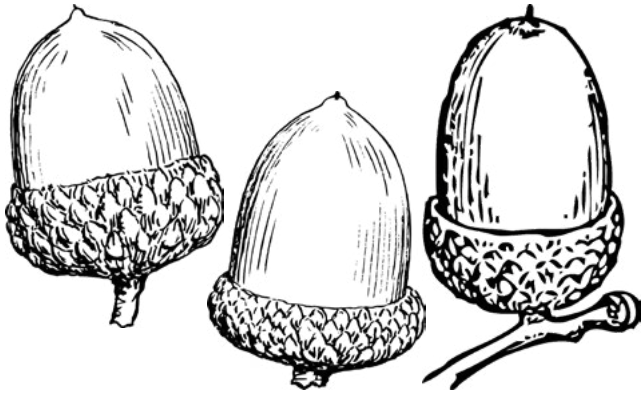
Isolate the plant variety.

When saving seeds, you don't want two plant varieties (see the Vegetable family tree in 'Sow Many Seeds') of flowering plants too close to each other. If the pollen from one variety is transferred to the other variety the seeds that form will be a mixture of the two varieties, this means the seeds you save will likely not turn out to be what you expected. It is therefore good practice to isolate two varieties of the same species from each other when saving seeds. The type of plant and how it is pollinated will help you determine the minimum **isolation distance** you can have between two varieties of the same species. Some plants only need an isolation distance of 2-3m, some will need 1-2 km. The isolation distance is also affected by the number of plants that have been planted, the number of pollinators, and the environmental conditions in the area, e.g the presence or absence of physical (walls) and biological (hedges) barriers. You can also make sure you only grow one variety each year so that two varieties of one species are not flowering at the same time.

How the plant is pollinated will also help you determine the minimum number of plants you need to grow to ensure you have enough genetic diversity for the next generation, this is known as the minimum population size.

Before sowing your seeds, find out:

1. How is the plant pollinated? – wind e.g sweetcorn, insect e.g sunflower or self e.g Tomato. This will determine the isolation distance and minimum population size required to ensure that you don't have any cross-pollination or lack of genetic diversity. Look at the flowers if you are not sure.
2. What is the plant's life cycle? – annual e.g Lettuce, biennial e.g Carrot or perennial e.g Asparagus. Some plants will flower and set seed in one year then die, others will grow over two years and only flower in the second. Others may not flower for several years.
3. Are your seeds open-pollinated or hybrid? This can be found on the seed packet. Only save seeds from open-pollinated varieties because these seeds will grow the same plant next year.



When are seeds ready to harvest?

Some seeds become dry when they are ready, for example, peas and beans. Some seeds are inside a fruit and don't need to dry before you can harvest them, for example tomatoes and peppers.

If the seeds on your plant go dry when they are ready to harvest it is important to try and leave them on the plant as long as possible to do so. Peas and beans will go from their fresh colour (green/purple/yellow) to a light brown colour. The pods will start to get thin, feel papery and snap rather than bend. You can check if the peas/beans are dry enough by hitting one with a hammer, if the seed is dry enough it will shatter, if it is still too moist, it will smush. To dry more, place a single layer in a warm, well-ventilated and rodent proof area until they pass the hammer test. After this they can be stored until next year.

If the seeds on your plant stay wet like in tomatoes, you just need to wait until the fruit containing the seeds is ripe for the seeds to be ready to save.

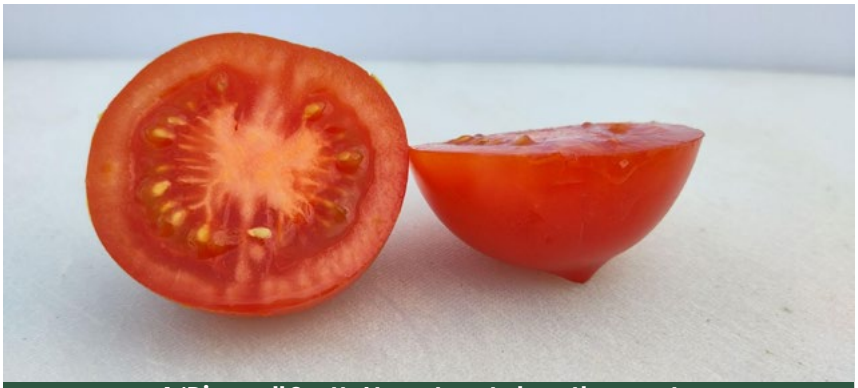
If you are interested in collecting and saving seeds for trees, this resource from TCV has lots of helpful information. **https://treegrowing.tcv.org.uk/wp-content/uploads/2019/09/handbook.pdf**

Look at the colour of these strawberries. Which one is ripe and how do you know?

Seed saving: Tomatoes

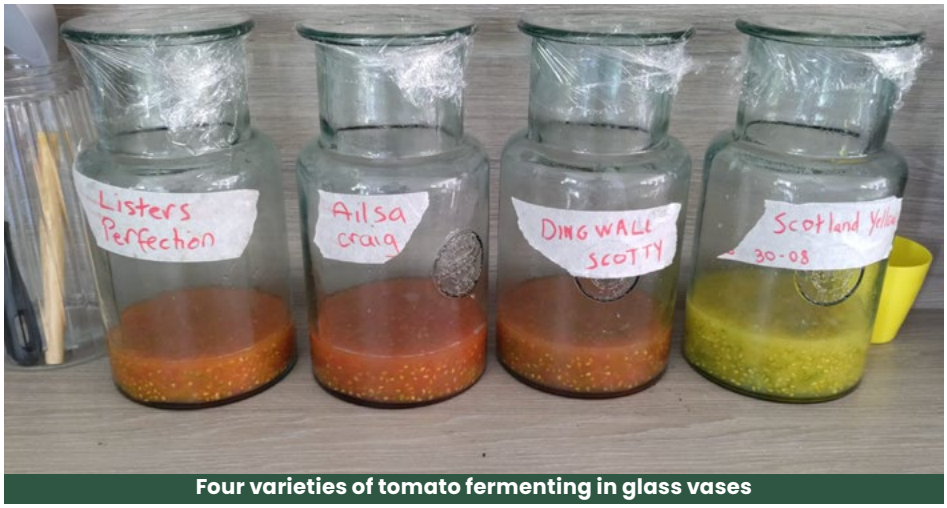
(Solanum lycopersicum)

Annual, self-pollinating, isolation distance 5m, minimum population 1 plant



A 'Dingwall Scotty' tomato cut along the equator

1. Slice the tomatoes in half along the equator (as shown in the picture) and scoop the seeds and pulp out with a teaspoon.
2. Place the seeds and pulp in a labelled jar or glass. Add water to the mixture to ensure it doesn't dry out. Cover your container with a napkin or cloth so the flies can't get in.
3. Leave in a warm spot, out of direct sunlight for 3-5 days. If you can, try and stir the mixture a couple of times a day. You want the mixture to ferment so that the germination-inhibiting sac around the outside of the seed disappears. Mould may appear but it's ready when there is a separation in the liquid with the pulp floating to the top and the seeds sink to the bottom.
4. Pour the liquid out carefully, the pulp should flow out first whilst the seeds stay behind. Repeat the process by adding water and carefully pouring it out several times until you have just clear liquid and seeds left. Drain the water and seeds through a kitchen sieve then tip out onto a labelled piece of baking paper or coffee filter (the seeds will not stick to this).
5. It is now important to start drying quickly. Arrange the seeds into a single layer and place them in a warm, rodent-proof spot out of direct sunlight with good ventilation, you could also set up a fan to blow over the top of the seeds. Good airflow really helps. You want to allow at least a week for drying. You can check if the seeds are dry enough by trying to snap one with some tweezers. If it snaps, it's dry enough. If it bends, dry for a little longer.
6. Once dry, place the seeds in a labelled packet and store them in a cool dry spot ready for sowing and sharing next season.



Four varieties of tomato fermenting in glass vases

Seed saving: Peas (Pisum sativum)

Annual, self-pollinating, isolation distance 1m, minimum population 1 plant

A dry Robinson pea - ready to harvest

Seed saving: French Beans

(Phaseolus vulgaris)

Annual, self-pollinating, isolation distance 5m, minimum population 5 plants

'Carters Polish' French beans

Seed saving: Lettuce

(Latuca sativa)

Annual, self-pollinating, isolation distance 5m, minimum population 1 plant

'Grenoble Rouge' Lettuce plants

Seed saving: Courgette
(Cucurbita pepo)

Annual, cross-pollinating, grow only 1 variety, minimum population 5 plants

'Syrian' Courgette plant in flower

Germination - wake up your saved seeds

What is germination?

Germination is when a seed starts to grow after a period of 'sleeping' called *dormancy*. Depending on the type of seed you have sown you will be able to make some observations based on the number and type of leaves you see. This can also help you to identify key features of seedlings in the wild.

Type of germination

It's useful to know the type of germination your plant has, as young plants with epigeal germination are more susceptible to frost damage so you need to take care that risk of frost is passed before planting out.

Hypogeal germination (a) is when the seed leaves and food stores remain in the soil with the root. The growing shoot emerges only when the true leaves form. If the growing tip is damaged by frost the seedling has a good chance of survival because its energy is stored below ground and can therefore produce a second shoot. Picture (a) below shows a sweetcorn seedling, only the true leaves are visible above ground, and the cotyledons remain below the soil.

Epigeal germination (b) germination is where the seed leaves emerge above the soil at the same time as the root radicle develops. The picture below shows a french bean seedling, you can see the cotyledons, the true leaves and the seed coat have all been brought to the surface. If the growing tip is damaged by frost or killed there are no more energy reserves below the soil and the plant will die. There is often a larger surface area of leaf produced which allows the small plants to grow fast.

(a) Hypogeal Germination

A sweetcorn seedling.

(b) Epigeal Germination

A french bean seedling.

Saving Seeds and Waking Seeds

Dormancy is a very important part of a seed's life cycle. In regions of the world that experience seasonal change between warm summer and cool winter, the period of dormancy prevents the seed from germinating as soon as it's ripe at the end of the growing season. If the seed germinated at the end of the season in Scotland the seedling may be killed by the cold and damp weather in winter.

In nature, most seeds would lie dormant on the ground during the winter months until the weather begins to warm up in spring and the perfect conditions for germination are provided. The process of breaking dormancy is very specific to each type of plant and depends on the type and category of dormancy. Seed dormancy is usually caused by a hard seed coat, an immature embryo or chemical inhibition of the embryo. Dormancy is categorised as shallow, intermediate or deep-seated dormancy depending on how hard it is to be broken. There are some things we can do to help seeds germinate:

- **Scarification** can be physical or thermal depending on the type of seed. For example; sweet pea flower seeds have a very tough seed coat, physically cutting the seed coat helps the seed to germinate.

- **Vernalisation / Thermal scarification** is using a change in temperature to help the seed to germinate, some seed coats contain a waterproofing that gradually breaks down a change in temperature. This can be achieved at home by placing the seeds in warm water or in the fridge overnight.

- **Chemically** this is not very common in Scotland, however in areas that experience bushfires such as Australia and South Africa, some plants have evolved seeds that germinate in reaction to the smoke once the ground has been cleared by the fire and there is very little competition from other plants.

Example: Tomato seeds

Have you ever felt the slimy gelatinous coat on a tomato seed? This is a protective layer that prohibits the seed from germinating inside the tomato where its warm and moist. If you save a tomato seed straight from the fruit it will struggle to germinate next year. To break the dormancy of the tomato seeds they need to be fermented in order to remove the gelatinous germination-inhibiting layer that surrounds each seed. See: 'Try Tomatoes on page 6' for more details.

Activity

2 Activities: Two types of seedlings - Monocots and Dicots

Cotyledons – 'Baby leaves'

When a seed from a flowering plant germinates it will usually send up 1 or 2 small leaves before the rest of the plant grows. These small leaves, sort of like baby leaves, are called *Cotyledons*. If 1 leaf comes up it is called a *Monocotyledon* (often shortened to monocot), if two leaves appear it is called a *Dicotyledon* (often shortened to dicot). The beginning of each of these words gives the clue for how to remember, Mono means 1 and Di can mean 2 for example, the word 'monologue' means one person speaks and 'dialogue' means two or more people are speaking. Monocots have 1 cotyledon and dicots have 2.

Activity 1: Find a dock leaf (Dicot) and a blade of grass (Monocot). The veins on the dock leaf run perpendicular to the centre and branch out many times. The veins on the grass leaf all run parallel to each other, this is a really great way to tell the difference between these types of plants. Try picking leaves from several different types of plants (a bush, some flowers, vegetables) and look at the patterns in the veins on the leaves. You could try and draw the leaves showing the patterns or use wax crayons to do leaf rubbings.

Activity 2: Soak a bean in a wet paper towel until it sprouts, you will see the two seed leaves emerge from each half of the beans. Soak a sweetcorn seed in a wet paper towel until it sprouts, you will see only one seed leave emerging.

Dicot

A tray of radish seedlings.

Monocot

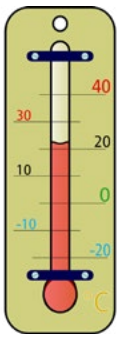
A tray of sweetcorn seedlings.

What causes germination?

Seeds will germinate when the conditions are good enough for them to grow into healthy plants. The most important things for a seed to germinate are: Warmth, Light, Water and Oxygen.

Warmth

Seeds that come from temperate climates will need a temperature of between 8-18C to germinate. The soil outside will warm up to this temperature naturally in the spring as the days get longer. (If it's warm enough to sit on the soil with bare skin it's warm enough to plant a seed). Examples of seeds from temperate climates are: carrots, parsnips, cabbage and beetroots.



Seeds from warmer climates closer to the equator will need a little more heat, more like between 15-25C to germinate and therefore may need a little help in our climate. You help them along by starting off your seeds indoors or in a polytunnel where it will be warmer than outside temperatures.

Light

As a general rule when sowing seeds it is best not to bury them too deep. Try not to sow them any deeper than double the size of the seed. If the seed is not too deep, it will quickly be able to find the light once germinated and start to grow. Some seeds actually require light for germination (e.g. lettuce), these seeds should not be covered with soil when sowing. Usually, the directions on the seed packet will tell you the best way to sow your seeds. Be careful when sowing your seeds as nearly all seeds when sown too deep will die or become dormant as they will not be able to recognise when there is enough surface light to grow.

Water

Most seeds will double in size before they germinate as they rehydrate. Water causes the seed coat to swell and burst. Plants need water to survive and a seed needs to grow in a constantly moist environment or else it may dry out and die. During the early stages of plant growth, the seedlings are particularly fragile and should be checked regularly. You also want to avoid watering them too much. What to check when deciding if you should water your seedlings;

- You can put your hand on the top of the soil to check if it feels moist. If you are not sure, carefully stick your finger in the soil, does it feel wet? You can reach 4 to 5 cm into the soil and feel how moist or dry the soil is. Be careful not to damage roots when you try this technique
- Look at the surface of the soil, does it look dry? Moist soil is almost always darker than dry soil.
- Feel the weight of the container, if it's wet it will feel much heavier than if it is dry.
- Look at the plant, are the leaves droopy and wilting? Has the colour of the leaves changed? This can be an indication of either overwatering or underwatering.
- Keep a record and make a schedule - It might help to have a clipboard and write down when you water your plants then you can also check when they were last checked/watered.

Oxygen

Plants also need oxygen to survive, they will suffocate if there is no oxygen around them. This can happen when lots of people or vehicles have been on top of the soil. All of the weight can close the gaps in the soil where the oxygen is. When this happens your soil is called compacted. Look outside in an area where there is a footpath that lots of people walk on, you might notice that there aren't any plants growing in the places where people walk.

If there is too much water in the soil, it will fill also fill all of the little gaps that used to contain oxygen with water when this happens your soil is waterlogged.

Soil or some sort of substrate

Seeds don't actually need soil to germinate, you can germinate seeds in a paper towel. However, if you want your seeds to grow into healthy plants you need to plant them in soil or a type of compost/potting substrate. When you are sowing your seeds you want to sow them into soil/compost or substrate that has small pieces. If the pieces are too big, your seedling might get trapped underneath and not reach the surface. This also means that your seed won't accidentally fall into a big gap and be too deep to reach the surface. It may be easiest to buy seedling compost from the garden centre but if you have made your own compost, try and sieve out the biggest bits before sowing seeds into it.

Activity

Activity 2: How many seeds to sow? A germination experiment

Not all seeds will germinate, seeds can only survive for so long (the length of time depends on the species), over time the number of seeds that will germinate from a packet will decline. Also, some seeds may not have formed fully on the plant or not gone through adequate scarification or vernalization. Therefore, it is useful to determine the germination percentage of the seeds that you have. This will also help you decide how many seeds you need to plant in order to get the number of plants you want.

Equipment needed:

- 1 or 2 packets of radish seeds (you can also use other brassica seeds such as cabbage or kale but radish seeds are slightly bigger and will germinate slightly faster). You want enough seeds to give each pupil at least 10 seeds.
- Absorbent paper: kitchen roll or blue / brown hand towels you might find in the bathroom
- Spray bottle with water.
- Sandwich bags.
- Paper and pens for recording results.

Method

1. Count out 10 seeds per pupil. You can use any number but 10 is easy to calculate germination percentage from and means your packet of seeds will go quite far.
2. Give each pupil a section of absorbent paper and ask them to put the seeds in a line in the centre of the paper spaced about a centimetre apart.

3. Wet the paper lightly, and fold the paper along the dotted line so the seeds are in the middle.

4. Roll from either end - into a sausage

5. Place the paper and seed sausage into the plastic sandwich bag.
6. Place the bag somewhere warm out of direct sunlight.

7. Check the bags every day, if the paper looks like it is starting to dry out then spray more water.
8. After 3 days, roll out the sausages and count the number of germinated seeds (there might not be very many). Remove any seeds that have germinated and record them on your germination experiment table *see example below.*
9. Repeat on 5, 7 and 10 days after sowing.
10. Calculate the final germination percentage. (number of seeds germinated x 10).

Activity

Pupil	Number of seeds germinated (removed)					
	3 days	5 days	7 days	10 days	Total	Final percentage
Example	1	5	2	0	8	80%

Top tips for growing young plants

Planning

If you plan to grow vegetables from seed, sowing the seeds indoors or inside of a polytunnel before transplanting out seedlings can help to increase your chance of success. This requires a wee bit of planning and some equipment. A good place for your seedlings to grow is somewhere warm with plenty of sunlight. A sunny windowsill often works well. You want a spot that is ok to get a wee bit messy and wet and that is in a location that is easy to regularly check on. As your seedlings grow they will need more space and may need to be potted on into bigger pots so make sure you know where your plants are going to be planted next or that you have enough room to expand.

Containers

You can grow in all sorts of containers but there are a few things that will help.
Is it big enough? - as your plants grow you will need them to have enough space to develop a healthy root system. You can also pot on your plants into bigger pots as they grow.

Does it have drainage? - make sure the container has holes in the bottom to allow water to drain out and the soil not to get waterlogged. You can use a 'Drip tray; to help with watering. A drip tray is basically just a tray (like a school dinner tray) without holes in it that your pot can sit in. You can pour water in the tray rather than on top of the plants, this can help avoid damage to your delicate seedlings from over-excited watering and also stop water from going everywhere.

You could also try and place a plastic bottle or container over your seeds while you wait for them to germinate, this will stop the water in the soil from evaporating too fast. You will see drops of water starting to form on the inside of the container as the moisture in the soil evaporates and condenses. Be careful that it doesn't get too hot in there though!

Glossary

Annual
Annual plants will complete their full life cycle from seed to seed in one year. Examples of common annual vegetables are; Tomatoes, lettuce, radish and peas

Biennial
Biennial plants will complete their full life cycle from seed to seed over two years. Examples of common biennial vegetables are; Carrots, Cabbage, Beetroot and Parsnips.

Cotyledons
The first leaf or pair of leaves produced by a seed, frequently different from true leaves.

Cross Pollination
Transfer of pollen from one plant to another.

Dicotyledon
Two cotyledons (or seed leaves), often with net-veined leaves.

Dioecious
Dioecious pronounced [DY] + [EE] + [SHUHS] is a term which describes a plant that has male and female flowers on different plants. Each plant will produce either flowers with anthers or flowers with stigmas.

Dormancy
Temporary stop of growth and slowing down of other functions.

Epigeal germination
Seed leave emerges above the soil whiles the root develops below the soil.

Hybrid (F1) Seed
Refers to the selective breeding of a plant by cross-pollinating two different parent plants. This means if you save the seeds from an F1 hybrid plant you will get either of the parent plants next season and not the same plant you saved the seeds from.

Hypogeal germination
Is when the seed leaves and food stores remain in the soil with the root.

Isolation Distance
The minimum separation required between two or more varieties of the same species for the purpose of keeping the seed true to type.

Minimum Population size
The minimum number of plants needed to maintain good healthy genetics in the seeds you save.

Monocotyledon
A seedling with one cotyledon (or seed leaf) and parallel veined leaves.

Monoecious
A plant with separate male and female flowers on the same plant.

Open Pollinated Seeds
Means seeds that are produced through natural methods of pollination such as wind or insects. If

you save seed from an open pollinated plant you will get the same plant again next season.

Perennial
Perennial plants live for over 3 years producing new vegetative growth each year and often die back over the winter.

Plumule
Plumule is the embryonic growing shoot of the plant

Radicle
Radicle is the beginnings of the plant's root

Scarification
A method of treating seeds to help break a period of dormancy.

Self-Pollination
Refers to a plant that produces viable seeds when fertilised with its own pollen

Variety
A population of cultivated plants that have been selected to have specific traits. Each variety holds a common name to help identify it. For example, 'Golden Beetroot' is a variety of beetroot that is yellow/ golden coloured.

Vernalization
Is the induction of a plant's flowering process by exposure to the prolonged cold of winter, or by an artificial equivalent. Some plants require vernalisation to help them grow for example garlic.

Additional Resources

Resource	Link
Royal Horticultural Society (RHS) school gardening club – general growing resources.	**https://schoolgardening.rhs.org.uk/resources**
School term gardening calendar produced by the RHS.	**https://schoolgardening.rhs.org.uk/getmedia/a2c52d2b-6b1d-470d-a9f8-0333be215d21/Weekly-Gardening-Club-Calendar_2021**
Short instructional videos on plant biology and seed saving.	**https://www.diyseeds.org/en/films/**

This resource has been researched and brought together by Finlay Keiller and Haley Shepherd, **Seeds of Scotland** - and editing for school use by Eve Keepax from Keep Scotland Beautiful.

DANDELION

UNBOXED
CREATIVITY IN THE UK

EventScotland™