

Heritage Seed Library



Seed Saving Guidelines

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Introduction to the Heritage Seed Library

Garden Organic's Heritage Seed Library (HSL) aims to conserve and make available vegetable varieties that are not widely accessible. HSL maintains a collection, mainly of UK and Northern European varieties, that are not readily offered by seed catalogues. Some of the varieties were once commercially obtainable, but have now disappeared from seed catalogues. Others have never been offered in catalogues, but have been developed by gardeners and passed down through the generations before being donated to us. There are also varieties with special local significance. Many have a story to tell. We also collect information on their characteristics, methods of use, origins and history.

We are not a gene bank, simply preserving seeds in cold storage, but a 'living collection', growing the seeds and making them available to gardeners.

We are not legally able to sell our seed. Under UK law only seed included on the UK National List can be marketed. To be on the list a variety must go through a series of tests, termed DUS tests. The D stands for distinct, as in different from another variety, the U for uniform, or all plants are the same, and the S for stable, which means the same over generations. Many of the varieties we hold would not pass these tests, as they are inherently variable. The tests also cost money, and there is an additional cost for maintaining a variety on the list.

With the costs incurred in breeding and maintenance of a variety, a large, profitable market is a necessity. This means that seed companies often decide against 'niche markets', e.g. gardeners, in favour of large-scale growers. The varieties available are therefore tailored to their requirements, that is, they ripen at the same time to make mechanical harvesting easier, are tough enough to withstand transportation and supermarket handling, and are visually familiar to appeal to the average shopper. Flavour often takes a back seat.

Those who wish to support our conservation activities pay an annual subscription which entitles them to select six free packets of seeds from our annual seed list.

Currently we have around 800 accessions of open-pollinated varieties (not F1 hybrids), of which around 150 are included in the seed list each year. We produce about 50% of the seed at our gardens at Ryton.



Tomato diversity

The other 50% is grown by Seed Guardians, members who volunteer to grow seeds of selected varieties, on our behalf.

The collection is expanding. Every year we receive vegetable seeds that have been grown and conserved by gardeners. Each is grown at Ryton and a series of trials carried out, botanically examining characteristics and carefully researching its history. This gives us the opportunity to ensure that it is unique within the collection, is not obviously diseased, has not cross-pollinated and is something that gardeners would be interested in growing. If it passes all of the tests then we add it to the collection.

Why is important to conserve these varieties? Why do we do it? If it wasn't for the work of the HSL many of these varieties would vanish. Since the introduction of the seed legislation in the mid 1970s untold hundreds, potentially thousands, have been lost. Open-pollinated varieties are very genetically diverse, having great capacity to adapt to changing conditions, climate for example. Our food supplies are susceptible not only to changing weather conditions but also to pressure from pests and disease. This has been prevented in the past by increasing pesticide usage and currently with the introduction of genetically modified crops.

Consumer choice is also important; not everyone wants to grow and eat the same things. Tough skinned tomatoes reach the supermarkets in tact, but may not always have the best flavour. Commercially catalogues have a tendency to play to the masses, but why shouldn't consumers have access to the diverse range of vegetables that are out there? We think that they should.



The methods we use for growing, harvesting, cleaning and packeting are very similar to those that you can use at home. Most is done by hand using familiar household tools. The HSL team and a band of dedicated volunteers on site assist us in a variety of tasks enabling production of the 40,000, or so, packets of seeds we distribute to our members each year.

Biodiversity is now high on the international agenda, with seed legislation currently under the spotlight. The HSL is involved with various national and international groups, and

contributing to discussions and consultations with government departments and other parties interested in biodiversity. In the meantime the HSL is here, with the support of our members, to keep our vegetables alive and growing.

Seed Saving Guidelines

Why Save Seed?

Different people save seed for different reasons. Some do it to preserve a link with the past, growing a variety their parents grew or one peculiar to the place they live. Some do it to assure themselves a supply of seed of a variety no longer available. Some are making a deliberate stand against current trends in the seed industry. Some, like the Heritage Seed Library's Seed Guardians, do it in order to conserve heritage varieties and produce seed that can be given to others. Seed saving completes the cycle of organic growing and for some saving seed is an opportunity to save money, manage their own seed supplies or even breed new varieties.

Genetic Erosion

Perhaps the most pressing reason to save seeds of a wide range of vegetable varieties is to keep them alive and in use. Seed banks and plant breeders' collections preserve diversity, but they are not currently open to the general public who want to grow those varieties. While seed catalogues offer new, improved varieties every year, the reality is that the choice continues to narrow, as does the genetic pool from which they are bred.

The main reasons for this loss of diversity are a mixture of legal and commercial pressures. However, the result of genetic erosion is a loss of choice for the grower and an increase in genetic uniformity in the fields.

Dangers

There are several problems caused by genetic erosion.

Food Security

With uniformity, both genetically and in the form of mono cropping, comes the increased risk of a pest or disease wiping out a whole planting. With uniformity can come limitation in buffering an attack. Many of the varieties currently relied on for our food supply lack the range of genetic information to allow them to adapt to new and changing conditions.

The Environment

Modern varieties have been bred to tolerate, and require, large doses of chemical pesticides and fertilisers. These can persist in the environment and many have the potential to cause harm to humans and other organisms.

Choice

For many producers the main reasons for growing particular varieties is ease of harvest and ability to travel, rather than flavour. Flavour of the month is dictated by what is on offer and what is available, and this is constantly changing. What if your choice isn't on the producers' or seed companies' top ten?

Global Changes

Uniformity in varieties also doesn't take into account the effect of climatic variations. Local varieties were more common because they grew well in the areas where they were bred.

With changes in climate, pests and diseases, and agricultural practices (the needs for organic farming are very different) choice in varieties will be necessary. When a variety disappears so do those potentially useful characteristics, which we may not yet even, know about, and once they are gone there is little chance that they will ever be recovered.

Solutions

Currently, seeds are stored long-term in gene banks. This effectively freezes the genetic information held within them, providing reference for the future. However, they are only grown out periodically, often many years apart, in order to refresh stocks, so some characteristics may not be known or noticed. Presently these seeds tend to only be available to plant breeders, plant scientists, and researchers but not the general public.

Amateurs can save their own seed, as has been done for thousands of years, well before the advent of large seed companies and modern agriculture. By doing this gardeners have control over their own food. Saving your own seed each year allows your varieties to adapt to your own specific conditions. You will also be able to note any interesting or useful characteristics, such as pest or disease resistance.

There are many ways this seed can be distributed, either through seed schemes like the Heritage Seed Library, or seed swap forums, many of which can now be found on the Internet. Saving seed and growing your own food makes sense for a sustainable future.

Preserve seeds by using them, saving them, and passing some on.

Seed Saving Guidelines

Basic Botany for Seed Savers

Classification

All living things are classified in a hierarchical system, the development of which was started in 1727 by Swedish scientist Carl Linnaeus. Linnaeus used two names for every kind of living thing. The first name is the genus; plants that are very like one another, for example the runner bean and the French bean, share the same genus, *Phaseolus*. The second name is the species; runner beans are *Phaseolus coccineus*, while French beans are *Phaseolus vulgaris*. Because everything has two names, the Linnean naming method is called the binomial system.

There are other systems of classification, above and below genera and species. Genera that share similar characteristics can be grouped into families, which in turn can be grouped into orders and then classes. Classes may be grouped into divisions (or phyla). The whole realm of classification is very like the outline of a great tree, with a few great limbs (orders); more branches, and hundreds of thousands of twigs (species).

Below species level may be yet another grouping. So beetroot and chard are both *Beta vulgaris*, but beetroot is *Beta vulgaris* var. *conditiva*, while chard is *Beta vulgaris* var. *vulgaris*. Lower still are cultivated varieties or cultivars. Thus there is a beetroot cultivar called 'Green Top Bunching' (full name: *Beta vulgaris* var. *conditiva* 'Green Top Bunching') and another called 'Detroit' (full name: *Beta vulgaris* var. *conditiva* 'Detroit').

The level at which seed savers are concerned is the preservation of the essential qualities that distinguish one variety from another.

Flowers

In order to create seeds, a plant must mate. This process involves flowers, which carry the male and female reproductive organs. Often the male and female parts are contained within a single flower. This is called the **perfect** flower. Sometimes, male and female parts are in separate flowers. These are **imperfect** flowers and may be formed on a single plant in which case they are termed **monoecious** (Greek: mono, one; oikos, household), or they may be carried on separate male and female plants. These are called **dioecious** (two households).



- Squashes are monoecious, with male and female blossoms on a single plant.
- Spinach is dioecious, with separate male and female plants.
- Peas are perfect, with male and female parts in a single flower.

The male part of the flower is called the stamen, and the number of stamens is characteristic to each plant species. Each stamen consists of a filament, at the tip of which is the anther. It is the anther that 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. It may be a sticky, knob-like structure at the end of the style, or it may be a long portion of the style, as in the silken tassels of corn.

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 fertilises one of the ovules. Eventually, the ovary forms the fruit or seed pod, while the fertilised ovules develop into seeds.

Pollination

For seeds to develop, pollen must be transferred from the anthers to the stigma. There are exceptions, called **parthenocarpic** plants (Greek: parthenos, virgin; karpos, fruit) but they do not concern us here.

Pollen and ovules carry the genetic messages from the male and female plants respectively. Sexual reproduction shuffles those messages, producing offspring that contain a mixture of traits from mother and father. If 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).

Seed savers must ensure that a variety remains pure by restricting the source of the pollen to the same variety as the ovule.

Some perfect flowers fertilise themselves. The anther may sweep past the stigma, as they do in the nasturtium, or the stigma may grow past the anthers, as in the tomato. Sometimes fertilisation takes place before the flower opens, as in the pea; this is called **cleistogamy** (literally, closed marriage).

For seed savers, self-fertilisation may make life easy, as in peas and most tomatoes, but these can also be cross-pollinated in certain circumstances. Finally, a flower may be self-incompatible; it is not capable of pollinating itself and must be cross-pollinated.

Cross-pollination generally requires something to transfer pollen from one flower's anthers to another flower's stigma. That something may be wind, water, or an insect or animal.

- Wind is the most difficult agent to control. Pollen is very fine and can be carried long distances.
- Water is not important for pollinating domestic crops.
- Pollinating insects, such as bees, are easier to manage. Often, they can be kept away from flowers with a simple cage or bag. In other cases, the seed saver may have to introduce substitutes for the natural pollinators. See the Seed Saving Guideline No. 3 Preserving Varietal Purity or the individual Seed Saving Guidelines relating to each vegetable type for more information on how to do this.

Seed Saving Guidelines

Preserving Varietal Purity

Over the years plant breeders, farmers and amateur gardeners have produced a vast number of different vegetable varieties. Anyone can preserve these varieties and continue to grow them in the future. Successful seed saving has two simple rules: prevent cross-pollination and only save seed from the best examples, removing any undesirable individuals along the way. If you remember these two rules this will ensure the seed you save remains true to type.

Roguing

You will need to save seed from **open-pollinated** varieties (not F1 hybrids). Open-pollinated varieties are inherently variable, each plant being slightly different from every other plant. It may be useful to think of plants as a 'group' rather than as clones. The amount of variation may be slight, as is the case with tomatoes, or quite noticeable, as with some brassicas. Variability is one of the advantages of an open-pollinated variety, as it allows some degree of adaptable resistance to diseases, pests and stress. It also allows future breeders to select various characteristics from which to develop other varieties. However, if the variability is too broad the variety loses its distinctive character.

To prevent this widening drift when saving seed you will need to **rogue out** those plants that are too far removed from the original standard for the variety. This involves some careful observation. Those plants that are markedly different need to be rogued out (removed) as soon as they are spotted so that they do not contribute to the next generation. When sowing seeds you will lose some to pests, disease and other factors, but you should also consider sowing more to allow for roguing out. In some of the Guidelines you will notice a recommended minimum number of plants to save seed from, so bear this in mind and sow a few extras.

Isolation and Pollination

Inbreeding vegetables, for example peas and French beans, will not readily cross with another variety, so most of that referred to below will not be relevant. Nevertheless, if saving seed, precautions need to be taken even for those that cross only rarely.

With **outbreeding** vegetables, e.g. brassicas, runner beans, alliums and beetroots, keeping pollen from different varieties away from each other is more important than roguing out as it will widen the genetic variability of the stock in the next generation. If this does happen you can normally rectify this by roguing out in the future, but this is difficult and takes both patience and several seasons to accomplish.

The easiest way to prevent cross-pollination is grow just one variety, as pollen can be transported between plants by wind and insects. If a neighbour is growing a vegetable that could cross-pollinate you will need to bear this in mind. One way you can reduce this risk is to grow varieties far enough apart that the pollinating vector cannot carry pollen to your seed-saving plants. This distance differs with plant species and is referred to as the **isolation distance**.

Isolation distance need not just be in terms of physical distance but also in time. Obviously growing in different years will work, but you can also isolate by ensuring that flowering does not occur simultaneously; sowing one variety early and the other later. However in Britain, with our shorter season, this isn't so easy.

Another way to isolate is by using barriers to prevent insects reaching the flowers. There are numerous materials and methods of construction you can employ to make tents and bags. We've used various materials, some cheap (99p a metre) and some expensive (£7 a metre). For the home grower the cheapest and most readily available are close-weave net curtains, used as bags or cages and supported with wire, reinforcing rods of willow, bamboo or anything else you can think of. Closely woven barriers to wind-carried pollen are also available. Barriers need not cover the whole plant, but just the flowers that you wish to save seed from. Runner beans can have their flower trusses covered, for instance.



Placing a barrier over a plant or its flowers can lead to problems. Physical barriers reduce light and increase heat so be ready for a growth spurt or flowers aborting because they get too hot. Another problem is the development of an environment that suits fungal growth (wet and warm) and the proliferation of pests with no predator able to get inside (including you). The last problem is ensuring that the pollinators are ready to work at the time the flowers are open (including you hand pollinating).

As isolation cages restrict insects from transferring pollen, they also restrict insects from pollinating the flowers inside them. There are a few ways around this.

- **Alternate day caging**
If you were growing two varieties of broad beans, for example, you could cage one the first day and then cage the other the next and repeat like this. This would allow pollinators to access both varieties but on different days.
- **Hand pollination.**
Very time consuming but effective. However, be prepared for some flowers to abort if you don't do it properly. Use a fine brush. More details can be found in the crop-specific Guidelines.
- **Introduce pollinators.**
Flies are the cheapest and easiest to maintain and manage, but not as effective as bees. Buy from an angling shop as maggots (buy 'whites') and put them somewhere to encourage pupation

(become castors), then transfer to your cage before they hatch into flies. Putting them into a lidded container with a hole cut into the side will protect them from the rain and allow them to fly out when they hatch. Make sure that the shop knows how you intend to use the maggots as they are sometimes treated to prevent them hatching. The whole process can take between two and three weeks and needs to be done several times. Think ahead, get the maggots before the flowers open. Do not expect every flower to be pollinated. This doesn't happen outside and is the reason plants produce lots of flowers. Flies will pollinate around 40% of brassica flowers; bees will do much better. Don't be daunted by this, being forewarned will ensure that you are better prepared.

Finally, another thing to think about is rain cover. If, as in the case of leeks, the seed heads are maturing later in the year, rain can inhibit ripening and promote fungal infection. Many people who grow flowers for shows adapt conical plant supports with covers to protect the blooms, a method that could be adapted for vegetables.

Remember your first priority is to keep a variety pure if you want to save it.

Seed Saving Guidelines

Planning your seed growing space

Understanding the requirements for your crops when growing for seed will help you plan your growing space and the resources you need for successful seed saving. These Guidelines provide an overview of isolation and population requirements for crop groups:

Inbreeding Annuals:

Peas, French beans and tomatoes with retracted stigmas. These are the simplest vegetables to save seed from.

- **These are vegetables with perfect flowers** that are capable of self-fertilising in an enclosed system and are less open to visiting insects.
- **Cross pollination is unlikely to occur** but the possibility of a cross shouldn't be ruled out entirely.
- **Inbreeding annuals are not likely to suffer from inbreeding depression** so seeds can be saved from a small population.

Partial Inbreeding/out-breeding Annuals:

Broad beans, peppers, lettuce, runner beans and tomatoes with protruding stigmas.

- **These are vegetables with flowers that are perfect but not enclosed and so cross-pollination will occur quite easily through insect activity.** Broad beans, runner beans, peppers and are particularly attractive to bees for example.
- **Varieties of the same vegetable type will need to be isolated from each other.**
- The type of isolation varies between vegetable and specific distances and isolation methods can be found in the individual seed saving guidelines for each vegetable.
- Lettuces and tomatoes can be isolated and will produce seeds without any additional pollination, but we have found that broad beans flowers produce much greater amounts of seed when hand pollinated. Runner beans will need to be hand pollinated (mimicking a bee 'tripping the flower') to produce any seed.

- **Tripping** a flower happens when the male and female parts of the flower are hidden away behind keel petals. The spring mechanism, which opens up the keel petal, is activated when a bee lands on the petal and the structure pops out, spreading pollen onto the bee.
- **Require moderate population sizes to avoid inbreeding depression, for example** lettuce 10 plants, broad bean 24 plants and runner bean 20-30 plants.

Out-breeding Annuals:

Radish, cucurbits (squash, cucumber, melon, dudi and courgette), spinach and sweetcorn.

- **Out-breeding annuals have either perfect flowers that are self-incompatible (e.g. radish), or they have imperfect flowers.** Imperfect flowers can be **monoecious**, with one plant having male and female reproductive structures on separate flowers (e.g. squash), or they can be **dioecious** with separate male and female flowers on individual plants. For example, spinach plants have either all female flowers or all male flowers.
- **All need another flower to pollinate and set seed.**
- **They cross pollinate very readily with other varieties, meaning that they can easily produce seed that is not true-to-type.**
- If more than one variety is grown each year, they will need to be isolated from one another and will need to be pollinated either by hand or by introduced insects.
- **Out-breeders need medium to large population sizes** to avoid inbreeding depression, for example spinach 25-30 plants. Cucurbits are an exception and don't seem to suffer from inbreeding depression as much, requiring a minimum population of 6 plants.
- **Selection** - they are likely to show more variation across a variety than inbreeders so more plants will be removed through the selection and roguing process. This should be taken into account when deciding how many seeds to sow.

Biennials:

This includes many members of the brassica family (cabbage, kale, broccoli etc.) carrots, parsnips and beetroot.

- **All are out-breeders**, so will readily cross pollinate and need to do so to create seed.
- **Multiple varieties grown in the same year will need to be isolated from one another followed by either hand or introduced insect pollination.** The same applies if you think there is a danger of cross contamination from related weeds or plants in neighbouring gardens.

- **Pollination.** Beetroot and related crops are wind pollinated so some regular and gentle shaking is all that is required once the plants are flowering. We use blowflies to pollinate brassicas, parsnips, carrots, onions, leeks and leeks.
- **Continuous inbreeding will result in inbreeding depression**, so biennials need medium to larger population sizes. For example, brassicas ideally 100 or more plants, carrots 20-30 plants and beetroot 20 plants.

Biennials: Additional Things to Consider

Biennials require quite a bit of effort but will reward you with lots of seed! They flower and set seed in their second year and so, in comparison with annuals, they have a longer cultivation time and multiple stages to go through before they produce seed.

- **There will be longer exposure to pests and diseases.** Pests in the first year may over winter on the crop and emerge again in the second year. There may be losses over winter.
- Some plants may fail to re-establish or flower after replanting.
- **Selection and overwintering.** The best examples will need to be selected and overwintered either in or out of the ground. The process of rogueing and selection after the first year's growth is an important step in seed saving. The **timing** of when you do this is also important because the vegetables need to be at the mature, eatable stage to rogue and select them successfully. Vegetables will need a cool, frost free area to over winter, either in suitable containers or in the ground.
- **The potential losses** from all these factors will impact on numbers sown from seed and final harvest plant numbers. In short, you will need more of a surplus of plants to allow for more losses.

Rotation

Having a good rotation is fundamental to growing organically and organic seed production.

The basics of crop rotation can be found on the Garden Organic website at www.gardenorganic.org.uk Search "rotation" for advice on planning your space.

However, there are additional factors to consider when planning a seed crop rotation:

- **Variable crop size.** Crop requirements, such as the required final population size, and seed yield data will determine the growing space.
- To accommodate this **the growing areas in your rotation will need to be of varying sizes**

- **The crop yield data and population size will need to be known** before planning your rotation.
- **Biennials that are replanted in their second year** and will need to be fitted into a rotation for the following year.

Plant Spacing

As a general rule, more space is needed for seed crops

- **Many seed crops such as French beans, tomatoes, peas, broad beans and runner beans** don't really take up any more space than equivalent edible crops would. However, because you are not harvesting any pods/fruit until the seed matures, they benefit from wider spacing to allow for greater air circulation. For climbing French beans, gently removing a few lower leaves and leaves around the pods can also help with air circulation.
- **Other seed crops grow for longer and grow larger before harvest than an equivalent food crop would.** For example brassicas, biennials, lettuce and dudi.
- **Extra space can be needed upwards as well as outwards.** Flower and seed stalks can get very tall, for example, lettuce stalks can reach up to 1.5 m high. In polytunnels with curved sides this can be an issue in the side beds where the roof is much lower. Isolation cages also need to accommodate the increased height. Flowers that touch the mesh can still be visited by insects and potentially pollinated.
- **Spacing for biennials and pollination.** Individual plants will be much bigger in their second year and will need wider spacing than in their first-year vegetative stage. For example, 2nd year kale and leafy brassicas need 1m space each way. Some carrot seed producers believe that by planting second year carrots close together they will encourage the production of the primary 'king' umbels (which have the largest seed heads and potentially the best quality seeds) at the expense of the smaller secondary, tertiary etc. seed heads.
- **For insect and wind pollinated crops, planting in a block aids pollination.** There will be a greater number of flower heads near to each other when block planted rather than in a long narrow bed.
- When planning a seed grow-out check first that you actually have enough space (rotation space too) to accommodate crops with large population sizes and space requirements.
- Specific crop spacing requirements can be found in the individual seed saving guides.

Support Structures

- **Crops will need sturdy structures to support the weight of maturing seed pods.** There may be lots of seed pods if none have been harvested for food, or very heavy fruits with maturing seeds inside.

- If grown outside, plants will need sturdy supports to prevent them being blown over on windy days.
- Well-supported flower stalks will make flowers more accessible to pollinators and hand-pollination easier.
- **Plants need good air circulation around them to allow the seed pods to dry.**
- Seed stalks need to be supported and kept upright to keep heavy pods and seed heads off the ground.

Examples of support structures used.

It is easier and far more successful to support crops before they show signs of falling over!

Different Methods:

- **Sturdy canes and string.** A series of canes spaced in and around the crop with a lattice of string. This method supports carrot, parsnip and broad beans pretty well. One cane per flower stalk, or per cluster of stalks, is a better system for onion, leeks and lettuce.
- **Heavy fruits may need additional support.** For example, dudi fruits are far larger and heavier at seed maturity than at edible harvest. Stretch material or net hammocks, upturned bricks or bins to support from underneath will help.

Seed Saving Guidelines

Seed Storage for Longer Life

Contained within the seed are all the genetic instructions for a particular plant and all the reserves to get the seedling off to a good start. As they are nature's way of preserving plants, they can last a long time. However, they do deteriorate and by storing them in the best way you can be rewarded with greater longevity.

The two factors that reduce the life of orthodox seed are moisture and warmth. Moisture is the more important factor that needs to be controlled. A dry seed will last much longer at room temperature than a moist seed in the fridge. Cool and dry are the two ideals for most of the seed we are concerned with. As a rule of thumb, the storage life of a seed is doubled for every 5°C drop in temperature and 1% drop in moisture content. There is a limit, though, and freezing and ultra-drying can be harmful. Home growers should aim to achieve 5% moisture content and then storage in a domestic fridge or freezer will suffice.

Extraction

This will depend on the crop. Specific details are given in the individual guidelines for the relevant vegetables. Some are easier than others and everyone has their favourite way to extract seed.

Drying

Water can make up 10-15% of the weight of fresh seed. Drying the seed to reduce some of this moisture content, down to around 5%, prolongs the life of the seed. Heat, however, will destroy seeds and they should never be exposed to temperatures greater than 35°C (95°F). Seeds can be dried naturally, preferably out of full sunlight and not somewhere too hot. This should be sufficient for short to medium term storage.

Even where only short to medium storage is planned, using a desiccant to dry seed can have the following advantages:

- Improved germination rate
- Plants grown from the seed retain vigour
- Reduces the chance of mould growth or insect infestation during storage
- Greatly slows the seed aging process
- Avoids premature germination while in storage.

Ordinary food grade rice from a shop can be used as a desiccant to dry seeds. Firstly, it must be dried for several hours in the oven at 100°C to maximise its ability to absorb moisture. Without this preliminary drying the rice may contain too much moisture to be effective. The seeds should be placed in a sealed container with the dried rice. Trials at HSL found that a seed to rice ratio of 1:6 was effective at drying the seeds in around 7 days; 14 days for large seeded runner beans.

Alternatively, you could try charcoal. It can be crushed and pre-dried in the same way as rice. A bit messier than rice and you will need to ensure that charcoal hasn't been impregnated with chemicals e.g. BBQ lighter fluid.

Orange indicator silica gel can also be used; the indicator turns green when moisture is absorbed. Care should be taken to follow the manufacturer's health and safety warnings about handling. It is also more expensive than rice or charcoal. Our HSL trials found that silica gave good results at a seed to desiccant ratio of 1:3 in just 7 days in sealed jars.

NB. lettuce seeds do not respond well to over-drying, and caution should be taken when using desiccants to dry them.

Storage

To save seeds until the following year it is sufficient, after having dried them, to keep them in a cool, dry place. If you want to store them for longer periods a fridge or freezer will be fine. In both cases use an airtight container, a Kilner jar or similar is ideal.

Recovery

When you remove your seeds from storage we recommend that you do two things:

- Allow the jar and its contents to come to room temperature before opening.
- Allow the seeds to 'rest' for a few days at room temperature and ambient humidity before sowing.

This will allow the seeds to reabsorb moisture and not shock the seeds, giving a better chance of germination.

Longevity

It is impossible to determine how long a seed will last in storage; different authorities give different lengths of time. Once the optimum storage time has elapsed germination rates reduce, though this does not necessarily mean that none will germinate. If you have old seed that you would like to grow, it is still worth trying before you discard it. Some seeds do not store well; parsnip seeds, for example, should always be used fresh. The individual guidelines for specific vegetables give approximate timings, provided that the seed has been dried sufficiently and stored correctly.



The HSL seed store

Seed Saving Guidelines

Easiest Annuals - French Beans

Phaseolus vulgaris

Family: *Leguminosae*

French beans are either dwarf or climbing (bush or pole in the U.S.), but many dwarf varieties put out a few long, climbing shoots. Different varieties have been selected to be eaten at different stages; immature pods of snap or green beans, fresh swollen seeds (often called haricots) removed from their pods, and dried mature beans. Some are stringy, others stringless. The colour of the pods varies from yellow through to green and purple, and some are beautifully marked. The beans themselves come in a bewildering array of shapes, sizes, colours and patterns. The flowers are perfect and self-compatible and predominantly self-pollinating but have to be tripped to set seed.

Growing & Roguing

- French beans being grown for seed should be grown as you would for an edible crop. However, you should make sure the growing season is as long as possible to allow the pods to mature and dry, and we recommend giving the plants more space to mature for seed.
- As French beans are inbreeders (that is, they self-pollinate), you can save seed from just a few plants – it is better, though, if you grow as many plants as possible as you may need to rogue out and select – we recommend around 20 plants. If saving seed for your own home-use, we recommend leaving a few pods on several plants to ripen.
- Some plants may produce noticeably different foliage or pods from the majority; seed should not be saved from these.

The characteristics of the seed – its size, shape, colour and markings – should be more or less uniform and the same from generation to generation. There will be no visible signs of crossing until the second generation, so, if variability is noticed, go back to the seeds saved from two harvests previously for seed that should be pure.

Pollination & Isolation

Insects do visit French beans and can cause crossing between different varieties. The extent of this crossing is hotly debated, but caging is probably not necessary and an isolation distance of 10m is considered adequate. Nevertheless, you should not grow two varieties side by side if you intend to save seed, or grow two varieties with very similar seed markings in the same year, as it will be much harder to detect any crossings.

Harvesting

Ideally, the pods should be dried on the vines but if bad weather threatens, uproot the plants and hang them upside down somewhere warm until the pods are completely dry.

Cleaning

It is best (if not dealing with large quantities) to pod beans by hand; reject any with atypical markings or obvious pest damage. Large quantities can be threshed by putting the pods into a pillowcase or sack and treading on them or hitting them with a rolling pin; or by shaking the vines vigorously inside a plastic dustbin. Seeds threshed this way will need additional cleaning by winnowing.

Winnowing is best done outside in a stiff breeze. Pour the seed steadily from one container to another, allowing the wind to blow the chaff away. Do this over a tarpaulin, in case a sudden gust wafts away the seed. Repeat until all the chaff has gone and only seeds remain. If necessary, set the beans out to dry further somewhere warm and dry, but don't allow them to get too hot.

You may notice small holes in your harvested beans. These are caused by bean weevil, or bean seed beetle, larvae. These can devastate your crop of beans as they can eat the endosperm away when they hatch, prohibiting germination. Adults often emerge in storage and can complete several generations before planting time. Remove all trace of any beetles you may find. All stages can be destroyed by a 7-day minimum stay in a domestic freezer, without damaging the seeds. Ensure that the beans dry out fully afterwards before storing them. Hand podding allows any infested seeds to be identified and discarded. As long as the embryo is not attacked and the seeds no longer contain any beetles, they will still germinate so, despite looking unsightly, can be kept for home use.



Infestation of bean weevil/bean seed beetle

Storage

French bean seeds should last in cool, dry storage for at least 4 years.

Returning Seed to HSL as a Seed Guardian

It is vital that seed returned to HSL is not cross-pollinated. So do not send seed to us that you suspect might have crossed.

Remove any beans with obvious weevil damage, retaining any that have not sustained embryo damage for your own use. **If you have frozen the seed, please note this on the packet.**

Seed must be completely dry and fully cleaned, as seed that retains moisture can go mouldy in transit and will have to be discarded. It can take a few days for seed to get to us in the post so pack seed in breathable material, e.g. a paper envelope or cotton bag, and place it in a padded envelope or stout box to protect the delicate seed from impact damage.

To find out more about becoming a Seed Guardian for the Heritage Seed Library please visit www.gardenorganic.org.uk/seed-guardians.

Seed Saving Guidelines

Easiest Annuals – Peas

Pisum Sativum

Family: *Leguminosae*

There are three groups of peas. **Smooth-seeded** peas are starchier and hardier than **wrinkled-seeded** peas; **edible-podded** peas are more commonly known as sugar peas or mangetouts. Most peas today are eaten fresh, but some are grown for drying. Pea flowers are perfect and self-pollinating. The flowers open early in the morning and do not shut. The anthers shed pollen the night before the flower opens, but this does not reach the stigma until the flower is tripped, usually by the wind.



Growing & Roguing

- Peas being grown for seed should be grown as you would for an edible crop. However, you should make sure the growing season is as long as possible to allow the pods to mature and dry.
- As peas are inbreeders (that is, they self-pollinate), you can save seed from just a few plants – it is better, though, if you grow as many plants as possible (preferably around ten). If saving seed in smaller quantities e.g. for your own home use, we recommend leaving a few pods on several plants to ripen
- Some plants may produce noticeably different foliage, flowers or pods from the majority of the plants; you should not save seed from these atypical plants, and they should be removed.
- The characteristics of the pea seed – its size, shape, colour and markings – should be more or less uniform and the same from generation to generation. There will be no visible signs of crossing until the second generation, so if you notice changes in characteristics go back to the seed saved from two harvests previously, which should be pure.

Pollination & Isolation

Peas are generally self-pollinating and the likelihood of cross-pollinating is low. However, insects do visit pea flowers and can cause crossing. Commercial seed growers recommend a minimum separation of 20m, which is not really practical for the home seed saver, but try to leave as great a distance as

possible. Crossing can be very difficult to detect as peas can look so similar, so it is best to grow only one variety at a time.

Harvesting

Peas mature very quickly and can be left on the vine to dry. If there is a risk of frost to a crop that is almost mature, lift the entire plants and hang them inside somewhere warm until the pods are completely dried.

Cleaning

It is best (if not dealing with large quantities) to pod peas by hand. However, larger quantities can be threshed. This can be done by putting the pods into a pillowcase or sack and treading on them or bashing them with a rolling pin; or by shaking the vines vigorously inside a plastic dustbin. Seeds threshed this way will need additional cleaning by winnowing.

Winnowing is best done outside in a stiff breeze. Pour the seed steadily from one container to another, allowing the wind to blow the chaff away. Do this over a tarpaulin, in case a sudden gust wafts away the seed. Repeat until all the chaff has gone and only seeds remain.

If necessary, set the pea seeds out to dry further and remove any that are damaged or discoloured.

You may notice small holes with a powdery deposit round them in some of the seed. This is a sign of pea moth, which lay their eggs on pea flowers. The caterpillars then eat their way out of the pods, often eating a few of the pea seeds in the process. If you notice signs of pea moth in harvested peas, you should pod them immediately or they will continue to be eaten. To avoid this pest avoid having peas in flower in June/July as pea moths are at their most active at this time.



Storage

Store in a cool, dry place. Pea seeds should last in storage for around 4 to 5 years.

Returning Seed to HSL as a Seed Guardian

It is vital that seed returned to HSL is not cross-pollinated. So do not send seed to us that you suspect might have crossed.

Seed must be completely dry and fully cleaned. Seed that retains moisture can go mouldy in transit and will have to be discarded. It can take a few days for seed to get to us in the post so pack seed in breathable material, e.g. a paper envelope or cotton bag, and place it in a padded envelope or stout box to protect the delicate seed from impact damage.

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Seed Saving Guidelines

Easiest Annuals - Tomatoes

Solanum lycopersicum

Family: *Solanaceae*

Tomatoes are generally divided into **bush (determinate)** or **cordon (indeterminate)** types. Bush tomatoes have several branches, each of which terminates with a flower truss, so the plant forms a bush. Cordons generally have a single major shoot, with trusses (and side shoots) from the axil between leaf and stalk, so the main shoot may form a very long vine. Both classifications (like the distinction between greenhouse and outdoor types) are somewhat arbitrary. Tomatoes are easy to save seed from and, with a few exceptions, easy to keep true to type.

Growing & Roguing

- Grow as you would for eating. In Britain tomatoes are treated as annuals, producing seed in the same year that they are planted.
- Tomatoes can usually produce seed outside, though varieties that are slow to grow and ripen do best in a greenhouse or polytunnel
- Tomatoes are inbreeders and many seed savers successfully maintain varieties by saving from just two or three plants, though it is best to save from at least six plants. If you are saving seed for your own home use we recommend saving from a few fruit across different plants.
- Remove any plants that look sickly, have different foliage to the rest, or any that produce tomatoes that differ from the rest of the crop.

Pollination & Isolation

Most tomatoes are not capable of cross-pollination as the flowers are perfect and self-pollinating. The female stigma is very short and grows within a tube formed by the fused anthers. For these types, different varieties can be grown close together.



Tomato flower with enclosed stigma



Tomato flower with protruding stigma

There are three exceptions: wild currant tomatoes (*Solanum pimpinellifolium*), potato leaved varieties, and double blossoms on beefsteak varieties. These often have a protruding stigma and are able to cross-pollinate, especially if there are other protruding-stigma varieties in the vicinity. To be absolutely certain, check a few newly opened flowers (if necessary, use a hand lens). The green stigmas will protrude from the anther tube. For safety, you could grow just one protruding-stigma variety a year, or you may want to cage plants or bag trusses, the flowers will self-pollinate within these. Alternatively, the recommended isolation distance for two open flowered varieties is 50m.

Harvesting

The seeds are fully mature once the tomatoes are ripe. Allow the fruits to ripen on the plant, if possible, or bring indoors and ripen them in a box or drawer with ripe apples or bananas.

Cleaning

Some varieties contain more seed than others. Large beefsteak or plum tomatoes may yield less than ten seeds, while small or cherry tomatoes can produce scores of seed.

To save a small quantity of seeds for your own use

Remove seeds from the fruit and rinse in a sieve under cold running water, rubbing them against the sieve to remove the gel coating. Spread them on a paper towel or piece of kitchen paper and leave to dry. Fold up the paper, label it, and in the spring pop the paper, with the seeds attached, on to moist compost in a seed tray to start your plants.

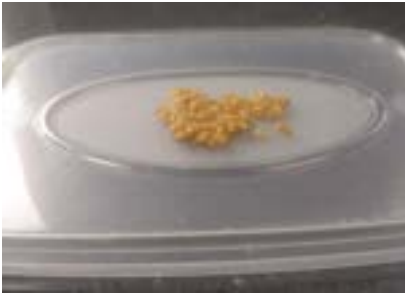
To save a larger quantity of seeds use the fermentation method

Fermentation removes compounds that inhibit germination, and it also destroys seed-borne diseases.



Scoop or squeeze the pulp from ripe tomatoes into sieve. Rinse and press through any of the tomato pulp, to remove it. Put the seed in a jam jar and top up with water. Place the jar at room temperature and out of direct sunlight for three or four days, stirring daily. You may notice the water becomes cloudier, a mouldy scum forms on the surface and there may be a smell.

The seed will start to separate from the gel and good seeds will settle to the bottom of the jar. To check if the process is complete spoon out a seed and feel if it still has a gel coating, or if it is dry and scratchy to touch. If so rinse out with clean water, tipping away any floating seed or debris until only good, clean seeds remain. Be careful to check the seed daily as they can start to germinate if left too long. Any germinated seed must be discarded.



Place the seed on a smooth surface such as a clean plate or plastic (they will stick to paper). Dry the seeds for up to a week, but avoid direct sunlight or heat. A cool, gentle breeze is best.

For larger quantities of fruit you can use the fermentation process on a larger scale such as in a bucket. You can also process ripe fruits into a food processor with an equal quantity of water until you have a pulpy mass. The seeds are hard and will not be damaged. After three or four days, when the bucket is topped with a mass of mould, add plenty of water and stir vigorously. Rinse and dry the seed in the same way.

Storage

Tomato seeds will last in storage for about seven years, depending on the variety.

Returning Seed to HSL as a Seed Guardian

It is vital that seed returned to HSL is not cross-pollinated. So do not send seed to us that you suspect might have crossed.

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Seed saving guidelines

Easy annuals - Achocha

Cyclanthera spp.

Family: Cucurbitaceae

Achocha, described as 'One of the Lost Crops of the Incas' is an annual climbing plant which can produce vines of 4.5m or more long. Cultivated for the cucumber-like green, teardrop-shaped fruits, which can be eaten raw or cooked when young. Older fruit is often cooked and stuffed. The palmate leaves and young shoots can also be cooked as greens.



Two different species are grown for the achocha fruit. 'Fat Baby' (*Cyclanthera brachystachya*) grows single fruits that are covered in soft, fleshy spines. 'Lady's slipper' (*Cyclanthera pedata*) sets smooth fruits in pairs.



Achocha 'Lady's slipper'



Achocha 'Fat Baby'

Growing and Roguing

Sow seeds into pots under glass or on the windowsill in April/May and transplant them out when all danger of frost has passed. Allow plenty of spacing between plants (20-30cm by 10cm) as plants require plenty of room to climb and spread.

Achocha is a rigorous climber, therefore will need netting or a trellis for the tendrils to scramble up. Once the vines have reached the top of the trellis or netting pinch off the tops, so the plant focuses energy into flowering and setting fruit rather than producing more vegetation. Achocha thrives on well-drained soil in warm humid conditions, so where possible, polytunnels or small greenhouses would suit this crop well. Although decent yields can be obtained outdoors without protection.

Rogue out any plants which seem off-type, flower too early, or are diseased.

Pollination and isolation

Both species of Achocha are monoecious, containing inconspicuous pale green or white male and female flowers on the same plant. Female flowers are racemes (several flowers on one stalk) while male flowers are solitary (one flower on each stalk).

Different varieties of Achocha can cross pollinate so it is recommended to only grow one variety at a time or an isolation distance of at least 800m. Flowering period occurs from July-September. Achocha flowers are self-fertile, therefore can self-pollinate. However to mitigate the risk of inbreeding depression it is recommended to save seed from a population of at least 10 plants. Many insects such as hoverflies are highly attracted to and pollinate achocha flowers. Therefore it's best to grow only one variety in a season to reduce the risk of cross-pollination. Achocha will not cross with other members of the cucurbit family.

Harvesting

Fruit should reach up to 15cm in size and should be left on the vines to fully mature. The black puzzle-shaped seeds are ripe before fruit has passed its prime. Thus, can be easily cleaned from mature fruit harvested for eating. Seeds can be harvested from late august until first frost.

Cleaning

Cut fruit in half along the length and scoop out flesh. Pick out and gently rinse the black puzzle-shaped seeds in a sieve and leave to dry in a cool, dark, space, ensuring to turn seeds regularly.

Storage

Store in an airtight container in a cool, dry place. Seeds can be kept for 4 years before germination starts to decline.

Returning seed to HSL as a Seed Guardian

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Seed Saving Guidelines

Easy Annuals - Aubergine

Solanum melongena

Family: *Solanaceae*

Aubergine, also known as eggplant and brinjal, is a tender, heat loving perennial plant that is usually grown as an annual in temperate climates, such as the UK. The fruits show great variety in colour, shape and size, ranging from grape sized to large club shapes, and from white through yellow and purple to almost black. Botanically, aubergines are actually berries, with seeds embedded within their flesh. When grown for seed saving they need warmth and a long season to ensure that the fruits mature sufficiently to produce viable seeds.

Growing & Roguing

- Grow aubergines for seed saving as you would for eating, but get them started as early as possible (mid-February) as a long growing season is essential
- Glasshouse or polytunnel cultivation is essential to maintain suitable temperatures for successful fruit production. Optimum temperatures for growth and fruit set are between 22-30°C daytime and above 18°C at night.
- Inbreeding depression is not common in aubergines. However, it is important to save seeds from the fruit of several plants and recommended to grow 20 plants, with a minimum of 6, to ensure that the genetic diversity of the population is maintained. At HSL we plant 34 plants to allow for losses.
- Once the fruits reach optimum maturity for seed development the production of other fruits on that plant will cease. Ideally select a couple of fruits for seed saving on each plant and pick the others for eating.



Pollination & Isolation

Aubergine flowers are perfect and self-pollinating, and as pollen is released within the anther cone a great deal of self-pollinating will occur. This can be aided by shaking the flowers gently or by using a soft brush

to transfer the pollen from anther to stigma. However, the style length and, therefore, the degree to which the female stigma protrude from the anther cone, varies from variety to variety. Insects do visit aubergine flowers and cross-pollination will occur, especially amongst varieties with more protruding stigma.

The recommended isolation distance between aubergine varieties is 3000m. If this distance from other aubergine varieties cannot be achieved individual flowers can be isolated under cover or using small mesh bags placed over the flowers before they open and removed once the fruit set. Mark these fruits by tying a piece of wool around their stem so that you know they are for seed saving. Always save seeds from fruits produced on the most healthy, vigorous plants

A more practical option is to build an isolation cage around all of the plants (see *Seed Saving Guideline - Preserving Varietal Purity*).

Harvesting

Allow the fruits for seed saving to mature on the plant. They will begin to change colour and lose their shine, most become a matt brown shade. When they are ready for harvest, they will be almost falling off the plant, or at least come away very easily. These fruits can be allowed to mature further, for several weeks, but don't allow them to become mouldy as spores may be carried on the seed coat and infect the next generation of plants.

Cleaning

The majority of the seeds are found towards the base of the fruit. To remove them carefully cut the aubergine skin and pull away from the flesh. This should expose the loculi; the white strands within the flesh onto which the seeds are attached. The seeds can be slippery and are best contained by putting the aubergine flesh into a bowl of water. Gently tease apart the flesh checking for further seeds. If possible, collect only those seeds that sink to the bottom of the bowl. Generally, those that are plump and golden in colour are likely to be the most viable. Place the seeds on a tray and leave in a warm spot to dry fully.



Storage

Stored cool and dry, aubergine seed should last for at least five years.

Returning Seed to HSL as a Seed Guardian

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Seed Saving Guidelines

Easy annuals - Chop Suey Greens

Glebionis coronaria

Family: *Compositae*

Also commonly known as Garland Chrysanthemum, Edible Chrysanthemum and Shungiko.

Chop Suey Greens are annual plants that have edible foliage and flowers. Those grown for their foliage will either have a finely divided leaf or flat and more rounded leaf which can be cut and come again. The aromatic leaves are added to stir fry's, soups, stews and salads while the flowers can be pickled. Ornamental varieties have edible leaves too but they are less abundant and don't recover so well after being harvested.



Growing & Roguing

- Chop Suey Greens grow best in temperatures between 7-25 degrees Celsius
- Sow in early spring into modules and transplant in to their final planting position after the last frost allowing extra time for the seeds to ripen.
- Alternatively, sow direct after the last frosts in late spring.
- Cover the small seeds with only a very thin layer of sieved compost.
- Grow in fertile, moist soil and water in dry weather.
- Allow 40-50cm between plants.
- Start with at least 10 plants, allowing for rotting, roguing and other mishaps. A variety can be maintained with only 1 or 2 plants.
- Plants in flower can grow to a height of 100-120 cm so will require adequate supports.
- Rogue out plants that are atypical for any reason.
- Remember, always save seeds from the best specimens.

Pollination & Isolation

The flowers are perfect and self-compatible, so good seed set should occur. Like lettuces, each individual flower opens successionaly over a season rather than all at once. However, insects do visit the flowers and can cause some crossing between varieties. An isolation distance of 10m is considered adequate. If you must grow two varieties side by side you can cover one variety in a small isolation cage

just before its flowers start to open. Isolated plants benefit from hand pollinating with brushes. Chop Suey Greens can also cross with other annual ornamental chrysanthemums.

Harvesting

Seed heads will start to appear in late summer and harvesting should take place when the seed heads are dry. For maximum yield, harvest every day picking individual seed heads and placing them into a paper bag. Leave the seed heads to dry in the bags for at least a couple of weeks. The seeds will then be easier to clean.

Cleaning

When completely dry, rub the top of the seed heads with your finger to release the seeds. The seeds are extremely small so use a very fine mesh sieve that will allow the seeds through but retain the chaff.

Storage

Seeds can be stored in a cool, dry place for up to 4 years, after which germination will drop off very rapidly.

Returning Seed to HSL as a Seed Guardian

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Seed saving guidelines

Easy Annuals - Lablab

Lablab purpureus synonymous *Dolchios Purpureus*

Family: *Fabacae*

Lablab is an annual or short-lived perennial plant, which has been cultivated in the tropics for almost 3000 years. The young pods, mature seeds and leaves are harvested as a valuable source of protein and are particularly popular in South Asian and African cuisines. A legacy of this long history of cultivation, is that a great degree of variability is exhibited in varieties, with flower colours ranging from purples to white. In addition, diversity is exhibited with displaying both dwarf and climbing habits, as well variation in pod shape, colour and size.

Pods can be purple, green to white in colour as well mottled varieties. Also pods can be pointed, round, and blade like in shape.



lablab
and blues
cultivars
as

as some
puffy, flat

Growing and roguing

- Sow lablab indoors in modules or small pots from mid-April. A warm light location is best germination requires temperatures of at least 18-21°C.
- Pot on and subsequently harden off seedlings before planting out from the end of May-June.
- Plants will grow in most soils but prefer fertile, well-worked soils. To aid water retention, and healthy, more successful plants, it's recommended to plant into a compost trench.
- A seed harvest population size of around 20 plants is recommended for these self-pollinating inbreeders, to allow for rouging and selection. Space plants 15cm apart, or in the case of climbers (which will require support) 2 plants per pole.
- Rouge out any plants which flower too early, or present off-type characteristics, such as flower/pod colour and height. Moreover, seed characteristics (size, colour, shape, markings) should be consistent throughout generations of a variety.

Pollination and isolation

Similar to French beans and peas, lablab flowers are perfect and self-pollinating, borne on many flowered racemes.



Insects can pollinate these lightly scented lablab flowers, however since plants won't cross with any other bean species, isolation is only needed if you or a neighbour are growing more than one variety of lablab within 10m of each other.

Flowering period is often later in the season, from end of July to September when plants are damaged by frost.

Harvesting

Some varieties of lablab have pods which dry well on the plant whereas others drop pods when the seeds are ripe. Thus, regular monitoring of maturing pods is important to ensure seed is harvested at the right time.

Fattened pods can be further dried in a warm, dark place, especially in the event of a wet end of season hindering drying on the vine.

Cleaning

- As with peas and other legumes, it is best to pod beans by hand, allowing for rouging of damaged or off-type seed.
- However, if cleaning large quantities, pods can be placed into a pillowcase or sack and bashed to free beans from the pods. Further winnowing or sifting between containers in a light breeze outside to remove chaff from the seed.
- Further drying of seed in a warm, dark place is recommended.

Storage

Store in a cool, dry and dark place. Seeds should be least 2 years in suitable storage conditions.

Returning to HSL as a Seed Guardian

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Seed Saving Guidelines

Easy annuals - Lettuce

Lactuca sativa

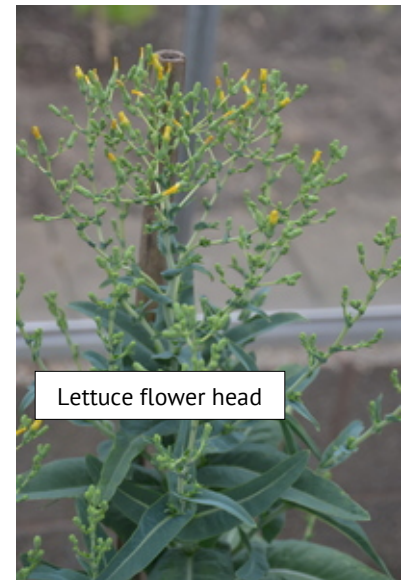
Family: *Compositae*

Of seven main cultivar groups of lettuce, the most common types are leaf, head and cos/romaine. All can cross-pollinate.

The flowers are perfect and self-compatible. Each 'flower' head contains 10 to 25 florets, all of which open on the same day, usually in the morning. The anthers form a tube, through which the style grows, picking up pollen grains to fertilise the single seed. The florets then quickly close, never to open again.

Growing & Roguing

Most lettuce varieties are annual, growing and flowering in the same year. However, they need a long season for seeds to form and ripen properly and some will not produce their flower stalks early enough.



- Sow early in the season, allowing maximum time for seed to ripen or sow lettuce varieties that will over-winter in late summer (usually the last week in August or the first week in September) under the protection of cloches. 'Bronze Arrow' and 'Stoke', are hardy enough to over-winter with minimum protection from the elements
- Allow 45cm between plants, they can be prone to *Botrytis* (a fungal disease) and plenty of air circulation will reduce this risk
- Ideally start with at least 10 plants, allowing for rotting, roguing and other mishaps. If necessary, a variety can be maintained with only 1 or 2 plants
- Lettuce plants in flower can grow to a height of 1.5m so will require adequate support
- In some 'head' lettuces the flower stalk has difficulty in pushing through the leaves; help it by slicing through the top of the head or peel back the leaves, taking care not to damage the developing stalk

- Remove any damaged lower leaves as the inflorescence develops, this will help to prevent fungal diseases such as *Botrytis*
- Take care not to save seeds from plants that bolt (go to seed) too early as plants sown from this seed will, themselves, tend to bolt
- Rogue out plants that are atypical for any reason
- Remember, always save seeds from the best specimens

Pollination & Isolation

The flowers are perfect and self-compatible, so good seed set is always assured. However, insects do visit the flowers and can cause some crossing between varieties. An isolation distance of 8m is considered adequate. If you must grow two varieties side by side, you can wrap spun fleece around one variety just before it's flowers start to open. Cultivated lettuce will also occasionally cross with wild lettuce (*Lactuca serriola*).



Harvesting

Like dandelions, lettuce seeds have 'parachute' plumes when the seed is ready. Seed will ripen irregularly, 12 to 24 days after flowering. Harvesting should take place on a dry afternoon. For maximum yield harvest every day during this period by gently bending the flower stalks over and shaking them into a large paper bag (a potato storage sack is ideal) or pick off the individual white fluffy seed heads as they are ready and place in a paper bag. Alternatively, cut the whole stalk about three weeks after the peak

of flowering and place on a large paper or cloth bag to dry. Leave the seed heads to dry in the bags for at least a couple of weeks, the seeds will then be easier to clean. Seed yield for lettuce can be relatively high and it is not unusual to harvest several thousand seeds per plant.

Cleaning

When completely dry, shake the flower stems in the bag. Rub the seed heads between your hands to release more seeds. Put the seed through a fine mesh sieve that allows the seeds through but retains the chaff and plumes. Winnowing is difficult because seeds and chaff are about the same size and weight.

The dust produced during cleaning causes irritation to the lungs and eyes. If cleaning large amounts use a mask and goggles, or clean outdoors

Storage

Seeds can be stored in a cool, dry place for up to seven years, after which germination will start to drop off.

Returning Seed to HSL as a Seed Guardian

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To find out more about becoming a Seed Guardian for the Heritage Seed Library please visit www.gardenorganic.org.uk/seed-guardians.

Seed Saving Guidelines

Easy Annuals - Peppers

Capsicum annuum and others

Family: *Solanaceae*

Peppers and chillies spice up our lives. Is it any wonder that they have spread rapidly around the world from their South American origins and now seem integral in cuisine from all around the world? They are a regular fixture in our gardens too and one of the easiest crops to save seed from.

Pepper flowers are perfect but will readily cross-pollinate.

Growing & Roguing

- Grow as you would for eating. In Britain peppers are usually treated as annuals, producing seed in the same year that they are planted
- Peppers originated in South and Central America so must be grown indoors, in a glasshouse or polytunnel to succeed in the UK climate
- Most of the commonly grown pepper and chilli varieties are of the same species, *Capsicum annuum*, meaning 'annual capsicum'. Despite this, the plants can be kept alive for a few years if they are grown in a frost-free place. This will give you an early crop from the second year onwards, and the longer season means that the seeds are more likely to ripen fully.

Pollination & Isolation

As sweet peppers and chillies are the same species, it is possible for them to cross-pollinate, so you could find that your sweet pepper has a bit more bite than expected when you grow it in subsequent years. The easiest way to prevent this is to only grow one variety if you want to save the seed. Alternately a separation distance of at least 50m, some recommend 500m, will prevent most cross-pollination, as insects will visit other flowers between the peppers. Blossom bags or isolation cages may be the safer option. The flowers are capable of pollinating themselves, so if you have one plant on the windowsill it should still set seed. Although peppers love the heat the flowers can drop off if the temperature gets too hot. If this is happening to your plant, try moving it somewhere cooler.

Harvesting

Although we pick peppers and chillies to eat from the green stage onwards it is not until they have fully changed colour, usually to red/purple, that they are fully mature. If they are picked too soon the seeds will not have developed fully, so for seed saving it is best to leave them until they stop changing colour.

Cleaning

Take great care when cleaning chilli seeds! Wear rubber gloves if you don't want to be rubbing chilli into your eyes for days afterwards. If the peppers have been dried then consider using a dust mask for cleaning larger quantities as the dust can irritate the throat and lungs.

Any excess flesh can be rinsed off and the seeds put somewhere warm and airy to dry. Once they are dry enough that they crack when a thumbnail is dug into them, they can be stored. Remember to write the variety and the year the seed was harvested on the front of the packet.



Storage

The seeds can last for up to 5 years in cool, dark and dry conditions.

Returning Seed to HSL as a Seed Guardian

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Seed saving guidelines

Trickier Annuals - Amaranth/Callaloo

Amaranthus spp.

Family: *Amaranthaceae*

Amaranth is a fast growing annual grown throughout Africa, Asia, the Caribbean and the Americas for the young leaves as well as for seed utilized as a grain crop. Several species of Amaranth are cultivated for vegetable and grain, including; ***A. tricolour***, ***A. cruentus***, ***A. dubius***, ***A. blitum*** & ***A. spinosus***. Eaten like spinach they are harvested for the young leaves and stems. The egg-shaped leaves can be red or green in colour and can be hairy or smooth.



Crimson flower heads of
Amaranthus cruentus.

Growing and roguing

- Start plants off indoors, in modules in late April, harden off and transplant outdoors in early June.
- Amaranth will grow on a wide variety of soils and climates but generally prefers temperatures of around 25-30°C. Additionally, plants will thrive best on well-worked, nitrogen rich soils.
- A population size of 20-30 plants is advised to reduce the risk of inbreeding depression and genetic drift. At HSL we plant 34 plants to allow for losses.
- Plants can reach up to 1-2.5 metres in height once in flower, therefore may need staking for support.
- Space the plants approximately 45cm apart, in rows 60cm apart. This should be wide enough to reduce likelihood of bolting but close enough to bag flowers from different plants together.
- Rogue out any plants that look diseased, or present off type size, shape, colour, flowers.

Pollination and isolation

Plants are monoecious, containing male and female flowers on the same plant and are wind-pollinated. Amaranth pollen is small and light and, although it is suggested that the pollen grains have a limited viability window, isolation distances of at least 150 meters are advised. This should prevent cross-pollination with other varieties or related weeds (bear in mind that Amaranth is also commonly grown as a decorative plant in gardens). Cross pollination between varieties by insects can occur but is rare due to the small flower size. Placing corn-tassel bags over clusters of flowers from different plants or caging all plants with fine grade mesh, will help to ensure varietal purity and seeds which are true-to-type. Regular agitation of bagged flowers or caged plants, facilitates pollen transfer between flowers on different plants thus mitigating the risk of inbreeding depression from extensive self-pollination.

Harvesting



As seed ripens and dries, seed heads crisp up and turn yellow-brown in colour.

Amaranth flowers are indeterminate, flowering continuously until harvest or frost. Therefore, the seeds will ripen sequentially throughout season, maturation generally starts from the bottom of the seed stalk to the top. A useful indicator of seed maturing is the yellowing foliage and flowers. Amaranth seeds vary in colour but often become more conspicuous on seed heads as they reach peak maturity and flowers dry and lighten in colour. Generally, from early September onwards.

Once most plants in a population display the above characteristics, seed can be harvested. Seed stalks can be cut and laid to dry out further on tarp, fleece or fine grade mesh in a dry, shaded place. Turning regularly to aid the drying process. If conditions are likely to be very wet during this time, it may be best to cut seed stalks slightly early to prevent seeds getting mouldy before harvest.

Cleaning

As the seed heads dry further, seeds should fall freely by beating seed heads together over the tarp or into a large bowl/tray. To separate chaff from the seed, shake the bowl and the lighter chaff will rise to the top so should be easy to remove by tipping the bowl and raking out.

Further cleaning can be achieved by sifting seed through a fine mesh screen to remove any small pieces of dirt. Gloves are recommended as seed caps can be prickly.

Storage

Store in a cool, dry place. Seeds can retain almost full viability in dry storage for up to 2 and a half years. Some experiments have shown amaranth seed to display viability in the soil seedbank for up to 40 years.

Amaranth seed often presents dormancy when first shed. So it will need 2-3 months of dry storage before germination will be possible

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Seed Saving Guidelines

Trickier Annuals - Broad Beans

Vicia faba

Family: *Leguminosae*

Broad beans range in height from 60cm to 2m. There are no clear botanical distinctions between field beans and those grown in gardens.

Broad bean flowers are perfect and can self-pollinate, though cross-pollination occurs readily due to insect activity. The flowers open early in the morning and do not shut. The anthers shed pollen the night before the flower opens, but this does not reach the stigma until the flower is tripped, usually by insects.

Growing & Roguing

- Broad beans being grown for seed should be grown as you would for an edible crop. However, you should start sowing early to ensure that the growing season is as long as possible to allow the pods to mature and dry.
- As broad beans are partial outbreeders (that is, they cross-pollinate), you should grow as many plants as possible, 24 as a minimum. This allows for roguing out any that are atypical and selecting just the best specimens and helps maintain the diversity of the variety. If saving seed for your own home use we recommend leaving a few pods on several plants to ripen
- Some plants may produce noticeably different foliage or pods from the majority; these should be removed. Any plants that produce flowers of a different colour should also be immediately removed. However, if the flowers have opened, they could already have cross-pollinated. In which case remove any opened flowers and any forming pods on the remaining plants.
- Seed that is the result of crossing will usually reveal itself in the next generation as a visible increase in the variability of the plants. As with other peas and beans, if crossing is identified, go back two generations for pure seed.

Pollination & Isolation

Broad bean flowers are attractive to bees and a good deal of cross-pollination can occur between broad bean varieties, and any field beans growing nearby. **We strongly recommend that you grow only one variety each year.**

Commercial seed producers grow broad beans a minimum of 1000m apart, but for home seed saving this may not be practical. 'Living barriers' in gardens help reduce the risk of cross-pollination, e.g. tall crops of a different species. It also helps if you grow large numbers of plants in blocks of 36 rather than rows and save seed only from the central four plants. Isolation cages can be used, but bagging is very difficult.

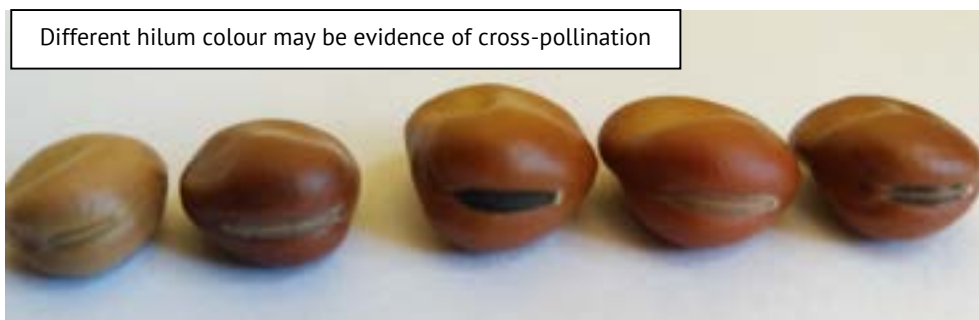
Broad beans can self-pollinate if no insects are introduced, but with less successful results. To get a reasonable seed yield from isolated plants you can hand pollinate but this can be a little fiddly. Remove petals from a picked flower to reveal the small toothbrush shape anther and use this to gently pollinate another flower while gently pressing down on its lower keel. Use pollen from another plant of the same variety, rather than from the same plant. You will only be able to pollinate a handful of flowers before requiring a new flower.



Harvesting

Allow the pods to dry on the plants if possible, but be aware that they may rot. As they ripen the pods blacken and lose their sponginess; they are ready to clean when the pods have become black and crispy. Whole plants can be brought in to dry in a warm, airy place if necessary.

The characteristics of the seed; its size, shape, colour and markings; should be more or less uniform from generation to generation. At HSL we may tolerate some variability, e.g. 5% variability in hilum colour is removed by hand, if we are confident that the plants were sufficiently isolated. A change may indicate that crossing took place when the flowers were pollinated on the parent plant. Seed that is the result of crossing will usually reveal itself in the next generation as a visible increase in the variability of the plants. Always keep the seed from different years separate. If you do discover evidence of crossing, discard the harvest from that year and the year before, which may appear fine but is when the crossed seed embryo was produced. Seed from two generations back should be pure.



Cleaning

Broad beans can be difficult to thresh so hand shelling is best, especially if you only have small quantities to deal with. If the seeds are not quite dry when podded, spread them out to dry further.

Winnowing is best done outside in a stiff breeze. Pour the seed steadily from one container to another, allowing the wind to blow the chaff away. Do this over a tarpaulin, in case a sudden gust wafts away the seed. Repeat until all the chaff has gone and only seeds remain.

You may notice small holes in your harvested beans. These are caused by bean weevil, or bean seed beetle, larvae. These can devastate your crop of beans as they eat the endosperm away when they hatch. If they begin to feed on the seed embryo the bean will not germinate. Adults often emerge in storage and can complete several generations before planting time. Remove all trace of any beetles you may find. All stages can be destroyed by a 7-day minimum stay in a domestic freezer, without damaging the seeds. Ensure that the beans dry out fully afterwards before storing them. Hand podding allows any infested seeds to be identified and discarded. As long as the embryo is not attacked and the seeds no longer contain any beetles, they will still germinate so, despite looking unsightly, can be kept for home use.



Storage

Broad bean seeds should last in storage for at least 5 years.

Returning Seed to HSL as a Seed Guardian

It is vital that seed returned to HSL is not cross-pollinated. So do not send seed to us that you suspect might have crossed.

Remove any beans with obvious weevil damage, retaining any that have not sustained embryo damage for your own use. **If you have frozen the seed please note this on the packet.**

Seed must be completely dry and fully cleaned. Seed that retains moisture can go mouldy in transit and will have to be discarded. It can take a few days for seed to get to us in the post so pack seed in breathable material, e.g. a paper envelope or cotton bag, and place it in a padded envelope or stout box to protect the delicate seed from impact damage.

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Seed Saving Guidelines

Trickier Annuals - Cucurbits

Squash - *Cucurbita maxima, moschata & pepo*

Cucumber - *Cucumis sativa*

Melon - *Cucumis melo*

Watermelon - *Citrullus vulgaris*

Family: *Cucurbitaceae*



The cucurbits all have fleshy fruits surrounding large seeds. Cucumbers and melons are easily recognisable, but there can be some confusion over squashes. Pumpkins, marrows and squashes are all members of the same genus *Cucurbita*; for convenience, we refer to them all here as squashes. Summer squashes (including courgettes) are often intended to be eaten immature and do not store very well even when mature. Winter squashes (including pumpkins) are eaten mature after they have formed a hard skin and can be stored for long periods.

Provided you have a long enough growing season squashes are easy to grow and harvest seed from, but great care is required to keep varieties pure.

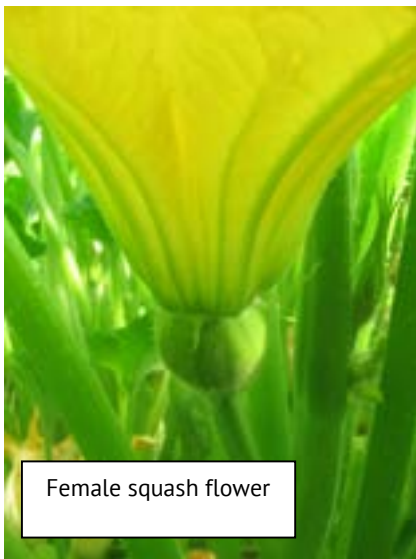
Growing & Roguing

- The plants can be grown as you would for a crop grown to eat.
- However, squashes grown for eating are normally picked when immature. For the purposes of seed saving allow as long a season as possible so the fruits and seed can develop to maturity. Protection from spring and autumn frosts with fleece or cloches will help length the growing season.
- Grow as many plants as possible – professional growers consider six plants as a minimum. However, squash do not suffer too much from inbreeding depression and if saving seed for yourself you can grow just two or three plants.
- Rogue out plants whose foliage is very different from the rest.

- Remove plants that look unhealthy. Crumpled and/or yellow mottling on leaves may indicate cucumber mosaic virus, which can be seed borne, so seed should not be kept from any plants displaying these characteristics.

Pollination & Isolation

Each plant produces separate male and female flowers. The female flowers can be distinguished by the ovary, a swelling behind the petals which will form the fruit. The male flower sits upon a simple stalk. Individual plants often produce a profusion of male flowers first, a device that helps cross-pollination. The flowers open early in the morning and insects, mainly honey bees, move the pollen from flower to flower and plant to plant.



Female squash flower



Male squash flower with petals removed

All members of one genus (for example all cucumbers, or all squashes) will accept pollen from any other member of that genus. There is much debate as to whether the various species of squash will cross-pollinate with each other. To be safe we would recommend an isolation distance of 800m. Ideally isolate and hand pollinate all cucurbits to ensure varietal purity is maintained.

The four main species of squash are as follows:

Cucurbita maxima

These have very long vines, huge, hairy leaves and soft, round, spongy, hairy stems. Seeds are thick, white, tan or brown with cream-coloured margins and a thin, cellophane-like coating.

Cucurbita mixta

These have spreading vines and large, hairy leaves. The stem of the fruit is hard, hairy and slightly angular and flares out only slightly where it is attached to the fruit. The leaves (slightly lighter in colour than *C. moschata*) have a rounded tip and hardly any indentations along the sides. Seeds are white or tan and have a pale margin and cracks in the skin coat or the flat sides of the seeds. They are covered in a thin, cellophane-like coating.

Cucurbita moschata

These display spreading vines and large hairy leaves. The stem flares out noticeably where it attaches to the fruit and is hard, hairy and slightly angular. The flower has large leafy green sepals at its base. Leaves are slightly darker than *C. mixta* and have a pointed tip and slight indentations along their sides. The small, beige seeds are oblong and have a dark beige margin.

Cucurbita pepo

These have prickly leaves and stems, particularly when mature. The fruit stem is hard and has five sharply angular sides. Seeds are cream with a white margin. Included in this species are soft-shelled, stripy and warty decorative gourds and nearly all of the commonly grown summer squashes.

Squash

For successful hand pollination, go out at dusk and select a female and male flower that are both about to open. It is best if the flowers are from different plants, but they **must** be of the same variety. Flowers that are about to open are still quite green but may be very slightly split and show a lot of orange colouration around the tip of the unopened petals. If the flowers are completely orange and slightly curly, they are past the viable stage. With a piece of masking tape, seal the flowers to prevent them opening and mark them with a cane so you can easily find them again.

Next morning, remove the male flower with its stalk and carefully peel back the petals to reveal the pollen-bearing stamen in the middle. Take this over to the female flower and carefully remove the tape from the petals, but only when you have the male flower ready for immediate pollination. Bees and flies find squash flowers irresistible and can invade a flower as soon as it is opened, sometimes right in front of your nose!



Brush the pollen onto the style of the female flower and reseal the petals immediately with tape to prevent entry by insects. Alternatively, mesh/blossom bags tied over the flowers isolate them very well. They will need to be removed as the fruit starts to swell.

Mark the pollinated flower with a piece of coloured tape or wool loosely around the stem so you know which ones should be saved. One male flower can be used to pollinate several females if there is a shortage of male flowers. However, if you can, pollinate one female flower with several male flowers.

Melon and cucumber

These have tiny flowers that are much trickier to pollinate. Melons are also likely to reject about 70% of hand pollinations. You may have to be persistent.

If pollination has been successful, the fruit will start to swell within a couple of days and develop as normal, otherwise it will go yellow and drop off. You can ensure as early a fruit set as possible by starting the plants off indoors and pollinating the first females to develop.

Harvesting

Squash

Harvest the fruits once they are mature; the fruit stalk will begin to shrivel and the skin of the fruit will harden. Do not remove the seeds immediately. Leave the fruit in a warm dry place, in a greenhouse or under a cloche, for about three weeks – during that time the seeds continue to increase in size and strength.

Melon

Seeds are mature when the fruit is soft and over-ripe. Over-ripe fruits are not so good to eat, and after all the effort of growing a melon you may want to pick one or two to enjoy eating!

Cucumbers

Keep on the vine until over-ripe. The fruits will be large and starting to go soft, green cucumbers generally begin to turn yellow. Like squashes, leaving them for a couple of weeks after cutting increases the number of fully mature seeds.

Cleaning

Squash

Seeds should be removed from the flesh and rinsed in a colander to remove any flesh or strings adhering to them. If they are still sticky or dirty, rub them gently in a sieve under a stream of water. Squash seeds are large and have a tendency to go mouldy before drying. Try laying the seed out on a flat tray with a cool fan gently blowing over them, turning the seeds twice daily for a couple of days

Melon

These may need a little more work to clean them. Rub them gently and put them in a large bowl with plenty of water. Hollow seeds and the pulp will float while fertile seeds sink to the bottom. Pour off the debris and repeat a couple of times until you are left with only good seeds.

Cucumber

The seeds are encased in a gelatinous sac, most easily removed by fermentation. Place the seeds into a large bowl and add about as much water as you have seeds. Put the bowl somewhere warm, but out of direct sunlight, to ferment. Be warned, this can be somewhat smelly. Stir the mixture occasionally. One or two days is generally sufficient. Add as much water as possible and stir the mouldy mass well. Good seeds will sink to the bottom so carefully pour off the debris. Repeat until you are left with clean seeds.

Storage

For all cucurbits, tip the seeds onto a plate or baking tray to dry, avoiding temperatures greater than 32°C (90°F), which will damage the seeds. Turning the seeds and providing a cool breeze will help seeds dry evenly. Test one for dryness - seeds that break in half rather than bending are dry enough to

be stored, but flat, 'empty' seeds will not be viable. Store in an airtight container in a cool dark place. Cucurbit seeds should last in storage for 5-10 years.

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Seed Saving Guidelines

Trickier Annuals - Radishes

Raphanus sativus

Family: *Brassicaceae*

There are three types of radish. Small annual varieties, often red and white, are the **Radiculata** group; long white types, sometimes called mooli or daikon, are the **Longipinnatus** group and those grown specifically for their fleshy, edible seed pods are the **Caudatum** group.

Radishes are easy to save seed from in small quantities, but cross-pollination can be a problem. Flowers are perfect, but self-incompatible.

Growing & Roguing

- Start off the plants as you would for an edible crop, making sure you are growing them in the correct season for that variety.
- As the plants grow, discard any that look unhealthy or that have foliage different from the rest. Remove any wild radish types.
- Spring and summer radishes are annuals and will produce seed the same year as you sow them. You can leave spring and summer radishes to go straight to seed or you can lift the roots once they have reached the edible stage to select the healthiest and most typical of the variety in size, shape and colour for seed saving. Replant them immediately, 45cm apart, firming in and watering well.
- Autumn and winter radishes should be treated as biennials to give seed in the summer after sowing. They must be lifted in winter and stored like other root vegetables, then replanted in spring spaced 45cm apart.
- There is no need to lift and replant varieties that are grown for their edible pods; sow them as early as possible in spring and space the plants 45cm apart.
- As radishes are strong outbreeders the more plants you grow for seed saving the better, and a minimum of 20, to preserve the health and diversity of the variety.
- Radish seed stalks can grow surprisingly large and bushy (over a metre tall), so allow at least 45cm between plants – be prepared to stake the flower stalks.

Pollination & Isolation

Radish flowers are pollinated by insects including bees and flies. Pollen must be moved from plant to plant as well as from flower to flower or pods will not form. All radish varieties can cross with one another and with wild radish *R. raphanistrum*, but they will not cross with other brassicas.

Due to their tendency to cross pollinate and their need for insect pollination across several plants, it is best to grow just one variety for seed each year. An isolation distance of 1000m is recommended to maintain varietal purity. However, this is not always practical for home growers so if you are growing more than one variety for seed, or if there are other radishes or wild radish flowering nearby, plants can be isolated in a mesh cage and blowflies introduced for pollination. Buy them from an angling shop as maggots (buy 'whites') and put them somewhere to encourage pupation (become castors). Transfer them to your cage before they hatch into flies. Put them into a plastic container with a hole cut into the side to protect them from the rain and allow them to fly out when they hatch. Make sure that the shop knows how you intend to use the maggots as some are treated to prevent them hatching. When introducing them into the cage take care to prevent other insects entering.

Harvesting & Cleaning

The seed pods dry to a pale brown and the stalks should be cut when the pods and stems are dry and crispy or hard.

For small quantities of seed

Pods can be picked from the stems individually when dry and crispy, cracked open by hand or crushed individually, and the seeds picked out.

For larger quantities of seed

Cut down the dry stalks and store in a dry place. When you are ready to clean the seed, pick off the pods and grate them through a strong, wide-mesh sieve, or put them into a pillowslip and beat them. Seeds threshed this way will need additional cleaning by winnowing.

Winnowing is best done outside in a stiff breeze. Pour the seed steadily from one container to another, allowing the wind to blow the chaff away. Do this over a tarpaulin, in case a sudden gust wafts away the seed. Repeat until all the chaff has gone and only seeds remain.

Another technique is to place the dry crushed pods on a flat board and slowly tilt the board, perhaps vibrating slightly. The seeds should roll to the bottom of the board.

Storage

Ripe radish seeds will store in a cool, dry place for at least seven years.

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Seed Saving Guidelines

Trickier Annuals - Runner Beans

Phaseolus coccineus

Family: *Leguminosae*

Most runner beans are tall, climbing plants, but there are dwarf varieties and some, called half runners, that are bushy with one or two long shoots. All need a long growing season.

- Black runners have intense red flowers and black seeds.
- Scarlet runners have red flowers and purple or mauve seeds with black blotches.
- White runners have white flowers and white seeds.

The flowers are perfect and will self-pollinate if tripped but will readily cross pollinate with other runner beans.



Growing & Roguing

- Runner beans, unlike French beans, are hypogeal: the cotyledons stay underground as the stem and true leaves emerge.
- As runner beans are partial outbreeders it is important to grow as many plants as possible to maintain the health and diversity of the variety; a minimum of 20 to 30 if possible. If saving seed for your own home use, we recommend leaving a few pods across several plants to ripen.
- **Runner beans also need vigorous selection to keep them true to type.** Grow them up canes or strings as you would with a normal crop, but before flowering starts remove any that look unhealthy or that have leaves that are different from the rest of the plants. As soon as the flowers open remove any plants where the flower colour is not true to type.



Practical Tip

Cut off any growth above the top of canes and those pods that form too late for seed saving. This should help the plant put all of its energy into the seeds to be saved.

Pollination & Isolation

Runner beans are pollinated by bees. They will cross with other runner bean varieties readily though cannot cross with other types of bean. We recommend a minimum isolation distance between runner bean varieties of 800m to be certain of maintaining varietal purity.

If runner beans are being grown within 800m of your plants, isolate them with a fleece bag around each truss or, more easily, with a large insect proof cage around several plants. It may be easier to cage plants grown around a wigwam of canes rather than a row.

As insects will be completely excluded from your plants you will have to trip the flowers yourself to ensure a good set. For small quantities of bagged flowers, do this by hand each day, simply pressing down on the lower keel of each newly opened blossom to mimic a bee landing. Then, using a thin paintbrush transfer the pollen from anther to stigma. Use pollen from another plant of the same variety, rather than from the same flower or plant. If you are growing more than one variety, remember to use a different brush.



Harvesting

Runner beans are very tender and may be killed by early frosts before seeds are mature. Fortunately, they are also perennial, forming a poisonous underground tuber. These tubers flower sooner than plants grown from seed, so if your growing season is short, dig up the tubers, store them over-winter and plant out once danger of frost has passed. Over-wintering roots can also be useful when maintaining varieties. The roots will give plants that are true to type even if there have been off-types, or plants of different

varieties flowering nearby the preceding year. You can select the best plants one year and save the roots to grow on for seed production in isolation the following year.

Leave the pods to mature and dry on the vines for as long as possible, ideally until the pods become dry and crisp. However, if bad weather threatens, uproot the plant, and hang them upside down somewhere warm until the pods are completely dry.

The characteristics of the seed; its size, shape, colour and markings; should be more or less uniform from generation to generation. At HSL we may tolerate some variability, e.g. 5% variability in seed coat colour is removed by hand, if we are confident that the plants were sufficiently isolated. A change may indicate that crossing took place when the flowers were pollinated on the parent plant. Seed that is the result of crossing will usually reveal itself in the next generation as a visible increase in the variability of the plants. Always keep the seed from different years separate. If you do discover evidence of crossing, discard the harvest from that year and the year before, which may appear fine but is when the crossed seed embryo was produced. Seed from two generations back should be pure.

Cleaning

It is best (if not dealing with large quantities) to pod beans by hand; reject any with atypical markings or signs of pest damage. Large quantities can be threshed by putting the pods into a pillowcase or sack and treading on them or hitting them with a rolling pin; or by shaking the vines vigorously inside a plastic dustbin. Seeds threshed this way will need additional cleaning by winnowing.

Winnowing is best done outside in a stiff breeze. Pour the seed steadily from one container to another, allowing the wind to blow the chaff away. Do this over a tarpaulin, in case a sudden gust wafts away the seed. Repeat until all the chaff has gone and only seeds remain.

Storage

Store in a cool, dry place. Runner bean seeds should last in storage for at least 3 years.

Returning Seed to HSL as a Seed Guardian

It is vital that seed returned to HSL is not cross-pollinated. So do not send seed to us that you suspect might have crossed.

Seed must be completely dry and fully cleaned, as seed that retains moisture can go mouldy in transit and will have to be discarded. It can take a few days for seed to get to us in the post so pack seed in breathable material, e.g. a paper envelope or cotton bag, and place it in a padded envelope or stout box to protect the delicate seed from impact damage.

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Seed Saving Guidelines

Trickier Annuals - Spinach

Spinacia oleracea

Family: Chenopodiaceae

Spinach is unusual among vegetables in being **dioecious**; individual plants produce either all male or all female flowers. There are two types of seed – prickly and smooth. Prickly-seeded varieties have flatter leaves, while those with smooth seeds produce more wrinkled foliage. Spinach is wind pollinated.



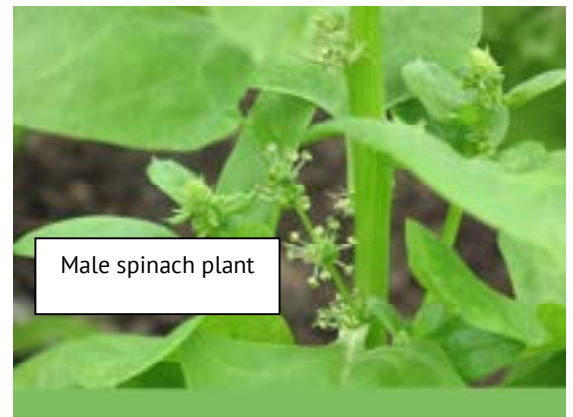
Growing & Roguing

- Plant as you would for a food crop, but grow at least 25-30 plants. As spinach is dioecious you should aim to achieve a reasonable mix of male and female plants
- Space the plants widely to reduce the chances of bolting prematurely, but close enough to cage when they come into flower, if you need to. It is best to grow them in a block.
- Make sure that they are well watered to reduce the chance of premature bolting.
- Rogue out any early bolters.
- Remove any that appear diseased.
- Rogue out any plants that do not form a rosette and that are noticeably different from the majority of the crop.
- It must be noted that once in flower these plants can reach up to 180cm in height.

Pollination & Isolation

Spinach will not cross with any other garden crop but, being wind pollinated, can be difficult to keep pure if other growers in the vicinity are allowing their spinach to flower.

Commercial seed growers isolate by as much as 15km. At home, the best plan is to grow only one variety each year, and even then to bag the flower because it is so easy for a neglected spinach plant in the neighbourhood to flower and cross pollinate with yours. Horticultural fleece will restrict the pollen quite well but can promote fungal diseases.



Seed set depends on day length, with the plants tending to bolt when the light part of the day reaches 12½–15 hours. Bolting may also occur in less than 12½ hours of daylight if the plants have been

subjected to fluctuating hot and cold temperatures. Crowding can also induce the plants to bolt. Getting the plants to flower is therefore very easy but it is important to save seed from those plants that are least inclined to bolt, otherwise there is a risk of selecting for easy bolting rather than leaf production.

Once the plants start to bolt they will need to be isolated. Cage several plants together with twice as many females as males (if possible), ideally at least four females and two males in each cage. Unfortunately, it is very difficult to sex a spinach plant until the seed stalks have formed, which often results in less than ideal spacing for caging. Female plants have clusters of flowers nestling in the axils of the leaves, males have tassels of flowers that are much sparser. Cage by covering the plants with fleece or old, very tightly woven net curtains using bamboo canes for support, or by making a cage with a wooden frame which will last longer and can be moved around to other crops that may need isolating. Occasional agitation of the cage and plants aids pollination. The caging needs to be left on until the fruits start to swell on the female plants.

Harvesting

Ideally the seed should be allowed to dry on the plants in the ground. If prolonged wet weather threatens you can cut the stems when still green, as long as the seeds are fully formed, and hang them somewhere warm and dry to finish drying. Harvest the seed as and when they are brown and dry by rubbing them off into a sack, leaving the others behind to develop further. This is time-consuming but it increases the yield of the seed. Prickly-seeded varieties can be very abrasive, so use gloves.

Cleaning

Most seed will come away quite easily from the flower stalks. The dry seed is easily cleaned by winnowing and reverse screening, which retains the seed but lets small pieces of debris through. In commercial production the prickly-seeded varieties are abraded to remove the prickles, but this has no positive impact on germination and is not necessary for home saved seed.

Storage

Spinach seed will store for three years before germination starts to reduce.

Returning Seed to HSL as a Seed Guardian

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Seed Saving Guidelines

Trickier Annuals - Watercress

Nasturtium officinale

Family: *Brassicaceae* (*Cruciferae*)

Watercress plants are perennial semi-aquatic plants that need continuously wet soil.

Wild plants have been eaten for many centuries however commercial cultivation really became popular in the nineteenth century and continues today. Watercress is rich in vitamins and has a peppery taste when eaten raw.



Growing & Roguing

- In early spring sow seeds on the top of very moist seed compost. The seeds should remain uncovered at a temperature of between 10-15 degrees Celsius.
- When the plants have several true leaves, transplant in to 20-25 litre pots. Watercress needs to grow in clean, fresh water to avoid contamination, in the wild and often commercially, plants grow in running water. However, watercress plants can be grown in pots sitting in a deep saucer filled with 5cm of water. **The water used should be drinkable (i.e. tap water) and changed daily to keep it fresh.**
- Plants will grow in sun or partial shade but cooler conditions will keep the water fresher. Once in position, protect plants from any late spring frosts
- Watercress are out breeders, so grow as many plants as possible to maintain health and genetic diversity, and a minimum of 20.
- Rogue out any plants that look unhealthy and have atypical foliage.

Pollination & Isolation

Watercress flowers are perfect and self-pollinating but rely on insects for good seed set. They are a long day plant so they begin to produce their white flowers as day length increases in early to mid-summer. To avoid cross pollination between varieties only grow one variety per year and check your local environment for any wild forms. Recommended isolation distance is 800m.



Harvesting

Once flowering has finished, the seed pods will start to form. The pods turn yellow as they begin to mature and shatter open to disperse reddish brown colour seeds. There is a danger that seed will be lost this way so, if you have time, break the seeds out of the pods into a paper sack every few days as they ripen and this will maximise seed production. Otherwise, remove the entire stalk when the majority of the pods have ripened and dried, but not shattered. Collect into paper sacks and allow to dry for a

further two weeks in area with good ventilation.

Cleaning

Seed should be fully dry for threshing and most seed will shatter from the pods of its own accord. The remainder can be broken out by hand or by beating the pods in a sack and winnowing.

Winnowing is best done outside in a stiff breeze. Pour the seed steadily from one container to another, allowing the wind to blow the chaff away. Do this over a tarpaulin, in case a sudden gust wafts away the seed. Repeat until all the chaff has gone and only seeds remain.

Storage

Stored cool and dry, watercress seed will last for at least five years.

Returning Seed to HSL as a Seed Guardian

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Seed Saving Guidelines

Biennials - Beetroot & Chard

Beetroot - *Beta vulgaris* var. *conditiva*

Chard *Beta vulgaris* var. *vulgaris*

Family: *Chenopodiaceae*

Beetroot and chard (and mangel) are the same species with varieties selected for different purposes, either the size of the root or the production of the leaves (often for their startling colour and with a wide midrib). They will cross-pollinate with each other, but not with true spinach which is a different genus. The 'seeds' of beetroot are actually corky fruits or seed clusters, which normally contain between two and four seeds

Growing & Roguing

Beetroot and chard are biennial, grown one year to produce seed the next. The flowers are perfect, but are out-breeders and wind pollinated so cross-pollination occurs freely.



Storing beetroot roots over winter

Producing seed from over-wintered roots (this method is recommended for beetroot)

- Grow the roots as normal for the first year, sowing in the spring and storing the best roots in the autumn for planting the following year. Lifting and storing them allows you to select those with the shape, colour and size most typical of the variety. Store the roots in damp sand or spent compost in a cool, frost-free place. Any roots that are not storing well or are misshapen can be eaten. Do not save seed from plants that flower the first year.
- As beetroot are outbreeders you should select and keep as many as you can in order to preserve the health and genetic diversity of the variety – ideally at least 20.
- Plant out the best roots in spring as soon as danger of severe frost has passed. Plant firmly in blocks or rows at least 30cm apart and with their crown at soil level. Water well to encourage re-rooting. Chard should have similar spacing.
- The tall twisting flower spikes are surprisingly attractive and smell delightfully like honey. The spikes are branched and can grow to 1m or more, needing strong staking.

Producing seed from over-wintered plants (this method is recommended for chard)

- Another method is to over-winter plants rather than mature roots. This is particularly the case with varieties that are selected for their leaves rather than root. Sow the seed in August and overwinter them with protection in a glasshouse or polytunnel, under cloches, or in pots (three to a 20cm pot) to be planted out in the spring. Beetroot and chard need cold treatment (vernalisation) to induce flowering.
- Sown in this way, the plants should flower in June (they will require isolation), with seed ready to harvest from September. Chard is hardy enough to be left in the ground and the best plants allowed to seed *in-situ* the next spring.

Pollination & Isolation

All beets and chards are wind pollinated and will cross readily with each other. Spinach beet, being a different type of chard, will also cross-pollinate with beetroot and chard, as will mangel and sugar beet (watch out for a field of sugar beet nearby where there may be plants in flower).

The pollen can be wind-borne over relatively long distances so isolation is important. Commercial seed growers recommend a minimum isolation distance of 3km. If you are confident that no other beet, chard or sugar beet is flowering around you and if you save only one variety each year, you may not need to worry about cross-pollination. Crops grown for eating are not a threat, provided any 'bolters' are removed before flowering.

Isolation can also be achieved by 'bagging' or using horticultural fleece. Isolate as soon as the first flowers start to form. Insect-proof mesh is not suitable for beets as the pollen is fine enough to pass through even a very small mesh. Horticultural fleece is a better barrier, but can cause problems with humidity.

'Bagging' beetroot (using potato sacks, which are reasonably weatherproof) is an option. However, as only six or seven can be isolated together, not the 20 required for a healthy population, there is a threat of inbreeding depression, so this should not be done on a regular basis. Push a stake into the middle of each circle of plants and gently bend all the flower stalks towards it. Cover the flowers with a large potato sack and tie round the base of the stems. Some sort of cushioning (cotton wool or soft paper towel) will be needed to reduce abrasion round the stems and to prevent stray insects and pollen getting in. On still days shake the bag to keep the pollen moving and ensure seed set.



Harvesting

The seeds are mature when they start to turn brown, which they do successively from the base of the flower spike upwards. They can be left on the plant until all are ripe, and then harvest the whole stem. Remove covers when flowering has finished to let in light and air. Inspect regularly to see when the seed clusters start to form.

Cleaning

The mature seed clusters can easily be stripped from the stalks by hand. Pinch off the tips of the stalks where the seed clusters are small and immature, and sieve to remove any debris or dust. There is no need to separate the seed clusters; they are normally supplied this way and separation can injure the seeds.

Storage

Beet seed will store for up to four years before germination starts to noticeably reduce.

Returning Seed to HSL as a Seed Guardian

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Seed Saving Guidelines

Biennials - Brassicas

Broccoli, Brussels sprouts, Cabbage, Cauliflower, Kale, Kohlrabi, Swede, Turnip

Brassica oleracea & *B. napus*

Family: *Brassicaceae* (*Cruciferae*)

Although they appear diverse, all brassicas have been selected from just two common ancestor species: *Brassica oleracea* has given rise to broccoli, Brussels sprouts, cabbage, cauliflower and kale; *Brassica rapa* is the original species of turnip and swede is *Brassica napus*. Within species, each will readily cross with another, so must be isolated. They are biennial, being sown and grown one year to flower and seed the next.



Brassica flowers are perfect but are outbreeding, so require insects for seed set.

Growing & Roguing

General

- The plants are sown and grown as for a food crop but should be spaced more generously as the seed stalks are tall and branched, reaching up to 180cm in height.
- Brassicas are outbreeders, so as many plants as possible should be used to maintain health and diversity. We recommend a minimum of 24 plants, ideally 100 plants to maintain a variety true to type over multiple generations, though this number is not practical for most home seed savers.
- Thinning alternate plants for eating will ensure enough space between most leafy brassicas – about 1m each way.
- Roguing is essential. Most older brassicas are very variable and plants that differ too much from the norm should be removed before they come into flower. Rogue frequently as the characteristics of the plants change as they develop.

- Brassicas are best grown in a block as this makes caging much easier. You can move mature plants to a special seed production area to fit in with a rotation, or to make room for crops that are to follow. Root brassicas such as turnip should be stored over winter and the best roots replanted at a spacing of about 1m.
- Growing plants in a block also enables you to discard seed from the outer row or rows if you think there may have been crossing. Bees do not carry pollen far within a block of brassicas so the central plants are likely to be pollinated by their neighbours rather than by plants from far away. Seed from the central four plants in a block of 36 can be saved separately with even more confidence that the variety has been kept pure, while seed from other plants may carry the risk of contamination.
- Remove dead leaves as they can wrap around the flowering stalks and promote fungal growth. In the case of cabbages, particularly the tight headed varieties, you may need to cut a cross into the head or remove a large amount of the leaves to allow the flower stalk to grow through.

Spring Cabbage

The heads can be cut and used, letting the flower stalks shoot from the stump. If you don't use the head will need to cut a cross in it to allow the flower stalk to emerge but there is potential for it to rot so keep a close eye on it.

Cauliflower

Winter and early summer varieties should flower in the same year and cause few problems. Autumn varieties are more difficult to obtain seed from, as the plants will need to over-winter.

Brussels Sprout

These can be left *in situ*. The lower buttons and top head can be eaten.

Turnip and Swede

Protect with straw in extreme cold when over-wintering. Turnip varieties may flower in the same year if sown early. Discard any plants that bolt early.



Pollination & Isolation

Cross-pollination can occur to a distance of 1500m, so isolation by distance is a possibility depending on where you live. The risk usually comes from neglectful gardeners nearby who allow their previous year's crops to flower, and from oilseed rape that can cross with *B. napus*. As well as its widespread growth on farms, this can often spread to roadside verges and hedgerows.

The best seed set is obtained in the open. If there are too many potential contaminant brassicas growing nearby, you can introduce flies as pollinators inside a cage. Buy maggots from an angling shop (buy whites) put them somewhere warm to turn into pupae (or castors), then add them to your cage before they turn into flies. Make sure the shop knows how you intend to use them as they are sometimes treated so that they do not hatch.

They will need to be protected from the rain but free to fly when they hatch. An old lidded margarine tub with a hole cut in the side works well. Being enclosed in the isolation tent their forays will be limited to the brassica flowers, thus ensuring varietal purity. As flies are not very effective pollinators of brassicas this is not ideal, and seed set is around 40%.

Alternate day caging is a good method of maintaining purity of two varieties in a single season, provided that there are no local contaminant species. Flowering starts as the days lengthen, quite early in the year – usually mid-May. This is the time to start caging. Spun fleece, fine mesh or old closely woven net curtain (draped over the plants with a little support from canes), is placed over the plants of one variety one day, then moved onto the other variety the next. Pollen does not survive long enough to be carried from one day to the next.

Harvesting

Once flowering has finished and the seed pods are developing, cages can be removed and the pods allowed to mature uncovered. The seed stem often grows much further as the pods mature.

The pods turn yellow as they begin to ripen and are ripe when they start turning brown and have a tendency to shatter. There is a danger that seed will be lost this way, so keep a constant check on the ripening pods. If you have time, break the seeds out of the pods into a paper sack every few days as they ripen and this will maximise seed production. Otherwise, remove the entire stalk



when the majority of the pods have ripened and dried, but not shattered. It is important not to cut the seed stalks too early, while the pods are still green, as the seed will not continue to develop once cut.

Cleaning

Seed should be fully dry for threshing and most of it will shatter from the pods of its own accord. The remainder can be broken out by hand or by beating the pods in a sack and winnowing.

Winnowing is best done outside in a stiff breeze. Pour the seed steadily from one container to another, allowing the wind to blow the chaff away. Do this over a tarpaulin, in case a sudden gust wafts away the seed. Repeat until all the chaff has gone and only seeds remain.

Storage

Stored cool and dry, brassica seed will last for at least seven years before germination starts to drop off.

Returning Seed to HSL as a Seed Guardian

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Seed Saving Guidelines

Biennials - Carrots

Daucus carota

Family: *Apiaceae (Umbelliferae)*

Carrots are biennial, in the first year producing a storage root (the edible part) that can over-winter. In their second year they produce spectacular 'umbels' made up of many tiny flowers. They will easily cross-pollinate with any other carrot in flower, and also with the wild carrot *Daucus carota*.

Carrot flowers are **protandrous**, that is the anthers (male part) open first and shed their pollen before the stigma (female part) of that flower is receptive. They are, therefore, predominantly cross-pollinating.

Growing & Roguing

- For seed production carrot roots need to be selected and stored over winter. Therefore, they should be sown later in the year (June, July) so that they are ready to store as the temperatures drop and growth is slowing around the end of Oct/November. We want them to be dormant in storage and not start re-growing until re-planting in spring.
- For small quantities of seed sow into modules and plant out before tap roots start to develop, larger amounts can be direct sown.
- Grow the plants as you would for a crop grown to eat.
- Rogue out plants that bolt or have foliage that looks unhealthy or differs from the rest.
- Lift and store the best roots at the end of the first year and trim off foliage. Store in a box of moist leafmould, coir or sand in a cool, frost-free and rodent-free place.
- Small, misshapen or sprouting roots should be removed and eaten; those roots that store best and have the best shape, colour and size should be used for seed production.
- Carrots are outbreeders; grow at least 20-30 to maintain the health and diversity of the variety and prevent inbreeding depression.
- Replant the selected roots in the early spring, making sure they are well firmed in, with the crown at, or just below, the soil surface, spacing at 45cm each way (in a block if you need an isolation cage). It is the primary 'king' umbel that produces the best seed, and a close spacing encourages the king umbel at the expense of the secondary side umbels.
- Plants will need staking as they can grow to 1.5m or more.



Pollination & Isolation

Carrot flowers are perfect but do not self-pollinate; they rely on insect visits for seed set. The recommended minimum isolation distance for carrots is 1000m. If this cannot be achieved, grow them in isolation and hand-pollinate or introduce pollinators.

Isolation can be best achieved by enclosing plants in a cage constructed of fleece or fine mesh.

Use bamboo canes to build a tepee over the plants as they are coming into flower and wrap the framework with spun fleece or mesh. Ensure the flowers do not touch the sides as it is possible that they may be visited by insects from outside, through the mesh.

To hand pollinate gently rub your palm or a large paint brush over the flowers moving back and forth between inflorescences. Alternatively, flies can be used as pollinators. Buy from an angling shop as maggots (buy 'whites') and put them somewhere to encourage pupation (become castors). Transfer them to your cage before they hatch into flies. Put them into a lidded container with a hole cut into the side to protect them from the rain and allow them to fly out when they hatch. Make sure that the shop knows how you intend to use the maggots as some are treated to prevent them hatching. When introducing them into the cage take care to prevent other insects entering. You will see seeds beginning to form if pollination has been successful.

Crossing with wild carrots will show up in the first generation because the fat, coloured roots of cultivated carrots are recessive to the spindly white root of wild relatives; coloured roots will still be pure. You may, however, not be able to easily detect crossing between different cultivars so it is best to use the cage method to ensure complete isolation.

Roots sometimes rot in storage, or do not develop sufficient root hairs after replanting, leading to a collapse of the flowering stalk just as it comes to maturity. To avoid this sow the seeds in large (25cm) pots in August. Allow the carrots to over-winter in their pots and in spring either leave them in their pots or plant into the open ground taking care not to disturb the root ball.



Harvesting

Once flowering is over remove the cages, allowing air to dry out the umbels. The developing seeds can be susceptible to fungal diseases and the airflow will help minimise the risk. The seed is ripe when it turns brown, the umbels become brittle and the barbed seeds come free of their stalks

Harvest repeatedly over several weeks. This will maximise the seed quantity and improve quality. If you must harvest all the seed at once do so when most seeds have ripened; few will do so once the stems have been cut.

Cleaning

Cleaning carrot seed is a straightforward operation; they are quite free of chaff and fall easily from their stalks. Remove the seeds by gently rubbing the flower heads and allow them to fall off into a paper bag or sack. Fine debris can be removed by reverse screening with a small mesh sieve that retains the seeds, but allows small pieces of chaff through

Carrot seed is bearded and carefully scarified to remove the beard for commercial packets of seed. Spines can be rubbed off against a fine sieve allowing the dust to fall through, it is a dusty process, so we recommend you wear a dust mask to prevent inhaling them.

Storage

The seeds can be stored in a cool, dry place for up two-three years after which viability will fall off very rapidly.

Returning Seed to HSL as a Seed Guardian

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Seed must be completely dry and fully cleaned. Seed that retains moisture can go mouldy in transit and will have to be discarded. It can take a few days for seed to get to us in the post so pack seed in breathable material, e.g. a paper envelope or cotton bag, and place it in a padded envelope or stout box to protect the delicate seed from impact damage.

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Seed Saving Guidelines

Biennials - Celery and Celeriac

Apium graveolens

Family: *Apiaceae (Umbelliferae)*

Celery and celeriac are biennial vegetables, and both must be kept over winter to flower and set seed the following year. The stem (celery), root and swollen base of the stem (celeriac) and spicy seeds (both) are all eaten.

Celery and celeriac flowers are **protandrous**, the anthers (male part) open first and shed their pollen before the stigma (female part) of that flower is receptive. Therefore, they are predominantly cross-pollinating even though individual flowers are perfect and potentially self-fertile. In their second year they produce tiny, white flowers on branched umbels that appear successionaly over a season.



Growing & Roguing

- To avoid bolting (flowering early before all the vegetative growth has occurred), seeds need temperatures of around 15 degrees Celsius during germination.
- Sow mid-March in modules or pots and transplant as soon as they can be handled to avoid transplant shock and protect new plantings from frost.
- Alternatively, sow direct and thin to their final planting distance.
- The seeds are very small so use a very thin covering of sieved compost or garden soil if sowing direct. The seeds can take a while to germinate so patience may be required!
- Grow in fertile and moisture retentive soil that should never dry out.
- During growth, rogue out plants that bolt or have foliage that looks unhealthy or differs from the rest.
- Celery and celeriac are out breeders and need a population of between 20-50 to maintain the health and diversity of the variety and prevent inbreeding depression.
- At the end of the first year, lift and store celeriac roots and trim off the foliage. Remove any diseased and damaged roots before storage. Store in a box of moist leaf mould, coir or compost in a cool, frost-free and rodent-free place.
- Celery can be replanted as a whole plant in to pots with slightly moist compost and stored in a cool, frost free and rodent-free place.

- Both celeriac and celery need **vernalisation** (a period of cold to flower) below 10 degrees for 4-9 weeks while being overwintered.
- Replant the selected roots after the hard frosts have passed in spring, making sure they are well firmed in, with the crown at or just below the soil surface, spacing at 60cm each way (in a block if you need an isolation cage).

Pollination & Isolation

Celeriac and celery flowers are perfect but do not self-pollinate; they rely on insect visits for seed set. The recommended minimum isolation distance is 800m. If this cannot be achieved, grow them in complete isolation and hand-pollinate or introduce pollinators.

Isolation can be best achieved by enclosing plants in a cage constructed of fleece or fine mesh.

Use bamboo canes to build a tepee over the plants as they are coming into flower and wrap the framework with spun fleece or netting. Ensure the flowers do not touch the sides as it is possible that they may be visited by insects from outside, through the mesh.

To hand pollinate gently rub your palm over the flowers moving back and forth between inflorescences. Alternatively, flies can be used as pollinators. Buy from an angling shop as maggots (buy 'whites') and put them somewhere to encourage pupation (become castors). Transfer them to your cage before they hatch into flies. Put them into a margarine tub with a hole cut into the side to protect them from the rain and allow them to fly out when they hatch. Make sure that the shop knows how you intend to use the maggots as some are treated to prevent them hatching. When introducing them into the cage take care to prevent other insects entering. You will see seeds beginning to form if pollination has been successful.

Harvesting

Once flowering is over remove the cages, allowing air to dry out the umbels. The developing seeds can be susceptible to fungal diseases and the airflow will help minimise the risk. The seed will turn from green to brown and detach easily from the plant when ripe.

The quantity and quality of seeds will be better if harvested repeatedly over several weeks. Either harvest individual seed heads or more realistically whole branches or plants. Harvest once 2/3 of the seeds have ripened. Collect in large paper bags and allow to dry for a further two weeks in a dry area with good ventilation.



Cleaning

Remove the seeds by gently rubbing the flower heads between your hands allowing them to fall off into a tray or a clean container. The more gently this can be done, the less likelihood of bits of stem and debris being mixed with seed. Fine debris can be removed by reverse screening with a small mesh sieve that retains the seeds but allows small pieces of chaff through.

Storage

The seeds can be stored in a cool, dry place for up to three years after which viability will fall off very rapidly.

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Seed Saving Guidelines

Biennials - Onions & Leeks

Leek - *Allium porrum*

Onion - *Allium cepa*

Family: *Alliaceae*

Onions and leeks share many characteristics. The main difference is that onion leaves are hollow tubes, while leek leaves are flat straps with a keel up the middle. Both are biennial, but the onion leaves die back to leave the dormant bulb while leeks are evergreen and winter hardy.



This guideline deals only with those onions and leeks that reproduce mainly by flowering and setting seeds. Other sorts (garlic, elephant garlic, shallots, potato onions, rocamboles etc) may flower occasionally but are usually propagated vegetatively. These are dealt with in Seed Saving Guideline No.15 Multiplier Onions and Shallots.

Allium flowers are perfect but cannot usually fertilise themselves. This is because they are **protandrous**; the male anthers open first and shed their pollen before the female stigma of that flower is receptive. Individual flowers in ball-like heads open over a period of about four weeks, peaking in the second week.



Growing & Roguing

- Leeks and onions are biennials, so in the first year follow your normal practice for crop production. Grow at least 30 plants to ensure at least 20 can be grown, after selection, in the second year.
- Onion flower stalks can reach around 150cm in height, leeks up to 180cm, so remember to have sufficient space and position stakes to support them later.
- Leeks are best left in their planting position to overwinter while onions are lifted and stored out of the elements over the winter (see storage notes below)
- Only choose those onion bulbs that are characteristic of the variety.
- Be ruthless about roguing out any plant whose foliage is not up to scratch, or which flower in the first year.

- In the second year plant the best of your onions in the spring and they will soon put out fresh leaves and a flower stalk.
- Susceptibility to disease, e.g. leek rust, can vary within a variety, so select the most resistant plants to save seed from.
- Avoid saving seed from 'bull-necked' (wide and rounded) or 'bottle-necked' (tapering up the stem) onions.
- You can slice across an onion, about a third of the way down, to check the evenness of the rings and the colouration, without any harm to the shoot inside. This allows you to check that it is true to type.



Pollination & Isolation

Bees and flies are the main pollinators, although *Alliums* attract many other insects. Onions and leeks will not cross with one another, although varieties within species cross readily. The easiest way to maintain varietal purity is to grow just one variety of each species for seed each year, allowing insects to do the work. They should be isolated from other varieties by at least 1500m. You can grow others to eat, but be vigilant about removing flowers, especially from potato onions and shallots (for onions) and elephant garlic (for leeks).

If you do want to grow two or more varieties for seed you must either isolate by 1500m or use one of the caging techniques. Unless you use alternate caging you will have to hand pollinate daily. Between 9.00am and noon remove the cage from each variety and use a soft brush to transfer pollen between the flowers. Go round the flowers two or three times to ensure a good mix, and either clean the brush in alcohol between varieties or use a different brush for each variety. You may need an assistant to keep insects away while you are busy pollinating.

Harvesting

Allium flowers need to be watched carefully as the seeds mature because the ripe seed pods shatter easily, splitting and releasing the seeds. As soon as you can see the black seeds within the drying flowers you should cut the whole head and place it in a paper bag to finish drying.

Please note: Leek seed tends to take a lot longer to ripen than onion seed.

Cleaning

Most of the ripe seeds will fall from the dry flower head quite easily, encouraged by gently shaking. The rest can be removed by rubbing the flowers between your palms, or across a sieve that allows the seed to pass through. The best way to clean seed is by sieving and winnowing in a light breeze.

Storage

Handle onion bulbs carefully, to avoid bruising, and cure them in the sun for a couple of weeks before storing. Onions store best at low temperatures and low humidity (0-7°C/32-45°F, <40% R.H.) or high temperatures and high humidity (25-35°C/77-95°F, 60-70% R.H.). Room temperature (16-21°C/60-70°F) is the worst situation for storing onions. Storage gives another chance to reject defective bulbs, such as any that do not last for long, before replanting in spring.

Onion and leek seed will store in a cool, dark place for at least 3 years.

Returning Seed to HSL as a Seed Guardian

It is vital that seed returned to HSL is not cross-pollinated. So do not send seed to us that you suspect might have crossed.

Seed must be completely dry and fully cleaned. Seed that retains moisture can go mouldy in transit and will have to be discarded. It can take a few days for seed to get to us in the post so pack seed in breathable material, e.g. a paper envelope or cotton bag, and place it in a padded envelope or stout box to protect the delicate seed from impact damage.

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Clean onion seed by rubbing flowers across a sieve

Seed Saving Guidelines

Multiplier Onions & Shallots

Allium cepa var. *aggregatum*

Family: *Alliaceae*

Potato onions and shallots are very productive and easy to grow. For little effort you can get a return between three and eight times by weight each year. Shallots invariably form a cluster of new bulbs, often as many as 10 or 15 a cluster. Some throw up a flower stalk, but generally this should be removed as soon as it is noticed. Potato onions usually form a cluster, especially if they are large when planted, but sometimes a small bulb simply grows without multiplying.

Growing & Roguing

- Soil preparation should be as for other onions, with plenty of organic matter and a pH of between 6.5 and 7.0. The big decision is whether to plant in autumn or spring; each has advantages and disadvantages.
- Autumn planting usually gives a much better yield, often twice that of a spring planting. The risk is that your plants will be destroyed by severe frosts. Multiplier onions are very hardy and can survive down to -30°F.
- The best strategy is to plant the largest bulbs in the autumn and smaller ones in the spring. Under no circumstances should you plant all your bulbs in the autumn, because you risk losing all of them.
- Large bulbs should be planted 20cm apart, in rows 30cm apart. Smaller bulbs can be placed close together.
- Two things that are particularly important are weeding and water. All onions suffer badly from weed competition, so ensure that they are kept down. Water is also vital; do not allow the soil to dry out, or growth will be checked and yield and bulb size will decrease.
- Multiplier onions generally reproduce clonally. For that reason, selection consists of replanting your best material. Do not replant any that have sprouted, or you will be selecting for poor-keeping traits. Always replant your best bulbs.

Autumn Planting

Autumn planting should be carried out mid-October, a week or two earlier in cold regions, or a week or two later in the warmer areas. The bulbs should be planted deeper than in spring, with 2-3cm of soil

over the top of the bulb. If your winters are very severe you might prefer to hill about 7cm of soil over the bulbs, removing this in the spring. Alternatively, you could use a straw mulch between 10-20cm thick, again removing it in the spring. The green tops of autumn planted multiplier onions can be used in salads and cooking.

Spring Planting

Plant as soon as the soil is workable. Small bulbs, less than 2cm across, should be planted so they are just covered.

Harvesting

The leaves of multiplier onions will die down in July or August. Stop watering once this happens. When about three quarters of the tops have died down you can start harvesting. Any whose leaves have not fallen over should be given another 7-10 days to ripen. Any bulbs still green after this time should be eaten as they will not store well.

Do not bend over the tops as this can allow diseases to infect the bulbs. To harvest, lift the bulbs gently by hand or with a fork and leave them on the surface or upturned crate to dry for a week or so. Cover with a cloche or fleece if necessary. Remove excess soil but don't attempt to clean the bulbs completely or separate the clusters.

Curing

This is an important process that improves the flavour and hardiness of the bulbs. Move the bulbs to an area that is warm and dry, shaded but well ventilated, and spread them out on wire screens or wooden shelves. Leave them for a month or two, checking every couple of weeks and removing any bulbs that have spoiled. Handle the bulbs as little as possible because they are still quite moist and will bruise easily. Once they have been cured you can separate the clusters, rub off the dry outer scales and cut off the top foliage about 2cm above the bulb.

Storage

Bulbs that have been correctly cured will store well over winter, provided they are kept cool, dry and well ventilated. Mesh bags and old tights are ideal containers, but bulbs also do well on shelves or in open boxes provided they are not stacked too deep. Inspect the bulbs every month or so and remove any rotten or sprouting ones.

Returning bulbs to HSL as a Guardian

Bulbs are easily damaged and may be spoilt if sent by post or carrier. They are also relatively heavy and will be expensive to send. We therefore recommend that you keep bulbs for your own use, or pass some on to friends.

If there are circumstances when you wish to send us bulbs there are some precautions you can take to minimise damage and get them to us in the best condition possible. Bulbs must be dry and clean with a minimum of excess crop debris attached. Use ample packaging to protect the delicate bulbs if sending them in the post. Any that go mouldy or are badly damaged in transit will have to be discarded. It can take a few days for packages to get to us in the post. If possible, deliver in person.

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Seed saving guidelines

Sorrel

Rumex spp.

Family: Polygonaceae

Sorrel is an early fresh perennial vegetable often harvested in early to mid-spring. However cutting plants back can promote harvest throughout the year. French sorrel (*R. scutatus*), produces small arrow-shaped leaves, with an acidic flavour. Patience dock (*R. patientia*), produces large, non-sour leaves harvested in spring. Common or garden sorrel (*R. acetosa*), is commonly cultivated but can also be found in the wild. Other species are sheep's sorrel (*R. acetosella*), wood dock (*R. sanguineus*), Wrinkled dock (*R. rugosus*), and Alpine dock (*R. alpinus*).

Growing and roguing

- Sorrel can be propagated through cuttings taken in autumn/spring, or by sowing seed in modules indoors from early spring (March onwards) and transplanted out late spring (April/May) onto fertile, well-drained soil. Sorrel seeds require light for germination. Therefore seeds will only need to be covered with a light sprinkle of compost and gently patted down when sowing.
- Plant size varies between species and varieties, and so will spacing needed between plants. Generally, French sorrel, wood dock, and wrinkled dock suit 15cm by 25cm spacing; while larger patience dock requires 25cm by 40cm spacing when planted out.
- Flowering stalks can reach 2-3ft tall and will form in the second year of growth from May-June. The plants should easily overwinter in situ in temperate climates until this time, but will benefit from cutting back to the last few leaves before the first winter.
- A population size of at least 20 plants is recommended for saving seed, as sorrel species are outbreeders.
- Sorrel plants prefer wet sites so regular watering is paramount to ensure healthy plants that don't bolt, and flower too early.
- Rogue out any plants which bolt too early, or present off-type characteristics, such as greatly different leaf size.



Arrow-shaped leaves of French sorrel, *Rumex scutatus*.

Pollination and isolation

Plants are dioecious, male plants producing small green flowers on dense panicles while female plants produce reddish flowers. Flowering occurs from late May to August. Flower and seed stalks can reach 2-3ft tall and are formed in the second year of growth. The seeds (called achenes) set from May until September.

Sorrel flowers are wind pollinated. Varieties within a species will cross-pollinate, so it is advised to isolate plants for seed saving by caging 5-10 male and female plants with fine mesh once flowers start form, agitating regularly to facilitate pollination.



Harvesting

Male plants and cages can be removed once female plants have set seed to aid the ripening and drying process. Watering should be stopped once all of the flowers have set seed, to allow the seeds to dry out on the plant for as long as possible. The seeds (achenes) should be firm, dry, and as brown as possible before harvesting. If weather conditions are not ideal for drying on the plant cut seed stalks and lay on cloth/tarp in a warm, dry, shaded place to dry out further before cleaning.

Cleaning

The achenes should easily rub off the seed stalks when fully dry, collected into a tray and laid out to dry further. Use a fine sieve to winnow any small debris from the seed harvest.

Storage

Store in a cool, dry and dark place. Seeds should be viable for approximately 4 years.

Returning to HSL as a Seed Guardian

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