

Plant Reproduction



Basic Plant Botany

Annuals, Biennials and Perennials

- **Annuals:** plants that go through their entire lifecycle through to setting seed in one growing season.
- **Biennials:** plants whose lifecycle spans two years, so they flower and produce seeds in their second year.
- **Perennials:** live for more than two years.

Flower Structure.

The process of creating seeds involves flowers, which carry the male and female reproductive organs.

- The **male part of the flower** is called the stamen. Each stamen consists of a filament, at the tip of which is the anther. It is the anther which produces the pollen grains.
- The **female part of the flower is called the pistil**, which is divided into the stigma, the style, and the ovary. The ovary contains one or more ovules, or egg cells. The stigma is the part of the pistil that is receptive to pollen grains.

When a fertile pollen grain lands on a receptive stigma, the pollen grain forms a tube that grows through the style until it reaches the ovary, where it fertilises one of the ovules. Eventually, the ovary forms the fruit or seed pod, while the fertilised ovules develop into seeds.

Often the male and female parts are contained within a single flower. This is called a perfect **flower**. They can be inbreeders (self-pollinate), out breeders or partial inbreeders/out breeders.

Sometimes, male and female parts are on separate flowers. These are **imperfect flowers**. The offspring will contain a mixture of traits from the male and female flowers.

- They may be formed on a single plant in which case they are termed **monoecious**. E.g. curcubits/squash/sweetcorn
- They may be carried on separate male and female plants. These are called **dioecious**. E.g. spinach

Pollination and Isolation

Pollination Vectors

Self-pollination can occur in a perfect flower. Pollen can also be transferred to the stigma by insects and wind, animal or by water.

The three main vectors for pollination that concern us are:

- **Self-pollinating** – e.g. French Bean, Lettuce, Pea, most, but not all, tomatoes.
- **Insects** – e.g. Onion, Cabbage. Attractive coloured, showy flowers or scent.
- **Wind** – e.g. Sweetcorn, Beetroot, Spinach. Can often tell by the flowers for wind pollinated things – they do not have features to attract pollinators such as scent and colour, fine and many pollen, features for capture of wind-blown pollen e.g. sticky strands of sweetcorn.

If the pollen and ovules are from different varieties, the resultant seed will be a mixture of those two varieties, rather than a characteristic member of a particular variety (i.e. not true to type). **Cross pollination will occur.**

Isolation

To prevent cross pollination we need to '**isolate**' one variety of the same vegetable from another.

Examples of physical isolation, poly tunnels, cages, individual mesh bags, high hedges and buildings.

- **Mesh size for isolation:**
 - 1.3mm x 1.3mm e.g. for cabbage white, bees, flies etc.
 - 0.22mm x 0.8mm will help to prevent whitefly
- **Drawbacks**
 - Reduced light, increased heat, fungal growth (wet and warm), pests can multiply without predators such as birds.
 - 30% reduction in airflow and 20% reduction in light.
- **Mesh and paper bags:** Possible to isolate individual flowers using mesh bags, and parchment paper bags. These work particularly well to isolate with squash and sweetcorn flowers.
- **Physical barriers:** High buildings, hedges and woodland can be effective but it's hard to ensure that they will be completely fail safe.

N.B. once your variety has been isolated, pollinators or hand pollination will need to be introduced in order to produce seed.

Other ways to isolate your crop? Distance and time.

- **Distances isolation:** Distances that reduce the risk of pollen travelling by insect or wind.
- **Time isolation:** The most successful and simplest way to isolate a crop if you only plan to grow only one variety in a year. Or alternatively you can stagger crops within a year - sow one variety earlier than a later variety so that they do not flower at the same time. E.g. broad bean: sow in October and March
- **Works particularly well on isolated sites and quite well for biennials.** Need to take in to account what others near you are growing. An isolated site will have less risk of cross contamination but be aware of wild flowers on your site. Such as wild carrot, and radish.
- **Biennials** are generally eaten in their first year so there is less risk of contamination from neighbouring crops grown for food. Possible to grow a carrot in the first year for food and have one growing in the second year for seed.

Inbreeders and Outbreeders

Inbreeding Depression

Depending on the vegetable type, a sufficient population size is **essential to maintaining a healthy & genetically diverse population.**

For, inbreeding, self-pollinators this is less of a problem. However, **for natural out breeders, continuous inbreeding will result in a decline in vigour, size, fertility and yield of the species involved – INBREEDING DEPRESSION.**

Inbreeders

Pollen transfers from the stamen to the stigma within the same flower. Self-pollinating varieties with perfect flowers are the easiest plants to start saving seeds from in the sense that do not readily cross-pollinate with other varieties – so remain true to type. Known as “**inbreeders**”.

- Inbreeders will **happily self-pollinate** without risk of inbreeding depression so you can save seed from just a few plants. **E.g. Peas, French beans and some tomatoes.**
- **An idea of range:** Peas and French beans, a minimum of 10 plants and tomatoes, 6 plants.

Partial Inbreeders/Outbreeders

These are vegetables with flowers that are perfect but cross-pollination can occur quite easily because the flowers attract insects.

- **E.g. Broad bean, some tomatoes, peppers, lettuce.**
- **An idea of range:** Lettuce 10, broad bean 24 and runner bean 20-30

Outbreeders

Out breeders either have perfect flowers that are self-incompatible (e.g. onions) or they have imperfect flowers with the male and female parts on separate flowers on the same plant or on separate male and female plants . All need another flower to pollinate and set seed.

- They can cross pollinate very readily with other varieties, meaning that they can easily produce seed that is not 'true to type'.
- **Continuous inbreeding in natural out breeders will result in inbreeding depression.** The result of which will be a decline in vigour, size, fertility and yield of the species.
- As a general rule, out breeders need larger population sizes
- They show more variation across a variety than inbreeders.
- Brassicas, carrots, beetroot, onions, leeks, sweetcorn and cucurbits are all outbreeders.
- **An idea of range:** Brassicas ideally 100, sweetcorn 100 or more, onions 20. Cucurbits are an exception and don't seem to suffer from inbreeding depression quite as much. Minimum population of 6.

Specific population sizes of most vegetable crops can be found in the Heritage Seed Library Seed Saving Guidelines

www.gardenorganic.org.uk/seed-saving-guidelines

