DANDELION

Sow Many Seeds

Contents

Introduction

This resource introduces you to seeds, what they are, how they are made and their part in our history and culture. You'll find both science and story here, with activities to improve knowledge and understanding of how flowering plants work and to raise awareness of the story of modern seeds and their place in our daily lives.

This resource complements the 'Saving seeds: waking seeds' resource that focusses on seed germination and seed saving.

There are both science based and citizen fieldwork activities for you and your pupils to engage with. You can find an explanation of and helpful tips on Citizen Fieldwork on page 6 of the Dig Where you Stand' resource.

SPROUTING SEEDS

FLOWER SEEDLINGS

HAZELNUTS

POPPY SEED HEAD

HOGWEED SEEDS

SUNFLOWER

What is a seed?

Seeds are capsules that contain all the genetic material needed to create a new plant similar to its parent plants.

Seeds are produced by flowering plants.

Flowering plants must be pollinated in order to make seeds. You can read more about pollination later in this resource

A seed has lots of challenges to face for a new plant to grow. It must:

- protect its precious contents
- travel away from the parent plant to find somewhere new to grow
- allow germination to happen at the right time
- provide the first nutrients for the seed

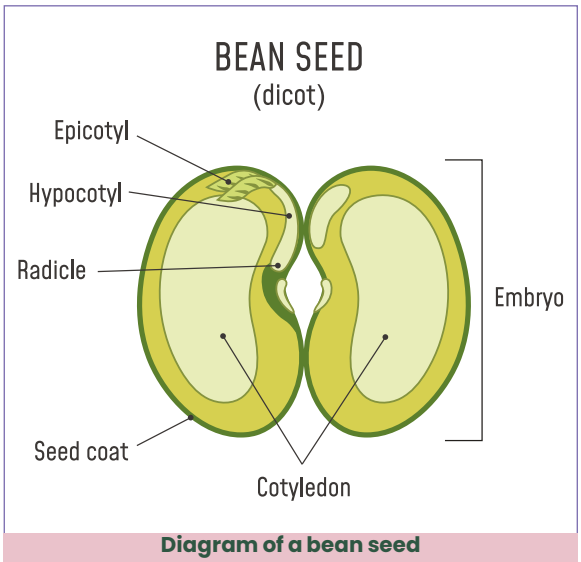


Diagram of a bean seed

Each seed is a little capsule containing a food store, called an endosperm, for the tiny plant and an embryo, which is the young plant itself. The seed coat provides protection for the embryo and its food store.

The embryo is made up of the plumule, radicle and the cotyledon. The plumule is the embryonic growing shoot of the plant and the radicle is the beginnings of the plant's roots. When a seed is mature and the environmental conditions are right, the seed will begin to germinate!

Common vegetable seeds

All sorts of seeds

Seeds can be many shapes, sizes and colours. Different seeds look different as they solve the tasks of surviving, travelling, and thriving in different ways.

The largest and heaviest seed in the world is the coco-de -mer. It can measure up to 30cm long (the length of your long ruler) and weigh up to 25kg (5 litres of water weighs 5kg). It is produced by the *Lodoicea maldivica* a palm tree found in the Seychelles in the Indian Ocean.

Compare this to an Orchid which has seeds like dust. The southeast Asian species *Aerides odorata* produces 3.4 million seeds in just 1 gram. The size of each seed is around 0.2mm! Where is that on your ruler?

Seeds are beautiful and diverse and come from all over the world! Knowing where the seed originally came from can help us think about what conditions it might like to grow in. Which of these seeds in the photos grow something to eat? Which ones are edible themselves?

Dwarf French Beans
Origin - South and Central America.

Nutmeg
Origin - Indonesia

Cress
Origin - Mediterranean

Scabiosa flower
Origin - North America

Sunflower
Origin - North America.

Sweetcorn Seeds
Origin - Central America

Seed Stories

Even the same type of plant can have seeds of different colours, sizes and shapes. This photo shows some varieties of French bean seeds. Which do you like best?

Activity

Create your own seed story

Different varieties of seeds can have names that relate to people, places or events. Read the two examples below. Then look back at the names of the French beans in the photograph. Why do you think they were given those names? Choose one of the bean varieties and imagine a story of how it got it's name. You can imagine lots of different stories. Make a note in the table below to remind you of all your ideas. As a group or as a class choose the story that you want to show to others by acting it out, perhaps at assembly. A good time for this is when you are planting out things to grow or at a harvest event.

'Irish Connor'

This chestnut-coloured little bean is named after Ken Connor who was born in Ireland in 1898. His family emigrated to Boston, Massachusetts in 1900, before moving to Canada in 1907 and finally settling in the Vancouver area of British Columbia. Irish Connor is a French bean that was donated to the Populuxe seed bank in Canada by a relative of 'Irish Connor'. Members of the Connor family now run an antique shop in the Vancouver area and still grow their family beans.

'Glamis' bean

Once thought to be extinct, 'Glamis' beans were bred in Scotland in the 1960s as a dwarf bean for our northern climate. They remained popular in seed catalogues up until the 1980s, then disappeared. In 2021 it was recovered from a Czech gene bank and is now being reintroduced in Scotland.

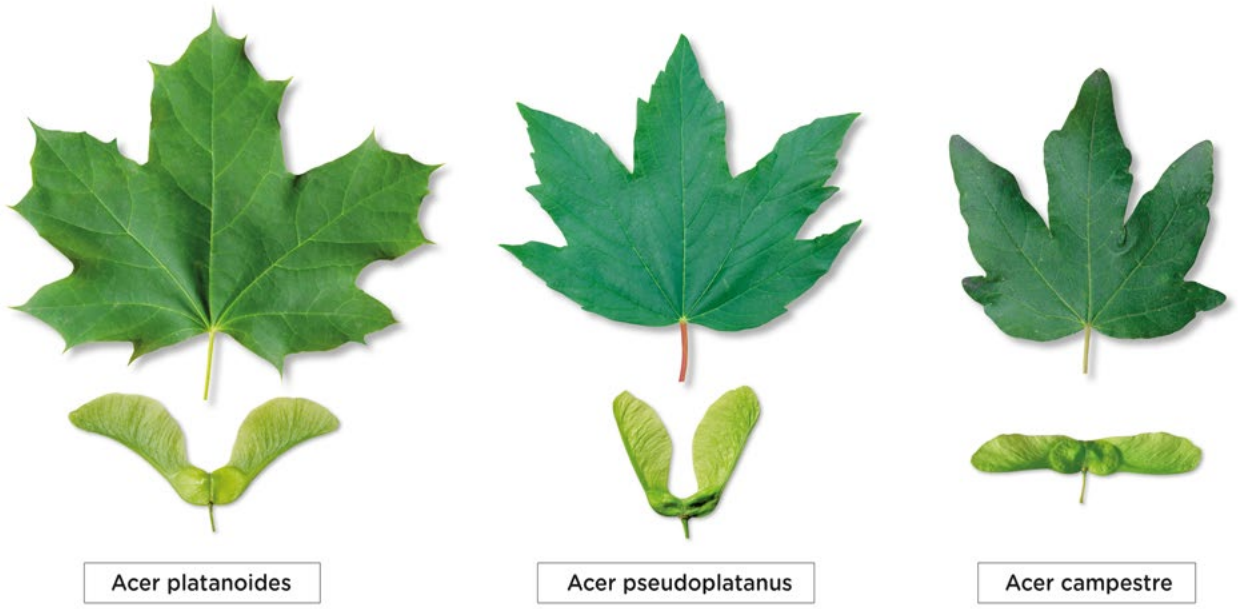
Name of bean	Story idea
Ying Yang	
Blue Jay	
Early Warwick	
Mor Kristin	
King of the Early	
Co-co bicolour	
Gaucho	
Carters Polish	
Cherokee trail of tears	
Faraday	
Tender Green	
Mystery	
Borlotti	
Blauhilde	

Leaving home - Seed Dispersal

If seeds germinate and grow close to the parent plant, they will have to compete with the parent plant for resources such as light, nutrients and water. Therefore, plants have evolved different strategies to ensure their seeds travel away from the parent plant, sometimes far and wide. Different seeds solve the challenge of making this journey in one of these ways:

- **Flying**
- **Floating**
- **Falling**
- **Hitch-hiking**
- **Propelled by Explosion**

Flying (anemochory)
Seeds don't have powered flight like a bird. Instead, they have structures, like fixed wings or tiny hairs or bristles that catch the wind. The seed can ride the air current away from the parent plant. Field maple *(Acer campestre)* and Hornbeam *(Carpinus betulus)* trees are examples of trees with winged seeds. As a famous cartoon character said. 'That's not flying, it's falling with style'. However, physicists studying dandelion seeds *(Taraxacum officinale)* have recently discovered a new type of flight involving the flow of air around the bristles called a Separated Vortex Ring. It's explained here: **The secret physics of dandelion seeds** CREDIT: Nature video



Acer platanoides | Acer pseudoplatanus | Acer campestre

Floating (hydrochory)
Plants that have adapted to growing near water often produce seeds that are buoyant and waterproof. Coconuts *(Cocos nucifera)* often drop their seeds on the seashore. Air trapped within the fibres of its outer husk makes it very buoyant, they often cross entire oceans before washing up on a shore and germinating.

Propelled by expulsion (ballachory)
Peas *(Pisum)* grow inside a pod, and when the seeds are ready the pod bursts open expelling the seeds some distance from the parent plant. In this clip **David Attenborough plays with Exploding cucumber pods** *(Ecballium elaterium)*

Falling (barochory)
Some seeds use gravity to fall from the tree. Their rounded shapes and weight help them to bounce or roll away from the parent tree. The conkers of the Horse Chestnut tree *(Aesculus hippocastanum)* have spiky green husks to protect them as they hit the ground.


horse chestnut seeds - conkers

Hitch-hiking (zoochory)
Raspberry *(Rubus idaeus)* seeds are encased in fleshy fruit to entice animals to eat them. The animal digests the fruit and the seed passes through the digestive system but doesn't get digested, as it is protected by its seed coat. The seed is deposited in droppings far away from the parent plant. Another hitch-hiking strategy is used by Burdock *(Arctium)* which has seedpods with tiny hooks. The hooks catch onto animal fur and people's clothing to hitch a lift. A Swiss engineer was inspired by these hook structures to invent Velcro.



burdock seeds with tiny hooks

Activity

Design a parachute for a seed

Choose a small object to represent a seed and then design a parachute that can help it to fly or 'fall with style' away from the parent plant. Consider what materials you will need and what properties they should have to make it work well. Here are two short film clips to get you thinking about aerodynamics and air flow.

1. Dandelion (Taraxacum) seeds can travel huge distances. This clip shows the amazing discovery of how they manage this. **https://www.nature.com/articles/d41586-018-07084-8** It's all about the physics of air flow!
2. This Action Lab video **'How To Get Regular Things Around Your House to Float in Air?'** shows how the shape of an object affects the flow of air around it to help it to float in air.

When you have your design, test it out to see how it works. Notice how it moves in the air and think about any improvements you could make. Are you confident enough to in your design to see if it will carry a small egg?

Pollination – making seeds

Pollination is the process by which pollen travels from the part of a flower that produces pollen (anther) to the part that receives pollen and initiates the formation of a seed (stigma).

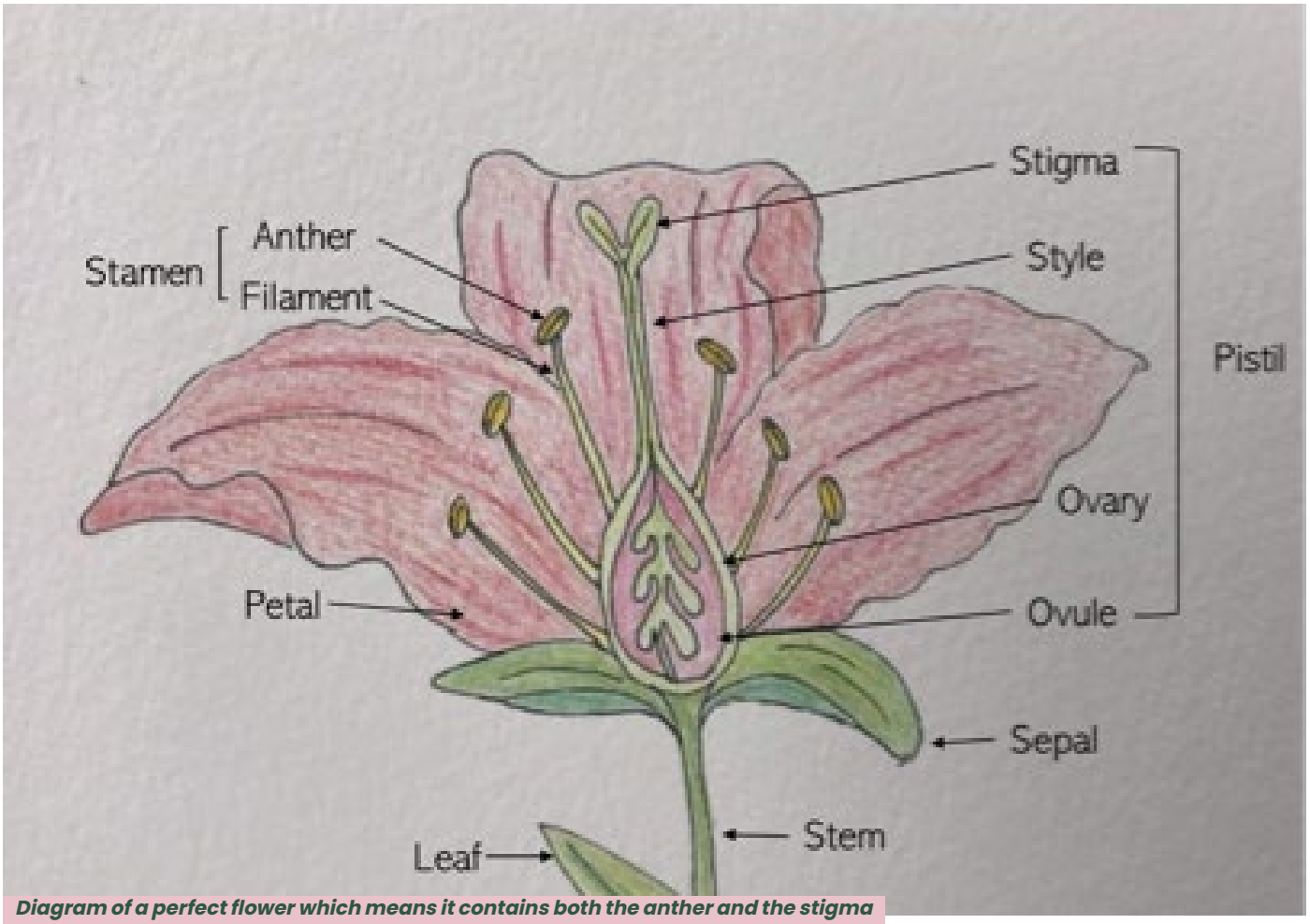


Diagram of a perfect flower which means it contains both the anther and the stigma

Where are the anthers and stigma in the flower in the diagram? Can you find them in real flowers too? Dissect real flowers in class to see the internal structures. Larger flowers work well such as daffodils, tulips, gladiolus or lillies. Be careful of lily pollen as it can stain.

Pollination involving animals (biotic)

Plants have evolved some clever techniques to ensure successful pollination. They often rely on insects or other animals to transfer pollen from one flower to another. Flowers that rely on pollinators are a bit like snack shops: they provide sugary nectar to drink or protein-rich pollen to eat and they advertise the nectar and pollen to attract pollinators by using bright colours and nice smells. Pollinators include bats, beetles, bees, butterflies, flies, moths, wasps and even small mammals.

Pollination without animals (abiotic)

Some plants use wind or water to transfer pollen instead of relying on pollinators. The flowers of these plants are often less conspicuous because they do not need to attract pollinators. Can you guess the method of pollination by observing the flowers of a plant? Have a go at the pollinator puzzle later on in this resource.

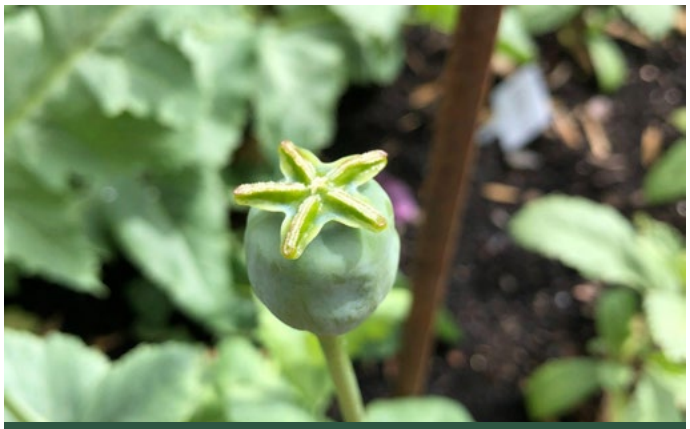
From flower to seed - a photo story

Showing the stages of flowering in a common poppy

Here is a poppy just before it flowers. This is called a flower bud. You can see the sepals protecting the flower until it is ready to open.

This is the poppy in full flower, ready to be pollinated.

It is a perfect flower - you can see lots of anthers surrounding the central stigma.



This is the poppy after it has been pollinated.

The anthers and petals are no longer needed and they have fallen off the flower head. Now you can see the swelling ovary (just below the star shape) that will be filling with seeds.

How do you think a poppy disperses its seeds?

Flowers and cross pollination

Some plants have flowers that contain both the anther and the stigma. Flowers that have both anthers and a stigma are called **perfect flowers**. A plant which has perfect flowers is often **self-pollinating** because the pollen needs only to travel from the anther to the stigma within one flower. Tomatoes and pea plants both have perfect flowers and are both self-pollinating.

When pollen travels from a flower on one plant to a flower on another plant, this process is called cross pollination. **Cross pollination** helps to keep genetic diversity high. Genetic diversity is a good thing, as it gives the population a better chance of survival.

Some plants have flowers that have either anthers or a stigma but not both. **Dioecious plants** - pronounced [DY] + [EE] + [SHUHS] are plants that only produce flowers that have anthers or flowers that have stigmas. This means the pollen must travel from one plant to another to create a seed. This means you need at least two plants to make seeds and that pollination is always cross-pollination. An example of a dioecious vegetable that uses wind as its primary means of pollination is spinach.

Monecious plants - pronounced [MO] + [NEE] + [SHUHS] have some flowers that only contain anthers and other flowers that only contain stigmas. For example, squash and courgette plants are monecious. For a courgette to grow, the pollen must travel from one flower with an anther to another flower with a stigma. This could happen on the same plant or pollen could be transferred to neighbouring plants. The word monecious is derived from ancient Greek meaning 'one house'. Both flowers with stigmas and the ones with anthers are found on the same plant, as though they share a home.

The flowers with anthers and the flowers with stigmas often appear at different times on one plant. This increases the chance of pollen being transferred from a flower on one plant to a flower on another plant.

This flower had only a stigma: at the base of the flower you can see the ovule has started to produce a small squash

Flower with only an anther: here you can see the anther covered in pollen but no stigma

Activity

Pollination Puzzle

Help these flowers to make their seeds. Look at the flowers in these pictures and use your observation skills to identify their main pollination method. Are they pollinated by insects, the wind or can they pollinate themselves without any help? What were the features of flowers that recruit pollinators? Have a look at page 11 to jog your memory. Answers are in Appendix 1. Head into the school grounds or a garden nearby to find some flowers and look at them closely to guess how they are pollinated.

How are these flowers pollinated? Self? Insect? or wind?

Sweetcorn *(Zea may)*

Answer

Tomato *(Solanum lycopersicum)*

Answer

Cosmos *(C.bipinautus)*

Answer

Salad Rocket *(Eruca sativa)*

Answer

Dill *(Anethum graveolens)*

Answer

Wheat *(Triticum. spp)*

Answer

Activity

When do plants make their flowers? Annual, Biennial and Perennial

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.

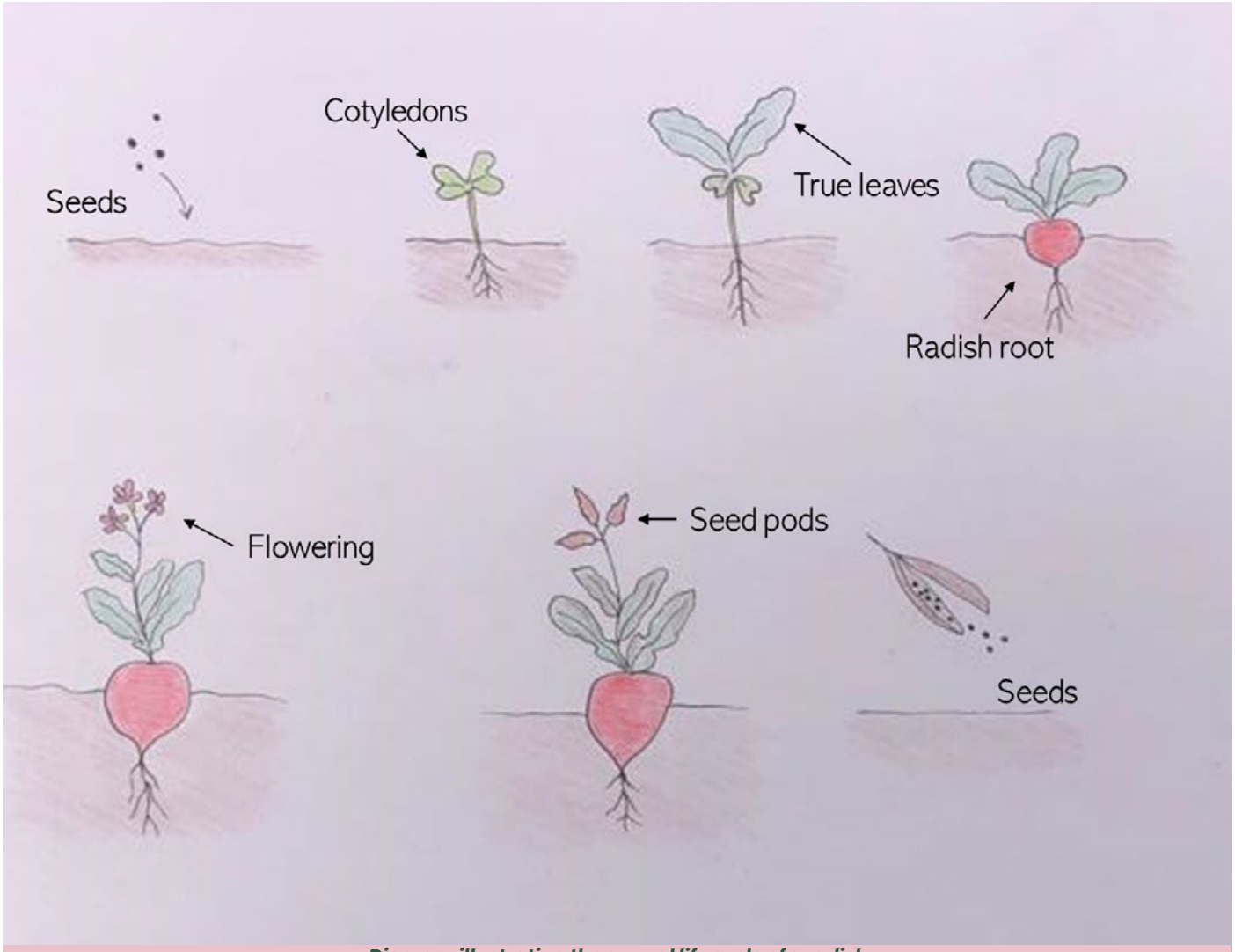


Diagram illustrating the annual life cycle of a radish

Biennial plants will complete their full life cycle from seed to seed over two years. Producing mainly vegetative growth such as leaves or roots in the first year. For example, a carrot will grow it's root in the first year, which is also when you would harvest a carrot to eat. The second year is when the root will grow flowers and produce seed.

Flowering in biennial plants can be triggered by environmental conditions such as experiencing a period of cold for a period of time, this is known as *Vernalization*. If you think about a carrot, it will spend its first year of growth producing a big root where it can store its energy over the cold and dark winter. After the carrot has experienced a period of cold temperature and spring is coming, it will put the energy stored in the root into producing a flower head which will appear during the summer when the pollinators are out. Examples of common biennial vegetables are: cabbages, onions, carrots, beetroot.

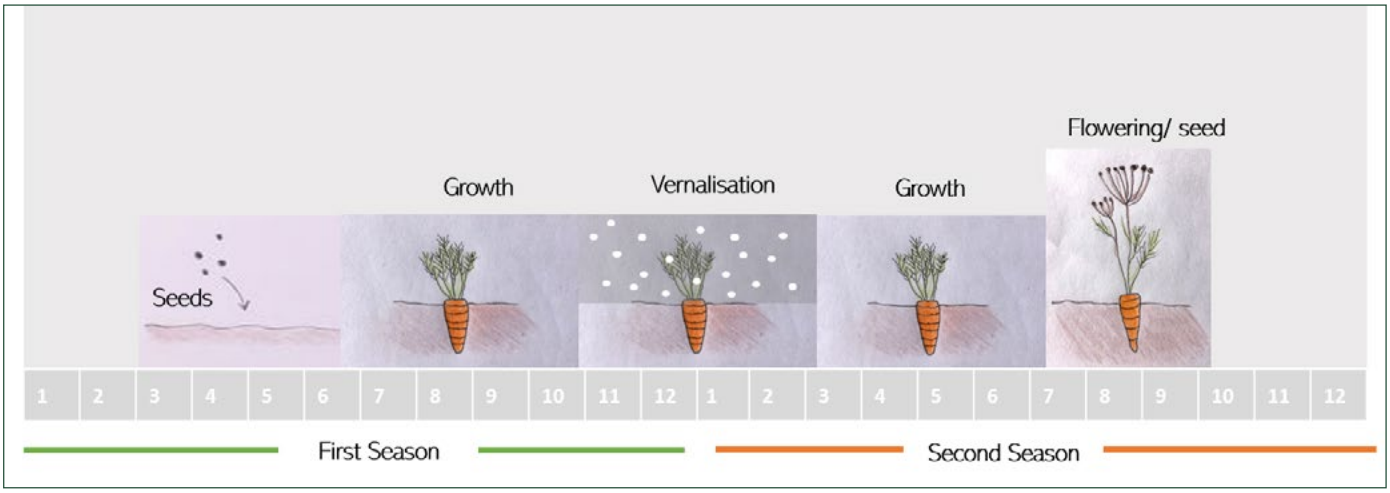


Diagram illustrating the biennial life cycle of a carrot.

Perennial plants live for over 3 years producing new vegetative growth each year and often die back over the winter. Most of the new growth is made at the base, or crown, of the plant. This means that perennial plants can often be multiplied by dividing these clumps (or crown) of the plant Rhubarb can be divided this way. Another example of a common perennial vegetable is Asparagus. Perennial plants do form seeds, but it will often take multiple years for them to do this, which is why dividing the crown can be a much faster way of producing more plants.

Rhubarb crown with new spring growth emerging

The origins of vegetables

All the vegetables and grains we currently eat have been selectively bred from wild plants by people over thousands of years through the processes of selection and saving seeds.

Our ancestors transitioned from hunter-gatherers into farmers around 10,000 - 12,000 years ago. Wild plant seeds were saved and planted. Farmers started to select their favourite plants, with the tastiest fruits or the largest leaves, or whatever characteristic they wanted to conserve and save seeds from them and share/swap seeds with others. This process of domestication continued over hundreds of generations as crops changed into what we recognise today.

The practical significance of saving seeds is clear if you save the seeds from some of your plants, you have food ready to plant for next year, you can take them with you to new ground, and you have better food security.

The wild ancestor of Sweetcorn is a plant called Teosinte. It is a grass native to central America with a small seed head of about 10-15 kernels. Modern domesticated sweetcorn can have over 500 kernels on it! Modern plant breeding has modified sweetcorn in recent years, but it was farmers saving seed that created it.

Sweetcorn plants growing outside in the Highlands.

What do kale, kohlrabi, broccoli, cabbage, Brussel sprouts, and cauliflower all have in common (apart from being very tasty with cheese sauce)? They all have a common ancestor, wild mustard *(Sinapis arvensis)*. Different parts of wild mustard are edible, and over generations of seed saving and selecting for different characteristics, distinctly different crops have evolved.

Crops developed from Wild Mustard

Cauliflower	Broccoli	Brussel Sprouts	Kale	Kholrabi	Cabbage
					
Flower clusters	Flower Buds	Lateral Buds	Leaves	Stem	Terminal Buds

Vegetable Family Tree

How closely related are a turnip and a parsnip? There is a system of biological classification for living things called taxonomy, like a sort of family tree, to categorise plants and animals. This system allows us to see how closely related different organisms are.

There is also a system of naming things to show relationships and so we understand exactly what organism is being spoken about. Each organism has a two-word name in Latin (in addition to the name you might know it by). The Latin name system is understood around the world, and it helps to avoid confusion with local names for things. The first word of the name is a generic name and tells you what genus (or branch of the family) it belongs to, and the second word is it's specific name and tells you what species it is.

It is useful to take note of the botanical (Latin) names of plants. Plants with the same botanical names, even though they may look quite different, will cross-pollinate with each other causing unexpected plants in the next generation. For example: *Brassica oleracea var. capitata (cabbage)* and *Brassica oleracea var. italica* (broccoli) will readily cross-pollinate when flowering and should be given sufficient isolation distance from each other.

At the same time, some plants that may look quite similar will not cross-pollinate with each other. For example *Brassica napus* (swede) and *Brassica rapa* (turnip) will not cross-pollinate when flowering and can be grown next to each other.

Plants are categorised according to their Family, Genus, Species and their variety. The *variety* is linked to a population of cultivated plants that have been selected to have specific traits. For example 'Shetland kale' cabbage has been selected to grow well in Shetland. See Appendix 2 – Latin names of common vegetables for more examples.

Shetland kale plant

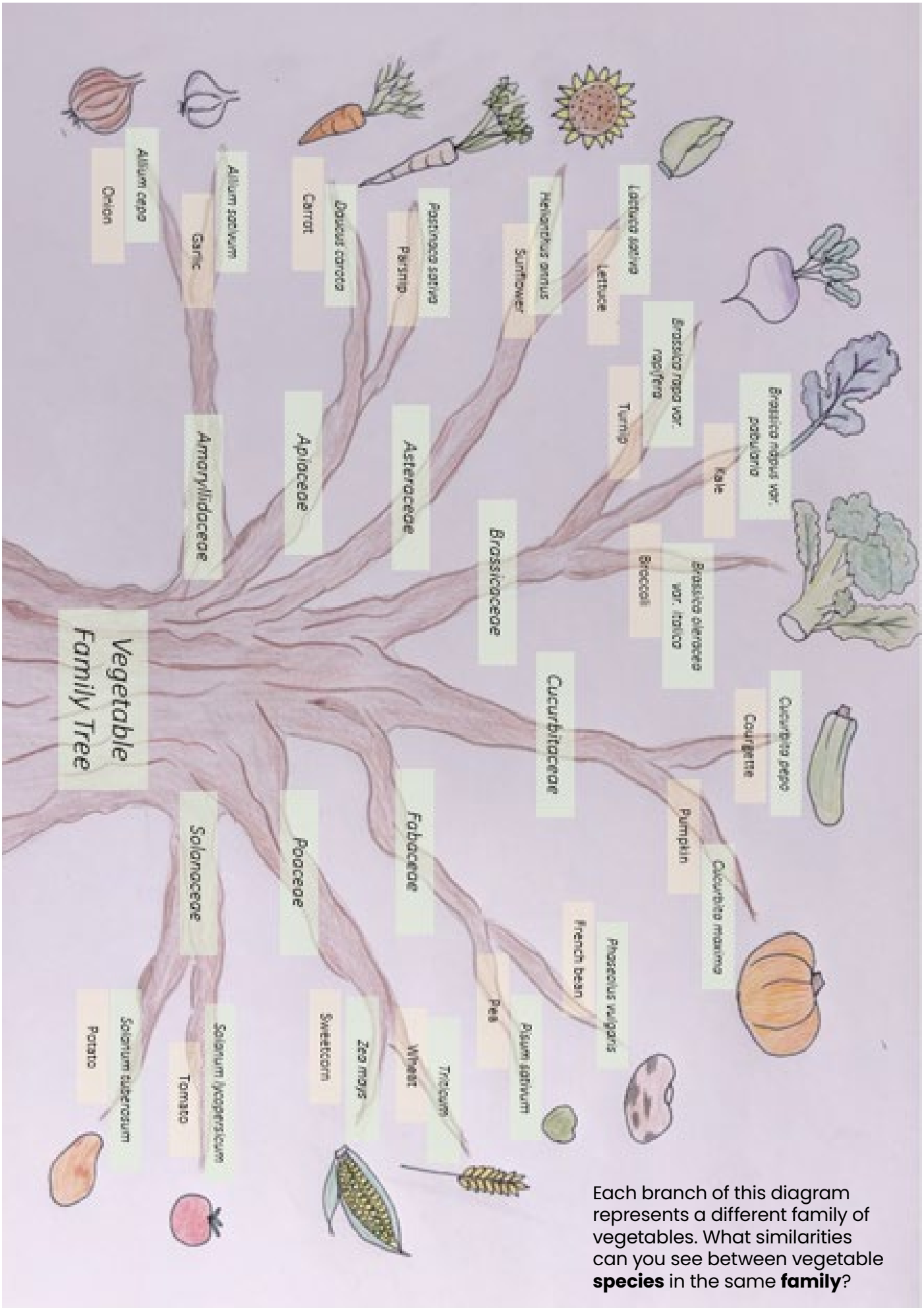
Here's the family tree of Shetland kale:

Variety - *Brassica oleracea var. capitata* – Shetland kale

Species – *Brassica oleracea var. capitata*

Genus – *Brassica oleracea*

Family – *Brassicaceae*



Each branch of this diagram represents a different family of vegetables. What similarities can you see between vegetable **species** in the same **family**?

Vegetable Family Traits

Just as we can share characteristics with our own families and relatives, there can be similarities between the members of each vegetable family. They may have similar features or prefer the same growing conditions. They may share the way they taste and have similar effects on our bodies and digestion. This sort of information is helpful if you have food intolerances.

Amaryllidaceae (Onion and Lily family)

Onions, garlic, leek and chives are all in this family alongside inedible flowers such as daffodils. They have long leaves that grow vertically and underground stems or bulbs. Many members of this family are grown from immature bulbs, called sets, as it's quicker than growing them from seed.

Apiaceae (Umbel Family)

The flowers are arranged in clusters, or umbels, where the stalks are the same length, so they make a sort of flat landing pad for bees and butterflies. Most of crops in this family are harvested before they form flowers.

Asteraceae (Daisy family) sunflower and lettuce

A diverse family that includes lettuce, and artichoke. It's members have daisy flowers, although, like the apiaceae family many crops will be harvested before the flowers appear.

Brassicaceae (Brassica or Cabbage Family) turnip, kale, broccoli

This family has the widest variety of edible species. Some brassicas have cross-shaped flowers with four petals and can also be called part of the Cruciferae family. If you'r growing brassicas, they like rich soil and lots of water.

Cucurbitaceae (Squash or Gourd Family) courgette, pumpkin

It is vegetable or is a fruit? This family sits at the border of the two. There are courgettes, pumpkins and squash but also cucumbers and melons. They tend to have large flat seeds, large leaves and bright orange flowers. Water them well and give them space and a warm place to grow.

Fabaceae (Legume or Pea Family) beans, peas (lentil)

Peas, beans and lentils are in this family. Their seeds are produced in pods and their super-power is that they can fix nitrogen into the soil through nodules on their roots. Great for the soil!

Poaceae (Grass Family) wheat, corn

This family has the world's major grain crops including wheat, corn, oats, rice and barley. Lots of animals can eat the leaves, but humans eat the seeds, mostly processed in some form.

Solanaceae (Nightshade Family) tomatoes, potatoes

This family has familiar plants such as tomatoes, chillies, peppers and potatoes. Tatties are quite different to its relatives as it is grown from seed potatoes, which aren't seeds in the normal sense. This means that the variety you grow will be true to type. Some of the vegetables in this family have low levels of toxin in their leaves, so eat only the fruits!

Activity

Veggie Card Games

Here are four games you can play. First you need to make the cards. Print out the cards below. Some are blank for you to make your own cards of other vegetables. Pupils can draw each vegetable on the reverse of the card.

Family tree: Use the cards to re-create a vegetable family tree.

Snap: Use the cards to play snap. Call snap when you have a vegetable from the same family.

Plan your garden - plan your garden using the cards. This could be as simple as thinking about size and shape of plants that might fit next to each other or taking it a step further and planning to save seed from a couple of plants and making sure you have adequate isolations distances and minimum population size.

Make a meal: Draw a plate or a pot or a pizza base and pupils can then place vegetables into the pot to create a soup or a pizza with their own mix of toppings.

Courgette

Latin name: *Cucurbita pepo*
Family: *Cucurbitacea*
Life cycle: Annual
Pollination: insect

Cabbage

Latin name: *Brassica oleracea*
Family: Brassicacea
Life cycle: Biennial
Pollination: insect

Tomato

Latin name: *Solanum lycopersicum*
Family: *Solanaceae*
Life cycle: Annual
Pollination: self or insect

Pepper

Latin name: *Capsicuum annuum*
Family: *Solanacea*
Life cycle: Annual
Pollination: self or insect

Aubergine

Latin name: *Solanum melongena*
Family: *Solanaceae*
Life cycle: Annual
Pollination: self or insect

Tattie

Latin name: *Solanum tuberosum*
Family: *SSolanaceae*
Life cycle: Annual
Pollination: self or insect

Runner bean

Latin name: *Phaseolus coccineus*
Family: *Fabaceae*
Life cycle: Annual
Pollination: insect

Spinach

Latin name: *Spinacia oleracea*
Family: *Chenopodiaceae*
Life cycle: Annual
Pollination: wind

Dill

Latin name: *Anethum graveolens*
Family: *Apiaceae*
Life cycle: Annual
Pollination: insect

Broccoli

Latin name: *Brassica oleracea*
Family: *Brassicacea*
Life cycle: Biennial
Pollination: insect

Sunflower

Latin name: *Helianthus annuus*
Family: *Asteraceae*
Life cycle: Annual
Pollination: insect

Carrot

Latin name: *Daucus carota*
Family: *Apiaceae*
Life cycle: Biennial
Pollination: insect

Sweetcorn

Latin name: *Zea mays*
Family: *Poaceae*
Life cycle: Annual
Pollination: Wind

Turnip

Latin name: *Brassica rapa*
Family: *Brassicacea*
Life cycle: biennial
Pollination: insects

kale

Latin name: *Brassica oleracea*
Family: *Brassicaceae*
Life cycle: biennial
Pollination: insect

Pumpkin

Latin name: *Cucurbita maxima*
Family: *Cucurbitacea*
Life cycle: Annual
Pollination: insect

Rocket

Latin name: *Eruca sativa*
Family: *Brassicaceae*
Life cycle: Annual
Pollination: insect

Onion

Latin name: *Allium cepa*
Family: *Amaryllidaceae*
Life cycle: Biennial
Pollination: insect

Pea

Latin name: *Pisum sativum*
Family: *Fabaceae*
Life cycle: Annual
Pollination: Self

Beetroot

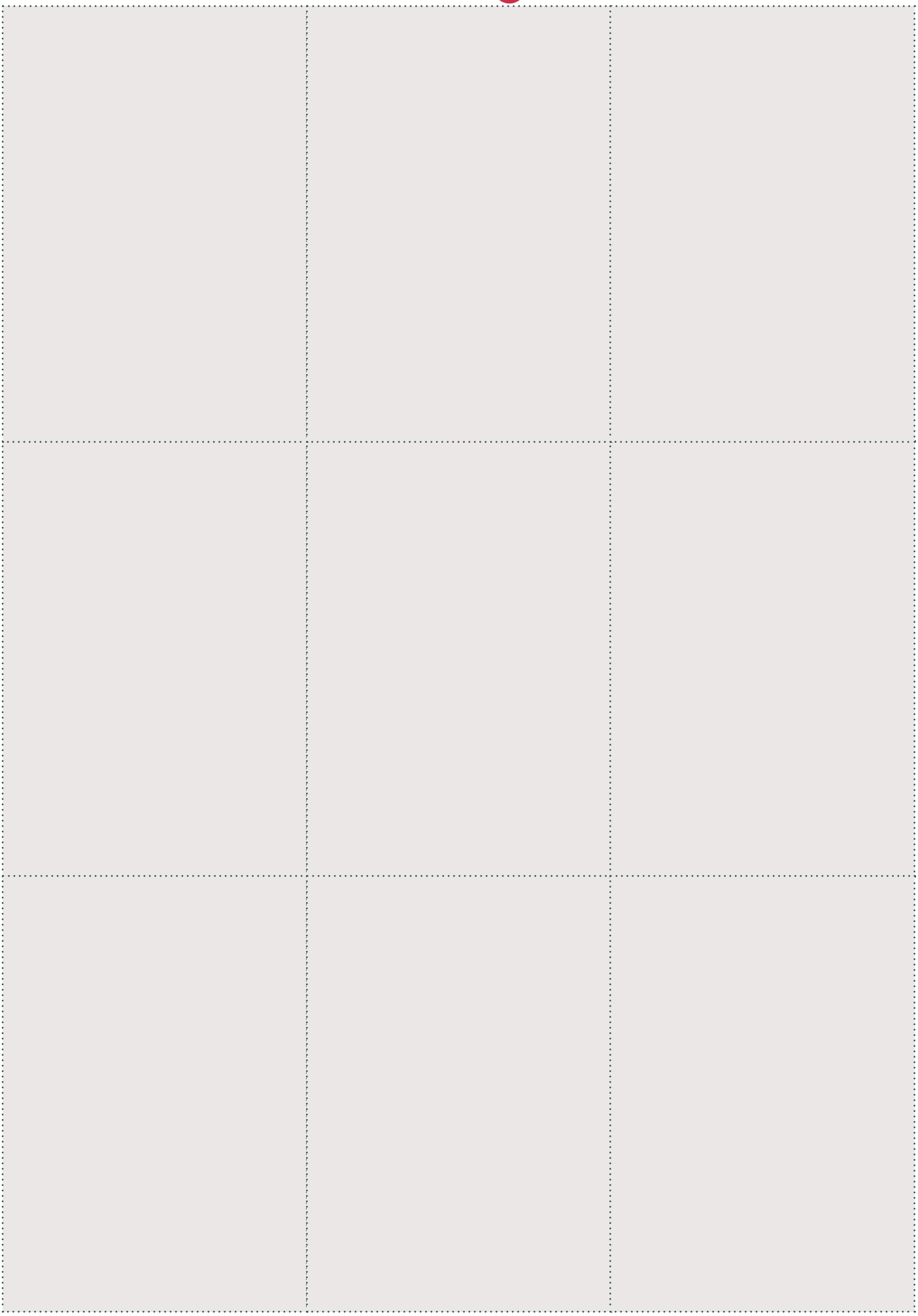
Latin name: *Beta vulgaris*
Family: *Chenopodiaceae*
Life cycle: Biennial
Pollination: Wind

Wheat

Latin name: *Triticum spp.*
Family: *Poaceae*
Life cycle: Annual
Pollination: Self

Lettuce

Latin name: *Lactuca sativa*
Family: *Asteraceae*
Life cycle: Annual
Pollination: self



Culture and crops

Food cultures and rituals have evolved around and alongside crops. An account of a seed's history and the expectation of its future is passed on over generations. These stories, which are entwined with the seeds and the plants that grow from them, are just as important as the seeds themselves.

Auld Maunsies Crö is a poem written in Shetland dialect which talks about the importance of Shetland Kail (kale) to the community and traditions of Shetland. In the poem, there are references to the practices that were used when planting the Kail as well as the structures used, namely 'Crö's'.

A Crö is an enclosure built from stone to keep animals in or to protect vegetable crops from other animals that eat them. The poem also references how the kail would be eaten, local superstitions and how important religion was to the islanders. The Crö would also be used as a navigational point for boats, a shelter for animals as well as an aid to help tell the time. His Crö and the Kail within it was very much the centre of the community.

Here is a website link where the Auld Maunsies Crö can be heard and read:
https://www.shetlanddialect.org.uk/auld-maunsies-cro

You can explore local stories or physical structures that are part of local food culture. Bring them together in a local food culture recipe book.

The importance of seed saving

Do some seed saving...

Nowadays, saving seeds has become less common among many gardeners in the UK. The knowledge is not being passed down from generation to generation as it was previously. By saving seeds you are also saving stories and that knowledge.

Seeds saved in your locality will also be better adapted to your weather and growing conditions. Seeds bought in garden centres may be produced far away. Saving your own seeds means that over time you can develop your own tastes, colours and shapes of veg. It is very satisfying.

The Story of Nicolay Vavilov (1887-1943) Moscow, Russia

Vavilov developed a theory that plants were not just domesticated somewhere in the world at random, but that there were regions where domestication started. These areas where domestication started contained the most diversity in plants.

To prove his theory, he travelled all around the world seeking out where diversity could be found in local crops. Whilst travelling he would also collect specimens of plants and seeds which would be studied and sent back to be stored at the the Vavilov Institute of Plant Industry in Leningrad where he was the director.

One example of his travels was when he went to Kazakhstan. He arrived in the outskirts of the city of Almaty where he found incredibly diverse forests of apple trees, some trees were tall, some trees were short, some apples were tasty, and some apples were not. By observing the diversity and talking to the local people he determined that the wild apple trees that he saw growing there were in fact where all the modern apples we can buy now originate from. Almaty is now the largest city in Kazakhstan, it was formerly known as 'Alma-Ata' which translates as 'Father of Apples'. His theories about the apples in Kazakhstan have now been confirmed by modern genetic techniques.

He made his incredible discoveries against the backdrop of a tumultuous time in Russian history. Early in Vavilov's life, Nicholas II was crowned as the last Tsar of Russia. In 1918, towards the end of the first world war, Nicholas II was overthrown in the Bolshevik revolution which transformed Russia into a socialist state. Vavilov was appointed director of the Vavilov Institute of Plant Industry during a period of severe famines in Russia. The institute and its staff would later survive the 28-month long siege of Leningrad by the Nazis during WW2. Many of its workers starved to death whilst protecting the precious seeds inside, knowing the importance that these seeds may have for future generations. Vavilov eventually lost favour with Joseph Stalin and was imprisoned in a gulag camp where he later died, possibly of starvation.

The Vavilov Institute still carries one of the world's largest collections of seeds and is based in modern day St Petersburg.

Activity

Seeds that feed us

Here are a couple of ways to make the connection between seeds and food for people. How much do we eat that depends somehow on seeds growing? Consider what would happen if seeds stopped working or if we didn't have insects to pollinate flowers to make the seeds. Start with a collection of food items or pictures including raw and processed food items and sort them into different categories of:

1. Which ones come from seeds?
2. Which ones are seeds?

Suggested items: a coconut, pumpkin seed, avocado, potato, pasta, apple, carrot, lettuce, bread.

Some food items have lots of ingredients. Deconstruct some popular meals, thinking about all the ingredients and how they can be traced back to seeds.

Let's take the example of Pizza:

- Pizza bases are made from flour which is often made from wheat. Wheat is grown from seed.
- Pizza sauce is made from tomatoes, maybe garlic and some herbs. All of these are plants that are grown from seeds.
- The cheese on top of pizza is often made from milk produced by cows. Cows eat grass to give them the energy to produce milk. The grass has grown from seeds.
- Salami or ham comes from pigs; What are the pigs fed? Often corn or soya, both of which have been grown from seeds.

Appendix 1

Answers to the Pollination Puzzle activity on page 18?

Sweetcorn *(Zea mays)*

Answer - Wind

Tomato *(Solanum lycopersicum)*

Answer - Self pollinating or insect

Cosmos (C.bipinautus)

Answer - Insect
Could be Nasturtium (Tropaeolum majus)
Answer – self pollinating or insect???

Dill *(Anethum graveolens)*

Answer - insect

Salad Rocket *(Eruca sativa)*

Answer - Insect

Wheat *(Triticum. spp)*

Answer - Self pollinating

Appendix 2

1. **Amaryllidaceae (Onion and lily family)**
   a. *Allium cepa* - Onion
   b. *Allium schoenprasum* - Chives
   c. *Allium sativum* - Garlic
   d. *Allium ampeloprasum* - Leek
2. **Apiaceae (Umbel family)**
   a. *Daucus carota var, sativa* - Carrot
   b. *Pastinaca sativa* - Parsnip
   c. *Petroselinum crispum* - Parsley
   d. *Anethem graveolens* - Dill
   e. *Foeniculum vulgare* - Fennel
   f. *Apium graveolens* - Celery
3. **Asteraceae (Daisy family)**
   a. *Lactuca sativa* - Lettuce
   b. *Helianthus annuus* - Sunflower
4. **Brassicaceae (Brassica or Cabbage Family)**
   a. *Brassica oleracea var. Italica* - Broccoli
   b. *Brassica oleracea var. Gongylodes* - Kohl rabi
   c. *Brassica oleracea var. Capitata* - Cabbage
   d. *Brassica oleracea var. Botrytis* - Cauliflower
   e. *Brassica rapa var. rapa* - Turnip
   f. *Brassica napus* - Swede (Neep)
   g. *Raphanus sativus* - Radish
   h. *Eruca sativa* - Rocket
5. **Chenopodiaceae (Beet Family)**
   a. *Beta vulgaris* - Beetroot / Chard
   b. *Spinacia oleracea* - Spinach
6. **Cucurbitaceae (Squash or Gourd Family)**
   a. *Cucurbita maxima* - Pumpkin
   b. *Cucurbita pepo* - Courgette
   c. *Cucurbita moschata* - Butternut squash
   d. *Cucumis melo* - Melon
   e. *Cucumis sativus* - Cucumber
7. **Fabaceae (Legume or Pea Family)**
   a. *Pisum sativum* - Peas
   b. *Vicia faba* - Broad Bean
   c. *Phaseolus vulgaris* - French Bean
   d. *Phaseolus coccineus* - Runner Bean
8. **Poaceae (Grass Family)**
   a. *Zea mays* – Sweetcorn
   b. *Triticum* - Wheat
9. **Solanaceae (Nightshade Family)**
   a. *Capsicum annuum* - Bell pepper
   b. *Solanum lypersicum* - Tomato
   c. *Solanum melongena* – Aubergine
   d. *Solanum tuberosum* - Potato

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.