

Seeds and Seed Saving

Introduction

Seeds are a gardener's greatest treasure. Nowadays we're spoilt for choice in both varieties and sources of supply, particularly since the internet has matured over the last ten to twenty years. But you don't have to go back many decades for much more restricted availability and, until a couple of centuries ago, virtually the only source was seeds saved oneself or obtained by personal contact.

Most seeds are now grown considerable distances away from where they are sold with a resultant hefty carbon footprint. Saving seed can save you money, reduce your garden's carbon footprint and if more people do it, increase a community's resilience to shocks due to peak oil. It can also be good fun.



Kale, beetroot, borlotto bean, carrot, runner bean seeds

Storage and viability

Seeds need moisture and warmth to germinate, some need light. You only want them to germinate when they're sown so they should be stored dry, cool and dark.

How dry? Below 8% moisture content and impervious to all external sources of moisture.

How cool? Below 5°C is optimal, in a freezer for very long term storage, properly dry seed is safe to freeze.

Dr James Harrington experimented on the effects of seed moisture content and temperature on seed viability back in the 1950s and established two approximate rules which have been subsequently verified by other researchers:

- seed life is doubled by each 1% reduction in seed moisture content between 6% and 16%
- seed life is halved by each 5°C increase in temperature from 0°C to 50°C

Thus, a seed which could survive 10 years at 5°C might only survive 7.5 months at 25°C! Let it absorb moisture and it may only survive a few weeks. Poor seed storage not only reduces germination, it weakens the seed, adversely affecting its early growth and often reducing the plant's ultimate yield.

I store my many seeds in food storage containers or jars in a filing cabinet in a very cool, unheated, Scottish barn. Their temperature almost never rises above 10°C and rarely drops below 0°C. I only ever take out what I'll sow in an hour or so, always keep that in the shade and protected from wet, and never leave them in a hot greenhouse. A day of heat maltreatment could shorten seeds' life substantially. I rarely buy seed from warm garden centres - a few months at 25°C does a lot of damage to seed viability - online purchased seed is much more likely to have been stored appropriately. Properly dried saved seed is best stored in something like 'ziplock' plastic bags which can be purchased online very cheaply in various sizes. These bags can then be kept in airtight food containers and jars.

When you open seed packets that you won't completely use up at once do so in a way that lets you reseal them properly and read all the important information - especially the seed's

identity and use by date. Seeds that have an inner foil packet can usually be fairly well resealed, seed packets without this are best stored inside a ziplock bag but always ensure the packet is dry before storage. If I've stored commercial seed well I often find it remains viable for several years beyond its 'sow by' date as this tends to be conservative to allow for typical heat and moisture abuse.

Fridges are ideal for medium term storage but you should ensure seeds are kept airtight for a few hours after taking them out of the fridge to avoid condensation moistening the seeds. If you plan to store seed for more than its natural lifetime freezers are the best option. You should ensure any seed you intend to put in the freezer is well dried before storage. When you need to use only take out the seeds you plan to use in the next few weeks and put the rest back into the freezer immediately. Keeping the seed airtight in the freezer and, when taken out, until it is up to ambient temperature is very important.

How long will your seed live? Surprisingly long if you treat it well. I've had 75% germination from tomato seeds I saved 12 years before and stored in a paper envelope in a cool place, and get very good results from cabbage, kale and beans saved 5 years and more ago. Not all seeds have similar longevity, here are some general guidelines (gathered from several sources - which can be surprisingly contradictory - and personal experience) for seed stored dry and below 10°C:

Very short (1-2 years): Parsnip

Short (2-3 years): Leek, onion, sweetcorn

Medium (3-5 years): Celery, celeriac, pea, carrot, rhubarb, parsley, sage, thyme, kohlrabi, basil, okra, coriander

Long (4-6 years): Beans (broad, french, runner), spinach (annual and perpetual), mustard, pepper, chilli, endive, salsify, scorzonera, beets (beetroot, chard), cabbage, rocket

Very long (5-7+ years): Lettuce, cauliflower, broccoli, borage, chicory, courgette, squash, pumpkin, tomato, cucumber, aubergine, fennel, turnip, radish, kale

I've done experiments on my own saved parsnip seed and got the following approximate germination rates at various seed ages:

Next season (less than 1 year old): 80%

Over 1 year old: 60%

Over 2 year old: 25%

Over 3 year old: 10%

Over 4 year old: 0%

Parsnip is the worst seed I know for keeping; commercial seed suppliers only have to prove 50% germination when packed. For virtually all other commercial vegetable seed minimum required germination rates - in ideal conditions - is at least 90%. It's recommended you only use parsnip seed in the season it is produced for, but I've had decent germination in the following year or two. Often the major cause of failed parsnip germination is cold, wet, soil.

Sowing and germination

The optimum temperature for most seed's germination (in both success rate and speed of emergence) is 20 to 25°C, worth knowing where you have total control as when sowing in a heated propagator - very few vegetables (cucumber, melon, okra) benefit from a temperature of more than that. Fortunately many are not too fussy and will germinate well, albeit more slowly, at lower temperatures. Most seeds tend to germinate and grow faster at higher temperatures but some, notably some lettuce, have strongly suppressed germination above 25°C.

Typical germination temperatures for common vegetables:

Aubergine 21 to 27°C

Broad bean 5 to 25°C

Runner and French beans 10 to 27°C

Beetroot 10 to 20°C

Broccoli 10 to 27°C

Cabbage 7 to 27°C

Carrot 7 to 30°C

Cauliflower 5 to 27°C

Celery 5 to 25°C

Chard 4 to 30°C

Chilli 20 to 27°C

Coriander 5 to 27°C

Courgette 15 to 30°C

Cucumber 20 to 27°C

Fenugreek 5 to 30°C

Lettuce 4 to 25°C

Leek 10 to 30°C

Melon 21 to 30°C

Onion 10 to 30°C

Parsley 10 to 30°C

Parsnip 4 to 30°C

Peas 4 to 25°C

Radish 7 to 30°C

Salsify 7 to 25°C

Scorzonera 7 to 25°C

Squashes 20 to 27°C

Tomato 20 to 27°C

Turnip 4 to 40°C

There can be considerable variation between different varieties of the same vegetable, some have been bred and / or produced in hotter climates and this can have a noticeable effect. Some seeds burst into life almost immediately given good conditions and you may see seedlings within a week: many brassicas, coriander, fenugreek. Others are naturally much more reticent: parsley, carrot, onion, parsnip, celery - they can often have you wondering whether they've failed or are just taking their time, you might not see seedlings for a month if you sow them in early spring.

Unfortunately most weed seed will be germinating and growing more vigorously than many vegetables so early weeding is critically important to enable the vegetable plants to get established.

Seed Saving

Seed saving is fun and mostly very easy. As well as saving money and having the satisfaction of growing plants from your own seed I've found that my saved seed nearly always performs better than purchased seed - it usually germinates faster, grows more vigorously and produces better crops. I don't know why this is, but hazard a couple of guesses:

- the plants were usually grown in the same climate as they were resown and had adapted somewhat

- commercial seed may have been harvested all at once rather than at optimum ripeness

- commercial seed may have been overly dried, hence slower to wake up

Growing seed

Simply: a plant grows, flowers, the seed ripens and you harvest - it's what the plant wants to do! But it's not quite that simple. Some plants do indeed produce seed in the same year they're sown but others, like most of our root crops, don't flower and set seed in one season from sowing - and they wouldn't be much use as root crops if they did. So, we have the problem of keeping them alive through winter to produce the seed crop in their second season and they will occupy space in the garden for two seasons. Then we have the problem of interbreeding between different varieties of the same crop, between closely related crops, even with related weeds. We can solve this by isolating our seed crop in space or time of flowering, or by barriers. Another problem, particularly in our northerly climate, is inclement weather hampering seed ripening and harvesting.

Many vegetables which need to overwinter will survive winter well enough in situ, and you can cover with a couple of inches of soil, or with straw or fleece to help. Root crops can be lifted and stored in soil clamps or in very cool conditions in slightly damp sand or compost. Basically they need to be cool enough to keep them sleepy, moist enough to avoid drying out but not so wet that they freeze or rot. Bigger plants like cabbages are harder to lift and store: they need to be lifted with about a cubic foot of rootball and they have a big leaf area to lose moisture through - storage is challenging if you don't have a root store, and 3 to 4 months is about the limit for storage even in near ideal conditions.

An alternative to lifting and storing is to grow immature plants specifically for seed to overwinter in a protected frost free but cool situation for planting out in spring. Typically these would be sown around the end of July, put somewhere safe from frost in October and planted out by late March (dependent on weather). The disadvantages are: you won't be able to see which plants are best and they will each produce significantly less seed than a fully grown plant would so you'll need more plants.

Even if plants have overwintered outdoors you may want to move them to spend the

summer producing seed. Most transplant well if you do it before they burst into life, do it carefully and take a decent rootball; I often don't move crops like purple sprouting broccoli and kale until they are beginning to flower. Planting them fairly closely in square or rectangular blocks is better than rows for space use and pollination. I space smaller root crops about 4 to 6" apart, larger plants so they are just touching. It's surprising how small an area is needed to produce a lot of different seed.

Often plants get unexpectedly tall when allowed to flower so growing them in a pattern that enables support with stakes and string is a good idea, especially in exposed situations. Until you know better assume the flowering plants will be about 4 feet high.

Can you eat crops from plants you intend to save seed? Yes, but - in most cases - the more you pick from them the less seed they will produce.

Some plants benefit from special treatment to help them produce seed. Tight headed lettuce and cabbage like a slit or cross cut in their heads about an inch deep to help the flower spike to emerge, brussels sprouts and multi headed broccoli produce more flowering heads if you pick out their main growing head.

Genetics and Selection

Hybrids (often termed F1 hybrids, F2 hybrids, etc) don't breed true, you'll almost certainly get poor results from saving their seed. Avoid. Like humans there can be considerable variation within one variety - you'll increase the likelihood of producing good crops from your seed by selecting your best and undamaged plants for seed production and minimising any cropping from them. For some vegetables, like salad crops, you don't want the seed from plants which go to seed soonest, you want seed from plants which stand longest before going to seed, so pull out and eat the ones that bolt first or pinch out their flower heads before they open. Also too much inbreeding can cause problems so you should try to save seed from a sufficient number of plants, fortunately about 8 is enough for the vast majority of vegetables.

Pollination

Some flowers are almost completely self-pollinating so even a single plant can produce viable seed; some cannot self-pollinate so require other plants of the same type to set seed; many are in between these extremes. Some are largely pollinated by wind; some require insects; some use both. Many vegetable species cross pollinate, some don't; some will cross-pollinate with related plants, including commercially grown fodder and processing crops, and there are some weeds which will cross-pollinate with certain vegetable crop plants. This is the main area of complexity with seed saving.

Isolation

Where cross-pollination is a potential problem you can isolate your seed crops by separating them from cross-pollinating crops by sufficient distance, usually about half a mile in open situations but much smaller distances - perhaps a fifth or tenth of the open recommended distance - can be adequate in areas with lots of barriers like buildings, walls, hedges. Or by growing them to flower at a different time, or by sacrificing the outer rows of your seed plant block and only saving seed from the inner plants (not so useful for small scale seed production), or by using physical barriers to protect your seed plants. Different crops and situations are amenable to different tactics. It's fairly easy to sow broad beans, for example, such that two varieties flower at different times by sowing an early variety at the beginning of April and a slower growing variety around mid-May. Most related plants are more difficult to separate in time like this - they tend to want to flower at the

same time, especially overwintered crops and those that take two seasons to produce seed.

Where several people are growing crops in close proximity, like allotments, or if you are saving seed from several varieties which cross-pollinate, isolation can be a real problem, particularly for brassicas, broad beans and courgettes / squashes. Bagging and caging can be necessary in such situations.

For insect pollinated crops a fine mesh or net curtain material is ideal, for wind pollinated crops something like polythene or fleece is needed. Individual plants or flower heads can be bagged to prevent external pollination; larger cages can be fashioned to enclose blocks of multiple plants. You often need to resort to hand pollination to produce an adequate seed set where you've excluded the normal pollination vector. A small paintbrush works well, use it to brush pollen from one flower's stamens onto the stigma of another flower. If the plants are "self-incompatible" the flowers need to be on different plants.

In the special situation of only two proximal cross-pollinating varieties you can use 'alternate day caging': isolating one crop on day 1, the other on day 2 etc during the flowering period, hence allowing the wind or insects to do their job when the variety is not caged. You need to make your cages easily movable or openable for this.

Ripening and harvesting

When are seeds ripe and ready to harvest? That's hard to describe in general terms but actually quite easy to tell if you use a bit of observation and common sense. It often takes surprisingly long for flowers to become ripe seed so be prepared to be patient. For peas and beans the pods need to have shrivelled, dried and darkened (beans) or lightened (peas) and become papery. If the pods feel dry and warm compared to a green pod they're probably ready - just peel them open and you have your seed. For small podded seeds like brassicas the pods lighten to a colour like dry grass and, if you keep a close eye on them, you'll probably see the most mature pods split and release their seed. Again, the warm and dry pod feel is a good indicator, roll the pods between your fingers and they will often split open and the seeds pop out into the bowl you're holding to catch them. Those that produce naked seeds like parsnips, lettuce and carrots, you will see the seed change colour, usually from green to buff - the warm and dry feel indicator works for these, too, and you can pluck the seeds or snip the seed heads off to process.



Ripe turnip seed pods

Unlike most commercial processors you might have the luxury of regularly checking your seed and harvesting it as it ripens rather than in one hit. However, if the seed is about ready and the weather is wet or threatening to be, you can cut off branches of seed heads or pods, even whole plants, and hang them up somewhere light and dry, with reasonable air circulation, to finish their drying and ripening. Seed harvesting is definitely a fair weather sport, avoid harvesting when wet if at all possible. At times the season's weather will defeat you, use your judgement to harvest what you can and hang up to dry and ripen before too late - most seeds continue to ripen once the plant has been pulled up.

Cleaning seeds

Common sense and ingenuity are very useful when cleaning seeds. A variety of sieves and a gentle breeze come in handy, too. Your objective is to have viable seeds and nothing but. A first stage will likely be separating the seed from its pod or head. Bean and pea pods you just peel open, small pods and seed heads usually respond to rubbing between your hands over a bowl or bucket, sometimes you'll need to use fingernails or plucking etc. This will give you a mix of seeds and unwanted detritus.

The two methods I use to separate them are sieves and a wind tunnel. Sieves depend on things being different sizes - the seeds you want will be bigger than some detritus and smaller than other detritus. But you'll never have exactly the right sizes of sieve and some seeds aren't round. The wind tunnel depends on the seeds being heavier than the detritus (more true than you might expect for most seeds) so the detritus gets blown away more than the seeds. No, I don't have a wind tunnel but I can blow on a bowl of seed while shaking it (carefully, it takes a bit of practice) and often use a breeze by pouring seeds from one container to another (beware: round seeds bounce, breezes gust). A cool and slow hair-drier or fan can be used too.

Gelatinous seeds like tomato need fermenting in water for several days to separate the seeds from their gel coating, just put the seed in a lidded jam jar with water, shake vigorously and release any pressure daily, and after 3 to 6 days the seeds will separate and you can wash thoroughly and strain, then dry them on a plate - avoid using paper as they stick to it.

The whole seed cleaning process is usually very iterative, at times patience trying, but ultimately satisfying. They don't have to be completely clean to be usable.

Drying seeds

How dry should your seed be before storing? That depends. If you are going to use it all next spring and store it in paper bags meanwhile then it just needs to be dry enough not to sprout or go mouldy - if you store it cool enough. If you intend to use it over several years and / or store it in airtight containers then it needs to be drier: a moisture content of below 10% by weight is necessary, and below 8% is advisable. Fungal growth will typically occur at above 12% seed moisture, insect activity (eggs, grubs) at above 8%. Commercial seed is typically dried to a moisture content of around 5%. Usually I just dry seed on plastic food trays or plates, ideally in a single layer (regular stirring and shaking works for layers a few millimetres deep) on a sunny window ledge. If you have live wildlife in with your seeds use a shallow plate to encourage them to wander off - most don't like too much heat, bright sunlight and nowhere to hide.

How long it takes to dry seed depends on how warm / sunny it is and how big the seeds are. Smallish seed like most brassicas, carrot, lettuce should dry sufficiently in about 5 sunny September days, beans can take several weeks - very dependent on how dried out they were when you harvested them. A rough way of checking if seed is dry is to see if you can dent it using moderate pressure from your fingernail, if you can it needs more drying. A more scientific way, if you have very accurate weighing scales and a decent amount of seeds, could be to weigh the seed before drying then daily as it dries. Since you don't know the moisture content before drying you won't be able to accurately calculate the moisture content when it's dry but you will notice that the weight drops more quickly initially then levels off, two warm sunny days with minimal weight loss (about 1% in total) should indicate it's sufficiently dry. Your scales should be accurate enough to detect a 1% drop in total seed weight - for 100gm of seed they would need to measure 1gm etc. Even more scientific would be to dry a weighed sample of the seed to destruction in a cool oven

(between 50°C and 75°C) for a day or so which should reduce its moisture content to below 2% and use that to calculate what the weight of the rest of your seed would be when dried to about 5% moisture. NB you should weigh the rest of the seed at the same time as you weigh the sample you then put into the oven so they are at the same moisture content for the calculation to work. I've not gone to these more scientific extremes. They would be good experiments.

Alternatives to sunny window ledges are: an airing cupboard, a very cool oven, a solar or electrical fruit drier - temperatures of 25°C to no more than 40°C are about right for most seed. Do alert other users of the facility about what you're doing or you may get upset seeds and tempers! Another way is to use desiccating crystals, like silica gel. I did try this method when I first started seed saving but felt more comfortable with the windowsill / airing cupboard approach. The basic principle is to dry out the crystals or sachets in the oven to expel the water they've absorbed then put them into an airtight container with the seeds (about equal weight of silica desiccant and seeds) for 5 to 7 days for smallish seeds, up to 2 weeks for large bean seeds. You may need to re-dry the desiccant for the bigger seeds.

Don't make the mistake of over-drying your seeds, ultimately you could kill them, 2% moisture is regarded as the lowest it's advisable to go, 5% is probably a sensible level to aim at. Drier seeds store longer but I think they need longer to wake up when sown. You could spread your bets (always a good gardening principle) by drying some seed a shorter time for use in the next year or so and the rest of the seed a bit longer to store in the freezer for 5+ years.

The really easy seed saving vegetables

Pea

Lettuce

Tomato

Broad bean

Runner bean

French bean (dwarf and climbing)

Chilli

Pepper

These all produce seed in one season, are self-fertile (pollination occurs within one flower), and are easy to process for seed. However, even some of these can cross-pollinate so you may want to take precautions against this happening. I say 'may' because sometimes you might not mind varieties crossing. This is particularly true for beans which usually produce something fairly good even when varieties do cross. One strategy could be to grow several varieties together one year to see what happens and just a single variety in alternate years to ensure a pure strain. If you have a big garden or multiple sites you could do both in the same season.

Lettuce is possibly the least likely vegetable crop to cross-pollinate. The flowers only open briefly (often no more than an hour), so there is little opportunity for cross-pollination. If you want to be near certain to avoid crossing, separate different varieties for seed saving by at least 5 yards. You can separate varieties in time, too, by separating their sowing time by a few weeks. The biggest problem with saving lettuce seed here is our weather, it can often be wet at the time the seed would be maturing resulting in soggy, useless, seed heads; lettuce flowers are rather like tiny dandelion flowers and their seed heads don't like the

wet, their seed is ripe 2 to 3 weeks after flowering. Growing lettuce for seed in a greenhouse works well, about 4 plants is sufficient. It's particularly important to avoid saving seed from the first plants to start bolting - eat them - and save seed from the plants that stand longest.

Peas are nearly as unlikely to cross-pollinate as lettuce, varieties should remain pure even when grown and flowering together. If you want to be certain of purity you could separate different varieties which flower simultaneously by 20 yards. If you grow one each of early, mid-season and late season peas their flowering should be isolated in time so you won't need to bother about separating them in space. Seed is sufficiently ripe when the pods become papery and dry.

Dwarf french beans, climbing beans and runner beans are all treated the same way. Crossing does happen, particularly between runner bean varieties, but is fairly infrequent. Where crossing occurs between similar varieties the result is often as good as the parents. If you want to ensure varietal purity about 10 yards separation should be sufficient for french bean varieties, 500 yards for runners. The big problem here is ripening the seed. It takes 6 to 8 weeks longer than producing edible pods. If we have a decent summer and an 'Indian summer' without frost (these beans hate frost) lasting into October then you have a sporting chance. If you have well filled but not fully ripe pods by the time frost threatens you can pull the whole plant up and hang somewhere light, frost-free and airy to hopefully complete the ripening and drying process.

Broad beans are, unlike the other beans above, very promiscuous - different varieties do cross readily and with field beans which are occasionally grown as a fodder crop. You'll need to cage them if other broad or field beans are simultaneously flowering nearby and you want to ensure purity. The charcoal flowered broad bean above is a single plant which grew in 2012, believed to be a cross between Witkiem Manita and Crimson Flowered varieties. Pods turn a dark chocolate brown when fully ripe but you can cut the plants and hang them to finish maturing once the pod walls have started to dry and thin.



Peppers and chillies do cross-pollinate easily, *"charcoal flowered" broad bean!* so you can get unpredictable and interesting results if you don't isolate them. Bagging or caging is needed to ensure purity if you grow more than one variety of these in close proximity. Let the fruit mature as much as you can - ideally till it starts to wrinkle - open, scrape out the seeds and dry them.

Tomatoes are a mixture for cross-pollination, some are virtually immune from cross-pollination but some can cross-pollinate; which is determined by the physical structure of the flower. Those varieties susceptible to cross-pollination have a stigma which protrudes from the flower. The others have a stigma which is enclosed tightly by stamens so the flower is self-pollinated. There's no hard and fast rule - you'll need to examine the flowers of each variety - but older varieties, large beefsteak types, very small fruited types and potato leaved varieties are thought generally more likely to cross pollinate. Since the flowers are self-fertile you can happily bag or cage plants if you need to avoid crossing, or separating varieties by about 30 yards is sufficient. Beware hybrids, many modern varieties are, you will very likely get very poor results from their seed. Cleaning the seed / removing the gel is covered earlier.

Cabbage Family (Brassicacae)

This large and important group of vegetables falls into distinct sets which readily cross-pollinate within their set but not outwith their set. Knowing which set your seed plants are in is the first problem with brassicas, their Latin names are a good guide to which they belong.

Brassica oleracea: kale (most types, including Red Russian / Ragged Jack), cabbage, cauliflower, kohlrabi, calabrese, broccoli (all types), brussels sprouts.

Brassica rapa (sometimes named *Brassica campestris*): turnip, chinese cabbage, mizuna, pak choi, tatsoi, mibuna, chinese and japanese mustards, winter fodder turnips.

Brassica napus: swede - including some grown as a winter fodder crop, oil seed rape, siberian kale.

Raphanus sativus: all kinds of radish.

Eruca sativa: rocket.

Lepidium sativum: garden cress.

Brassica juncea: Indian mustard, mustard greens, some of the green manure mustards are this.

Brassica hirta (aka *Sinapis alba*): white mustards, many of the green manure mustards are this.

Brassica nigra: black mustard, the kind used for producing mustard powder and paste.

The winter fodder crops will likely have been eaten before they flower so shouldn't be a problem for cross-pollination; oil seed rape within a half mile can be a problem for swede. Many brassicas are "self-incompatible" and require pollen from another plant to produce seed; also nearly all require insects for pollination. This combination is awkward, if you cage to exclude outside insects the flowers won't get well pollinated unless you do it by hand. Isolation and successful pollination is problem two!

Apart from summer radish, the salad leaf types and some broccoli which can be annuals, most are biennial. After overwintering they tend to flower about May in these parts. Problem three is keeping the plants alive over winter.

These difficulties may seem daunting but, with a little forethought, you should be able to save seed from five or six brassica types quite easily in a single season in the same garden. Choose just one or two of your overwintering *Brassica oleracea* vegetables - because of pollination issues - then transplant in March with a good rootball the best 6 to 12 plants of each type into a closely spaced, about 12 to 24" between plants, rectangular block (at opposite ends of the garden if doing two types), let them flower and collect the seed from around midsummer. If doing two types you could use alternate day caging using a fine mesh to help ensure purity but you should get good results without.

Turnip and swede usually survive winter pretty well, protecting with straw or fleece helps. They don't cross-pollinate with each other or with *Brassica oleracea* types so you can safely grow one of each for seed. Transplant the mature roots in March into blocks, turnips can be closer spaced and, since they produce less seed, it's good to grow a few more for seed.

Biennial brassicas which are not so winter hardy, like summer cabbages, cauliflowers, broccolis, can be efficiently grown specifically for seed rather than food crops. Sow around mid-July and keep protected in polytunnel, greenhouse or cool indoors over winter to plant out in mid-March. They'll flower on schedule but won't produce as much seed as bigger plants would. An alternative is to lift mature spring sown plants to be used for seed around

end November, store, and re-plant as soon as possible in early spring. To store them for about 3 months you need to lift a decent rootball with the plants, about 12" across and deep, and store between 0 and 5°C at about 80% humidity - a root cellar is ideal, they don't need light.

The annual brassicas are straightforward, just let them flower and go to seed. If you want to keep strains pure just grow one variety of each to flower at one time. You could easily save seed from two different varieties each of rocket and radish in one season. Growing multiple varieties of radish and rocket which flower simultaneously produces useful seed and is only a problem if you want to keep varieties pure.

The annual oriental salad brassicas (mizuna, pak choi, mibuna, mustards) seem to be surprisingly simple. I've had good results - no noticeable crossing - with several types flowering at the same time, even saved seed from a mixed oriental salad of about 6 types and got similar results from the saved seed as the original.

When growing brassicas for seed it's important to pull up or pinch out any flower heads of other brassicas you don't want to cross-pollinate with your seed plants before they flower. This can be a problem on allotments.

Most brassica seed pods are similar, spitting easily to shed their round seed when ripe. Threshing and rubbing between your hands in a bucket extracts the seed easily. Radish is the exception, their seed pods are more corky and robust and you'll probably need to use your fingernails on them.

Onion Family (Alliums)

This includes leeks, garlic, chives as well as onions. Each will cross with its own vegetable type but not with the others. If growing more than one variety of a type for seed you ideally need more than a half mile separation or use alternate day caging. They are insect pollinated. Chives and garlic are best propagated vegetatively, splitting clumps of chives and replanting individual cloves of garlic. You can save their seed but the results tend to be variable and it takes about three years to get a usable crop.

Mature onions easily store over winter in a cool, dry place and can be replanted in spring to flower around midsummer. Keep a close eye on the developing seed heads because they can shed their black seed rapidly when ripe, pick each head when it is ready and hang up indoors to shed its seed. If your original crop was grown from sets try to make sure it was not a hybrid.

Leeks are similar but the flowers and mature seeds are later, slower to ripen and harder to extract. You'll need to cut off the seed heads in October and hang them somewhere to dry for a month or so before vigorously rubbing between your hands to extract the seed. The plants can be left to overwinter where grown as a food crop then the best remaining plants transplanted to a block by early April to produce seed, they'll be there until autumn.

Carrot, Celery, Celeriac, Parsnip and other roots

These all need two seasons to produce seed and are insect pollinated.

Carrot varieties cross with each other and with wild carrot (Queen Anne's Lace). If you grow two varieties for seed try to separate by half a mile or use alternate day caging. Contamination with wild carrot pollen will cause some of your seed to produce small and useless white roots but normally this is an insignificant problem and you wouldn't use those progeny to produce future seed. Also carrots are prone to inbreeding depression if the seeding population is too low. The answer to both these potential problems is to grow a few more carrots for seed, try to grow at least 20, ideally 40. They flower July to

September and the seed sometimes has difficulty ripening here before the weather turns. The seed is ripe once it turns from green to pale brown, rub seed heads between hands to separate the seeds and rub off the little seed spikes.

Parsnip varieties cross with each other and with wild parsnip but the latter rarely causes problems here. Parsnip is actually one of the easiest vegetables to grow for seed and I do one variety every year, just transplant a dozen roots in spring and their tall, often over 4', flower spikes will produce seed in August. The seeds are produced in pairs on each flowerlet, a good indicator of a flowerhead being ripe is the first sign of these pairs starting to split apart. Parsnips produce a lot of seed, you can get a pint from about 8 plants. Unfortunately the seed only remains viable for 2 to 3 seasons; the perfect solution would be for a handful of people growing at least half a mile apart to produce a different variety each and share the proceeds.



Ripe parsnip seed heads

All celery and celeriac cross with each other and with wild celery (rarely a problem) so it's best to grow only one variety for seed in one place / season, or else separate by a half mile or use alternate day caging. I have grown both vegetables for seed close together and there was clearly a lot of crossing resulting in a high proportion of useless plants. Celeriac should survive winter well enough with a straw mulch. Celery is less hardy, particularly the selfblanching varieties, you can earth it up (slugs will thank you for their new winter palaces), or lift and store somewhere very cool and humid for replanting about the beginning of April once the worst frosts are over.

Salsify and scorzonera are easy to grow for seed, they don't cross with each other or any other vegetables, only with varieties of their type - there aren't many of those and what there are tend to be very similar. Both produce tall and pretty flower spikes, salsify's are blue, scorzonera's are yellow and daisy like. Salsify is easy enough to relocate in spring but scorzonera's deep roots are hard to extract and replant intact so I've just left about 8 plants to flower where originally grown. They survive winter well in the ground.

Hamburg parsley is related to parsley but the once I've saved its seed with leaf parsley growing nearby I didn't detect any obvious crossing, and it doesn't cross with any other vegetables. For cultivation treat as parsnip but the seeds mature later - September / October.

Cucurbits

Courgettes, marrows, pumpkins and squashes; melons; cucumbers and gerkins.

These are insect pollinated and will cross within their species but not without. Progeny from crosses are generally inferior and often useless as crops. Since common names are not always a good indicator of species I'll have to resort to Latin nomenclature and you'll need to use it to determine the likelihood of cross-pollination, I've simplified a little to avoid giving you pages of varieties most of which you'll never encounter.

Cucurbita pepo: nearly all marrows, all courgettes, most acorn squashes, crookneck squashes, all scallop squashes, most pumpkins, some gourds.

Cucurbita moschata: butternut squashes, cheese squashes, some other squashes and a few pumpkins.

Cucurbita maxima: buttercup squashes, hubbard squashes, banana squashes, a very few marrows, turban squashes, Uchiki Kuri, Marina di Choggia.

Amongst the squashes you may also rarely encounter *Cucurbita mixta*, *Cucurbita ficifolia*, *Cucurbita foetidissima* - same rules apply: they cross within but not outwith the species.

Citrullus lanatus: watermelon.

Cucumis melo: nearly all other melons.

Cucumis sativus: (nearly) all cucumbers and gerkins.

If there is another variety of the same species growing within an open half mile (much less if there are barriers) you should probably resort to bagging and hand pollination. The objective is to ensure only pollen from a male flower of the same variety fertilises a female flower. You can use a male flower from the same plant as the female (known as "selfing") or from a different plant of the same variety ("sibling"). Sibling tends to increase genetic diversity, selfing is used when trying to select specific characteristics and to reduce variability. It's beneficial to use more than one male flower on each female, and each male can be used on a couple of females, but it's a good idea to use at least one fresh male on each female.

First you need to identify the male and female flowers. Male are usually borne on longer, thinner stalks; female are usually borne on a detectable immature fruit. For most species, particularly those with larger flowers, this is quite easy to see. Then you need to catch the flowers before they open, once they have insects may have pollinated them already. Examination at least daily, best in evening, is needed; ideally twice daily, morning and evening. Having spotted the about to open flowers you need to stop them opening using something like a plant tie, clothes peg, masking tape, elastic band or bag sealed round the flower stem. It doesn't matter if the male flower is damaged as it will be discarded after pollination, but the female flower will need to be resealed again so avoid damaging it too much. About twelve hours after first sealing the flowers it's time to do it. Prepare your males: pick them from the plants with a few inches of flower stalk if possible, carefully unseal and tear off the petals, take them to a female, and ready materials to reseat the female. Very carefully unseal the female, gently rub the male pollen onto the receptive part of the female's stigma then quickly and carefully reseat the female flower, you don't want insects getting in. The female flower needs to remain sealed for about 4 days after

pollination, and you should mark each manually fertilised fruit so you know which are being saved for seed - coloured ribbons or tape are useful for this.



Manual pollination of a courgette flower, the insect shouldn't be there!

A few other problems... Ideally you should save seed from a minimum of six different plants. The fruit need to be left on the plant to mature fully and then stored (removed from the plant) for a further 20 days for the seeds to develop further (less important for cucumbers but still well beyond the edible stage). You need to have sufficient time before the first frosts for the fruit to mature, so pollination early in the season is advisable. Maturing fruit suppress subsequent fruit's growth on the same plant. The seedless ("parthenocarpic") / all female greenhouse cucumbers won't produce seed. Some seeds have gelatinous coats - remove by fermentation, described earlier; all the seeds benefit from a good wash before drying as there can be germination inhibitors. Avoid drying seed in direct bright sunlight or at temperatures above 35°C. Good luck!

Beetroot, Chard and Spinach

Beetroot, swiss chard, mangelwurz, sugar beet and perpetual spinach are all *Beta vulgaris* and will cross-pollinate. They are biennial and can be overwintered here given protection with straw or fleece. It's advisable to save only one variety of this group in a season. The flower spikes tend to be tall and sprawling; support is usually needed to avoid

the seed, which is produced in small clusters along the stems, from rotting or germinating on the ground. The seeds tend to mature from the bottom of the plant first, turning brown and corky. You can pick the early ripening seed in situ and later cut the whole plant down to hang up and dry then strip off the main crop of seeds.

Annual spinach (*Spinacia oleracea*) varieties don't cross with the above.

The big problem with all these is their light, fine pollen. They are wind pollinated and the pollen is carried for miles. If you suspect there are any flowering that will cross-pollinate within 5 miles it would be wise to cage the plants using fleece - fine mesh is no good as it lets the pollen through. Most annual spinach plants are either male or female, but some are both. If yours doesn't have hermaphrodite plants you should aim for a ratio of 2 female to 1 male and a population of at least 6 plants in total; if you grow about 20 plants you don't need to worry about the male / female ratio.

Chicory, Radicchio and Endive

All chicories and radicchio are *Chicorium intybus*, out-breeding, and can be cross-pollinated by insects. Endive is *Chicorium endivia* and is self-pollinating. *C. intybus* can be pollinated by *C. endivia* if grown in close proximity but not vice versa. It's probably wise to only grow one variety of chicory / radicchio for seed in one season, use alternate day caging or separate by half a mile if more; and, if you are also growing endive for seed, separate it from the chicories by at least 10 yards. Chicory seeds are clumps of stubby cylinders inside the base of the flowers and are a bit of a pain to extract and split up.

Most are biennials and reasonably winter hardy; the less hardy ones can be lifted and stored as roots, trimming all but 1 to 2" of leaf, they transplant easily enough.

Herbs

Many herbs are relatively easy to save seed from. Generally they will cross within their own species but not outwith, and if you do save seed from multiple varieties of one species their crosses are usually reasonably good. Here are some brief notes:

Parsley is biennial, usually overwinters well and is easy for seed saving but the seed often doesn't mature until around October here.

Garden sorrel is perennial and very easy. It also propagates vegetatively forming clumps which can be split.

Sage is perennial, the largish round seeds form in small clumps inside the base of the flower, ripening from the bottom of the plant upwards from about late July through September. They tend to fall out as soon as they turn brown and ripen so successive collection by regularly picking the nearly ripened flower husks is the best way. Sage is also easy to propagate from cuttings.

Basil is usually treated as an annual here but some can be perennial given a warm winter home. There are many varieties and they do cross quite readily, about 50 yards separation between varieties is necessary for purity in open situations. As it needs fairly hot temperatures to flourish and insects to pollinate, it's quite difficult to produce good seed here. Like sage it matures from the base of the flower spikes but the seed doesn't drop out easily and takes some effort and care to extract and clean.

Dill is an annual that quickly goes to seed and doesn't cross with anything else. Saving is easy provided you sow no later than May to allow the seed to mature in a poor summer.

Fennel, *Foeniculum vulgare*, has three forms: Florence fennel grown as a vegetable for its bulbous stem base; herb fennel grown for its leaves and seeds; Sicilian fennel grown to be

used like celery. They can be annual, biennial or perennial, and all forms can cross-pollinate via insects. Isolation of a half mile or caging is recommended if growing two varieties that will flower. Bolting is a problem with Florence fennel. Sowing in the second half of May seems about best for most varieties here, the bulbs can then get to a usable size by about mid September when they will probably start to bolt. Of course, then there will be insufficient time for seed to mature before winter unless you are growing in a polytunnel. If you have some plants which don't bolt you could mulch or lift and store like celery to obtain seeds in their second season. If you have a few perennial herb fennel, saving its seed which is mature by about September is very easy.

Coriander / cilantro doesn't cross with anything else, is a very brief annual and quickly goes to seed. There don't seem to be any widely recognised different varieties but seed from different sources definitely varies in ability to produce a decent amount of leaf before bolting. Once you find one or two strains that do work well for leaf production I suggest you restrict yourself to them, rogue out any that bolt early and save your own seed, it's extremely easy.

Fenugreek, whose seeds are used in Indian cooking, grows well in a polytunnel and will produce a fair crop outdoors in most summers. It's like a very small bean held in long, thin pods.

Angelica is an impressive biennial plant a bit like a giant hogweed in its second season. The seed doesn't keep well so should be sown within a year in either autumn or spring. I've collected seed from a solitary plant and it has performed well.

Oregano / marjoram has many varieties and they can cross. Saving its very tiny seed is fairly easy: pick and dry the dead flower heads, rub them to separate the seed and very carefully shake and blow to remove the detritus.

Thyme is very similar to oregano for seed saving but the seed is even tinier so harder to collect. You can also propagate thyme and oregano by 'layering'.

Rosemary is best propagated from cuttings; mint by root division; horseradish by root 'thongs' about the 6" long and the thickness of a pencil.

Flowers

Wild flowers and herbs are a great source of seed if you happen on them at the right time. Saving seed from many garden flowers is easy but beware hybrids. These usually work well: sweet pea, poppy, calendula, marigold, tagetes, wallflower, forget-me-not, lupin, antirrhinum, cornflower, echinacea, foxglove, cornflower; but try anything, you're more likely to have success than failure.

Other sources of information

There is less useful information available online and in print than you might think.

The International Seed Saving Institute (USA based) has a fairly good online vegetable seed saving guide:

http://www.seedsave.org/issi/issi_904.html

The US Seed Savers Exchange has information for individual vegetables followed by an alphabetically organised set of herb and flower seed saving instructions:

<http://www.seedsavers.org/instructions.htm>

The Real Seed Catalogue, based in Wales, have a good page on saving vegetable seed:

<http://www.realseeds.co.uk/seedsavinginfo.html>

Locally there is the Highland People's Food Seedbank Project where seeds are being gathered from a wide variety of sources and stored in freezers to ensure seed supply for future years.

Contact:- Chris Scatchard, The Highland People's Food Seedbank Project,
35 Telford Road, Inverness, Scotland, IV3 8JA – tel 01463 729277 or email
highlandseedproject@hotmail.co.uk

Suggested books

"Seed to Seed" by Suzanne Ashworth, very good, detailed and comprehensive reference but American.

"Back Garden Seed Saving" by Sue Strickland, quite good, British.

"Saving Seeds" by Marc Rogers, quite good, American.