

SEED SAVING STRATEGIES



A Seed Saving Handbook

GARDEN PLANNING

BOTANY BASICS • POLLINATION

HARVESTING • STORAGE

This workbook serves as a companion to live workshops offered in winter (Garden Planning, Botany Basics, Pollination) and summer (Harvesting, Storage), and is created with the inspiration and support of Seeds of Diversity Canada, the Bauta Family Initiative on Canadian Seed Security and other sources.



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Why save seeds?

As the growing season draws to a close, you will find many of your garden plants are developing and maturing seeds. Collecting your seeds, storing them to plant for the next growing season and sharing them with friends is one of the most fulfilling aspects of gardening. Seed saving can elevate your gardening experience to a sustainable level whilst promoting genetic diversity and security in our food system.

A century ago, millions of seed-saving gardeners and farmers kept our plant varieties alive by saving the seeds of their favorite plants. This has been a normal part of traditional agricultural practice for 10,000 years. In 1900, our food was provided by as many as 1,500 different plants, plus thousands of different varieties. Today over 90% of the world's food is provided by only 30 different plants. Growers have become dependent on large seed companies, which for many years have been paring down the variety of plant seed available and promoting development of hybrid stock. Over the last two decades, large, multinational companies like Monsanto have taken over family-owned seed companies and focused on producing their own hybrid and patented varieties.

Why is this an issue? These hybrids do not always produce viable seeds and, because they are being patented, cannot be collected legally and used by farmers or home gardeners.

This means that home gardeners and farmers must buy new seeds each year from these corporate sources. It also has meant that we are losing the knowledge of traditional seed saving and plant propagation.

The marked loss of diversity tracked over the last century may be slowing down, due in large part to the rise of expert seed saving organizations, public seed banks, and small regional seed companies dedicated to saving vegetable varieties. With the dedication of individual farmers and gardeners – people like our gardeners here in the Elk Valley – it is possible for us to keep the seeds in the hands of the people.

On the local level, we can do our own part by selecting and sharing seed from vegetable varieties that perform well in our growing conditions. Allowing vegetable plants to mature seed may make the garden look untidy, but saving seed produced from our own food plants, and teaching these skills to our children, is a vital lesson to be learned in our changing world.

From this workbook you will gain basic knowledge of plants and seed saving. For information on growing and saving seed from specific plants and plant families, refer to our resources list in the workbook. We recommend that seed savers have a good manual to work from after completing this introductory workshop.

Plan on saving seeds

Your seed saving journey will begin in the winter when you plan your garden. What types of plants do you want to try saving seed from? Do you have a favorite that you've been planting for a year or two, but the seed packet is nearly empty? Has a friend or relative gifted you their very special heritage seeds?

It's likely that you've already seen some of your vegetables put up flower stalks and noticed how large a little radish, for example, will become when it matures. When you plan your garden, you will want to allow room for the plants you want to grow out for seed.

Record Keeping

For seed savers, record keeping is very important. When you're planning your garden and collecting seed to plant, list the plant type, its name, where it came from and the year it was produced. If it's commercial seed, that information will be on the seed packet.

Note on your garden map where each variety is planted, or have a stake in the garden with its specific name written in non-fading ink. A mature plant may not be as recognizable as it was when young. This workbook includes a form you can use and copy for listing your plantings as well as a graph sheet for garden mapping.

Isolation

Varieties of the same species, unless they are self-pollinating (e.g., tomatoes), have to be isolated from each other by a certain distance to avoid cross-pollination. Self-pollinating species need only a short isolation distance, a few metres, just in case bees manage to wriggle into the blossoms and move pollen from one to another. Wind- and insect-pollinated species need much greater isolation distances.

Isolation planning can be a tricky exercise for new seed savers, particularly if they are gardening in an urban area where other gardeners may be allowing their vegetables to flower.

There are some tricks to prevent unwanted cross-pollination, though. Hand pollinating is one process; planting at different times or planting both early and late maturing varieties is another. Also effective are pollinator distractions, like growing wildflowers or other plants that bees love near insect-pollinated plants you want to save seed from.

Crops that pollinate by insects and wind can be covered with a fine mesh such as no-see-um netting to trap pollen inside. Plants under the covering can pollinate one another but pollen from similar varieties won't be able to enter. For large plots, frames can be constructed and covered with the mesh.

Selecting your Plants for Seed

For home-use seed saving you can select some parts of a plant for seed and eat the rest (in larger-scale seed saving, entire plants are left to mature all their seeds). With peas and beans, for example, select from the healthiest plants and tie a small length of yarn around the pods you want to save for seed to make sure they won't be picked for eating. You may want to select entire plants that show desirable characteristics, such as radishes that mature to the expected size and shape before putting up a seed stalk. You will want to rogue out certain plants that exhibit undesirable traits, such as carrots and chard that put up seed stalks in their first year.

Plant Population

If you will be saving seed for your own use or sharing with friends or seed-swapping, only a few plants of a variety you want seed from will be enough. Often you may not have room in your garden for more.

If providing seed for seed libraries or banks, or selling, however, a larger plant population is very important to assure genetic diversity and avoid variability from possible cross-pollination. For example, if you are collecting peas for seed a sample size might be 10 plants for home use; if you are giving to a seed library, your collection of seed should be harvested from at least 20 pea plants. That amount is easily done in a home garden for peas, but when you are looking at lettuce plants with a recommended population of 6, even that small number will take up quite a bit of space in your garden when the plants are mature.

Information on populations for commonly grown species is available from any of the manuals listed in the Resources section in this workbook.

Seed Life

Seeds of some plant varieties last for many years, but others only remain viable for a year or two. If you are planning to finish a packet of old seed, remember that older seed may produce slow-germinating or slow-growing plants that never seem to be as vigorous as they should be.

Try to plant out your saved or purchased seeds within a year to have healthy, high quality plants. Test-germinate for viability in the spring by placing about 10 seeds of each variety inside a folded moistened paper towel. Keep from drying out by wetting every day, or place in an open plastic bag. Depending on variety, seeds will germinate in 2 to 14 days. Some seeds, usually perennials, need a period of freezing in a moist environment (stratification) before they will germinate. Placing in the freezer for some weeks will do. Other seeds with tough husks (like nasturtium) germinate better if they are scarified. This involves carefully scratching the outer husk.

	POLLINATION	ISOLATION	MINIMUM POPULATION (NON-COMMERCIAL)	SEED LONGEVITY (YEARS)
Arugula	insect	200 m	12	3-4
Bean, Bush	self	3 m	20	3-4
Bean, Runner	insect/self	200 m	20	3-5
Broccoli	insect	200 m	6	3-5
Carrot	insect	400 m	20	3-4
Cucumber	insect	400 m	6	4-10
Kale	insect	200 m	6	3-5
Lettuce	self	3 m	6	2-5
Pea	self	3 m	20	3-5
Spinach	wind	200 m	12	3-5
Squash	insect	400 m	6	3-10
Tomato	insect/self	5 m	6	4-10

Botany Basics

Knowing how your plants relate to one another will help in planning what you can grow out for seed in your garden without unwanted cross-pollination. Seed saving techniques tend to be similar for plants in the same family. Understanding how plants reproduce will enhance your gardening experience and make your seed saving experience fascinating and successful.

Botanical Classification

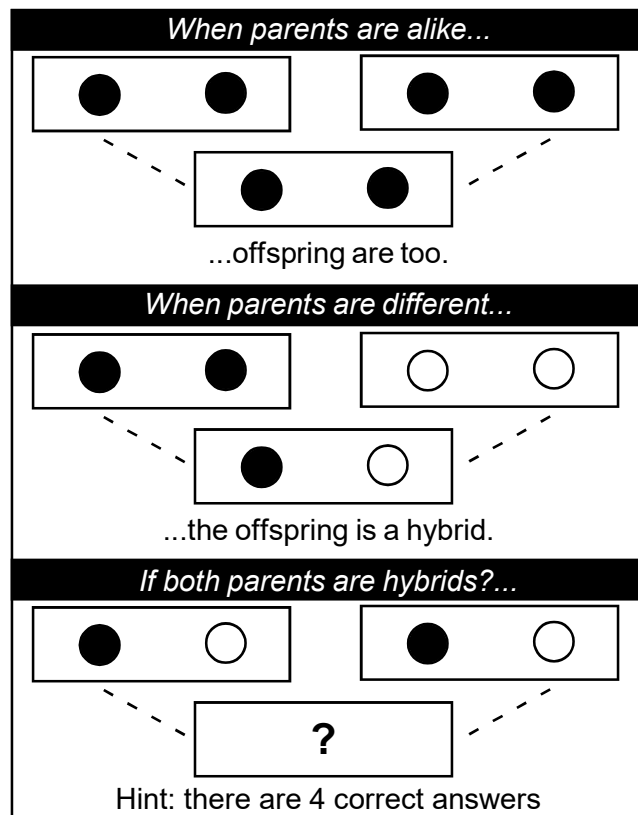
(see diagram on next page)

Family: A group of plants that have similar basic features and common ancestors.

Genus: A group of plants from the same family that are similar to each other, but different in significant ways.

Species: A group of plants that can interbreed to produce fertile offspring, and are very closely related, both genetically and physically. A good rule of thumb is that plants in the same species can pollinate each other and produce viable seeds. Plants in different species usually don't successfully pollinate each other.

Variety: A group of plants within a species that have similar physical qualities. Different varieties within the same species can cross-breed and produce "hybrids."



Reproductive Mechanisms and Terms

Annual: A plant that grows from a seed, produces new seeds, and dies during the same growing season (ex: pea, bean, cucumber, spinach)

Biennial: A plant that produces flowers and seeds during its second growing season, then dies naturally. This means it must survive through one winter in the garden, or be stored and replanted in the spring in order to produce seed (ex: carrot, kale).

Perennial: A plant that can live for several years and bear fruit and seeds many times during its life. Most types produce only leaves in their first season (ex: strawberry, rhubarb)

Open pollinated: Plants have been allowed to pollinate naturally, either by insects, wind, or self-pollination. This term is also used as a synonym for "non-hybrid", meaning that a pure variety has either self-pollinated or cross-pollinated with other plants of the same variety.

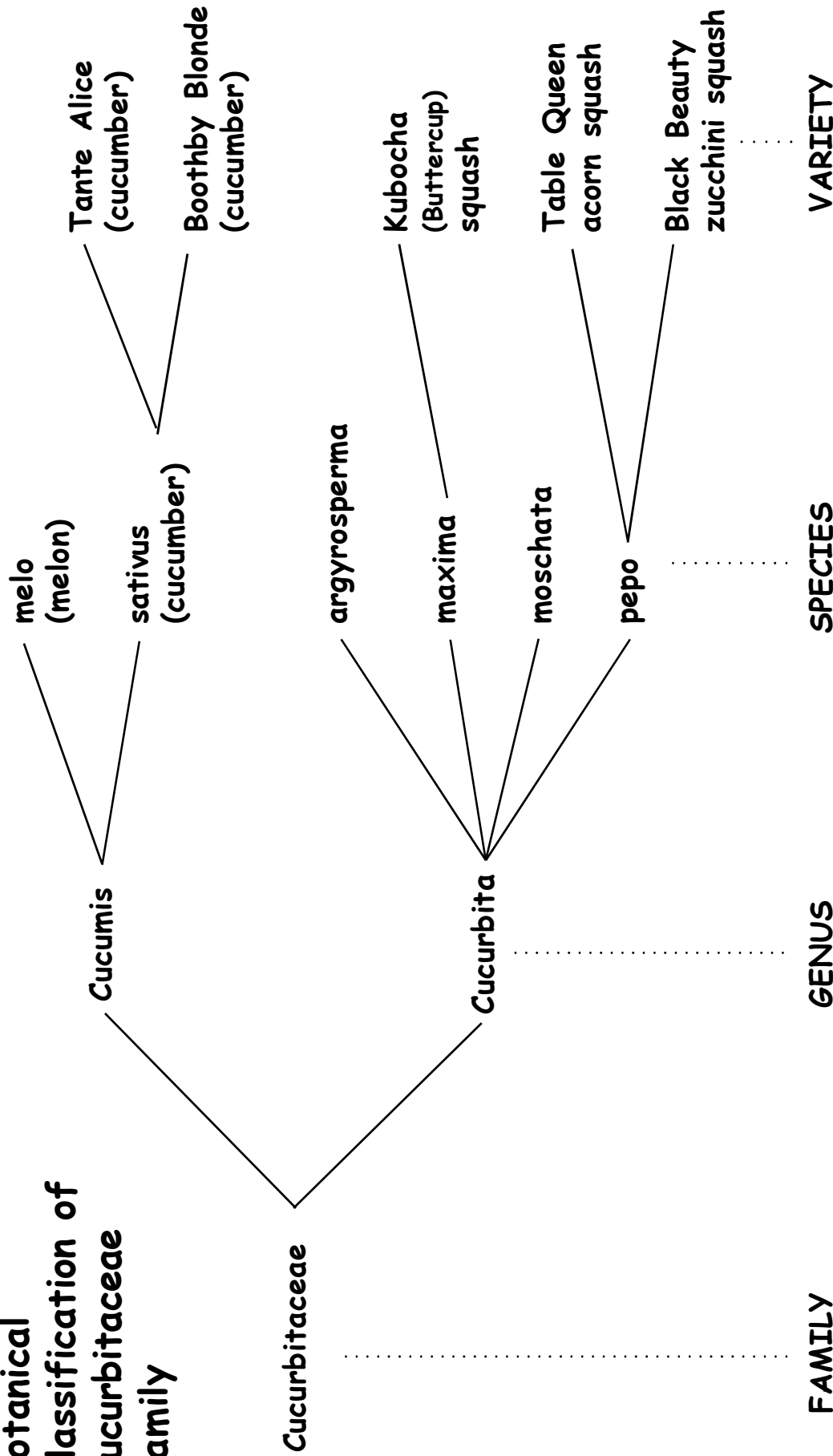
Vegetative or clonal propagation: The result of dividing a plant into pieces and growing each piece into a complete plant (ex: garlic, potatoes; techniques such as grafting, root division, stem cuttings etc.).

Hybrids: Created when two varieties of the same species cross-pollinate. Pollen from the male parent fertilizes seeds within a fruit of the female parent, and each parent contributes 50% of its genes. Each hybrid seed is a 50/50 combination of the two parent plants.

What does "Hybrid (F1)" mean?

These seeds are the first generation offspring of two distinctly different and genetically pure parent plants. Seed saved from F1 plants will not express the same traits as its parent. New varieties are often created through hybridization in the hopes of combining specific desirable traits expressed by the parents, such as increased productivity, ease of harvest, shape, colour, or disease resistance. These seeds are almost always impossible for seed-savers to reproduce because they are made by crossing proprietary parent varieties that are corporate trade secrets.

Botanical Classification of Cucurbitaceae Family



Melons, cucumbers, and squash are all in the same family (*Cucurbitaceae*).

Melons (*C. melo*) and cucumbers (*C. sativus*) are similar enough to be grouped in the same genus, but they don't interbreed, so they are different species. Different varieties of cucumber can cross-pollinate and make hybrid cucumbers.

There are actually four different species known commonly as "squash." All grouped in the *Cucurbita* genus, squash can only interbreed with members of their own species. So Acorn can cross with Black Beauty, but not with Kubocho.

Pollination

There are four kinds of pollination

Self-pollination: Both male and female parts are in every flower, and the petals are closed so insects and wind can't carry pollen from one flower to another. This kind of flower almost always pollinates itself, so different varieties can be grown near each other without crossing (ex: tomatoes, beans, peas).

Insect-pollination (complete flowers): Both male and female parts are in every flower, but the petals are open, allowing insects to move pollen to and from other flowers. This kind of flower can self-pollinate, but insects can also cross-pollinate different varieties. It is impossible to tell which seeds are crosses, so different varieties should be separated by large distances (ex: peppers, cabbage).

Insect-pollination (incomplete flowers): Each flower is either male or female, so the plant needs insects to move pollen from the males to the females. This can also be accomplished by hand-pollinating, a technique where a small brush is used to move the pollen. Hand-pollinated flowers can be taped closed to prevent insects from interfering with your own pollination efforts if other varieties are nearby (ex: squash, cucumber).

Wind-pollination: Flowers with light and dusty pollen can be blown on the wind to cross-pollinate any nearby flowers in the same plant species (ex: beets, spinach, corn).

There are two kinds of pollen

Notice the differences between plants that produce **wind-blown** pollen and **insect-carried** pollen.

Many plants have tiny, insignificant flowers and produce large amounts of dusty pollen that blows off the plant in the wind. Their strategy for pollination is to throw as much pollen into the air as possible so that some will land on another flower of the same species. Most of the pollen lands on the ground and is wasted, but the plants compensate by not having to create attractive or fragrant flowers.

Other plants grow colourful, fragrant flowers with sugary nectar to attract insects. They also produce a small amount of sticky pollen. When the insects visit these flowers to feed, they carry pollen directly from flower to flower, delivering it precisely where the plants need it to go. The plants expend a lot of energy to produce

these flowers, but they compensate by creating only a small amount of pollen.

Pollen is very nutritious. It would be a super-food for people, except there isn't enough to feed us. Plants only create enough to feed little insect bodies. It's the only solid food that bees eat, so bees and flowers have a special and consummate relationship.

Pollinators

Honeybees, bumblebees, wasps, hornets, beetles, and flies all play a role in the natural pollination of our food plants. Without them our global food supply would be limited to a very narrow variety of foods. We would have very little fruit. That is why the current crises in bee populations is so alarming, and worth all our efforts to resolve. Wild honeybee populations are particularly endangered. Honeybees that are managed for honey or farm pollination work within the areas where they are placed, so they aren't likely to be pollinating your garden plants.

Principal pollinators for our gardens are the many other kinds of bees and flies. There are even flies that look like bees to fool predators.

Bumblebees are one of the most recognizable and common kinds of native bees. They can fly up to about 750m from their nests. If you notice bumblebees in your cross-pollinating plants (such as cucumbers), you'll have to separate different varieties by 750m.

Some bees are specialists; they like certain kinds of flowers best. Squash bees, for example, love squash pollen but other bees aren't so interested in it. Bumblebees and honeybees may visit other flowers nearby, and shun the squash. Squash bees travel a maximum distance of 50 metres, so if they are the only pollinators visiting your squash, you can reduce your isolation distances.

Flies are a little-appreciated pollinator. Syrphid, or hover flies, are easy to recognize by their flight: they hover perfectly motionless as they choose which flowers to visit. As flies are nomadic, it's difficult to predict their range and effectiveness at cross-pollinating.

Watch the pollinators in your garden during flowering times and observe who is visiting your plants!

Harvesting Seeds

When?

There are different harvesting techniques for each plant family, but there are basic methods that apply to all types of seed and indications of when it is the right time to harvest.

Dry seed heads or pods: Most seeds are ripe when their fruit or flower has dried and turned into a brown pod, capsule, or seed head. Pea and bean pods will be dry and crackly. Lettuce seeds are ripe when the seed head is dry and fluffy. There will be a tiny seed connected to each fluffy “parachute”, just like on a dandelion.

Fleshy fruit ripe for eating: Tomatoes are a good example. When a tomato is soft and ripe, you can remove the seeds to save and eat the rest of the fruit. It’s best, however, if you can save the tomato, or leave it on the plant if frost doesn’t threaten until it is quite ripe indeed - a little beyond the eating stage. The seeds will be better nourished by the ripening and produce healthier plants.

Fleshy fruit that’s over-ripe: Cucumbers and summer squash usually haven’t developed their seeds when they’re at the best eating stage. For seed-saving leave them to fully ripen on the plant. Cucumbers will turn yellow, and zucchinis will have a hard skin. If frost threatens, they can be cut and stored in a cool place for several weeks to allow the seeds to mature.

Too long: Seeds that ripen in pods or fluffy seed heads will naturally disperse their seeds if you don’t harvest them at the right time. A dry pod of kale seed will pop open at the slightest touch and seeds will scatter. And the lettuce seeds with their little parachutes will float away.

Not long enough: Seeds that are collected before they’re fully ripe will not last long in storage. Immature bean seed, for example, will wrinkle and shrink as they dry and may last only one year in storage rather than five.

Bit by bit or all at once: Most plants do not ripen all their seed at once. If you are harvesting small quantities, it’s not difficult to take ripe seeds from a plant every few days. If you have many plants to harvest, cut plant when most seeds are ready, sort out and discard the immature ones.

Drying

Dry all collected seed material in a warm and dry place, out of the sunshine and safe from nibbling animals. Spread seeds or seed pods on screens or hang plants with seed pods in loose bunches with good air circulation. Do not dry in ovens, as heat over 40 degrees celsius will kill the seeds.

Cleaning

Most seeds are collected from plants that have dried, with the exception of seeds that are inside wet fruits like tomatoes and squash. Wet seeds require different cleaning methods.

Dry seeds: You will want to separate the seeds from the “chaff”, bits of dried flower, stems, etc. This isn’t absolutely necessary if you’re saving seeds for your own use, but if you are sharing it’s important that you’re passing on containers of only seed. Cleaned seed takes up less space and is more visually appealing. Seeds can be rubbed on screens or sieves to separate from chaff, or separated by a process called “winnowing.” Pouring the unclean seed from one container to another in a light breeze, or in front of an electric fan on low setting will cause the lighter chaff to be carried off while the heavier seed drops into the lower container. Some seeds are easier to clean than others: some seeds are as light as the chaff and will need hand sorting.

Wet seeds without pulp: Most fleshy fruit, such as pepper and squash, have wet seeds inside. Once the seeds are removed from the fruit, spread them out on a ventilated surface to dry.

Wet seeds with pulp: Tomato and cucumber seeds are surrounded by a gelatinous pulp which prevents the seed from germinating prematurely. There are two ways of removing this layer:

1 - Gently rub it off with a cloth or your fingers in a sieve if you have only a small quantity to dry.

2 - Ferment it off by placing seeds with pulp in a bowl with enough water to cover. Leave at room temperature, covered, for a few days. During this time the gel surrounding each seed will rot and begin to ferment. At this point the freed seeds will sink, the pulp can be discarded and the seeds rinsed and spread to dry.

Storing Seeds

Germination testing

Before storing your seeds you will want to be sure they are good by performing a germination test on each batch.

Sow 10 or 20 seeds of a variety in sterile potting soil and grow just as you would in the spring. Or place your sample of seeds between wet paper towels, keeping either material damp (having the paper towel on a plate inside an unsealed plastic bag will keep it damp). If only a few seeds from your sample germinate, you may still have time to harvest more of that variety if there are any left. **If the germination rate is poor, that seed batch may not be a good one to share.** A good germination rate would be anything above 80% of seeds germinating.

Keep your seeds dry, dark and cool. Storing in a cool basement is ideal, but storing in a fridge works well too. Be sure your seeds are in moisture-proof containers: glass, never plastic. Although it seems impermeable, a plastic bag will allow passage of moisture through its membrane over a long storage period.

For longer term storage of seeds, keep them in a freezer. Be sure the seeds are fully dried, because moisture in the seed will freeze into sharp ice crystals that damage the living plant inside.

A good way to store small seeds is to put them in paper envelopes and place the envelopes in a mason jar with tight-fitting lid. You can place small packets of silica gel in the jars to absorb moisture. Be sure to label your jars and envelopes with a detailed description and harvest year of each seed type you're storing.

It's a good idea to periodically test your old seeds to see whether they need to be regrown or replaced. Seed batches that germinate above 80% should last for at least a few more years if they're well stored.

Genetic Drift

A batch of seeds with poor germination can be genetically different than it was when it was first placed in storage. Certain seeds in a batch will have a genetic trait that allows them to live longer in storage. When you plant a low-germination seed batch, the lucky seeds that survive are a particular genetic selection from the original group. Other traits will be connected to those seeds, so they may show different characteristics than the original population.

Growing out Biennials

Overwintering

For plants such as carrots and kale that don't bloom and produce seeds until their second year, you will have to protect them over the winter. Hardy varieties can be left in the garden and mulched with straw. A protective layer of mulch allows the roots to freeze gradually so ice crystals don't form inside the plant tissues; it also prevents the soil from heaving which can rip the plant roots.

Dig up in spring and inspect to be sure roots have survived and are sound. Good roots can be replanted in a part of the garden where they can grow to full size without crowding other plants.

Cellaring

ROOTS (carrots and beets): Dig up roots when ground is not too wet. Cure roots for a few days before storage by allowing to dry slightly, out of the sun, to thicken the skin so it will better resist spoilage. Don't allow to dry for too long or they will become soft. Do not select any roots that have been cut or bruised, or have insect damage or damage to the crown. Cut off leafy parts, leaving about 1" on the crown. Packing roots in damp sand, sawdust or peat moss will help keep roots moist and firm until spring.

NON-ROOT CROPS (cabbage, celery): Cut off top leaves, taking care not to damage crown (the centre growing part). Plant roots in sand or sawdust that is slightly moist, just enough to keep roots from drying out.

Prime storage conditions for roots and plants are cold and moist (about 5 degrees C and about 90% humidity). If you don't have a root cellar or cold basement, you can store them in a refrigerator if you have space. Store in plastic bags, and check periodically. If too much moisture has accumulated, remove roots and dry them, then return to storage in a clean bag.

In spring, select plants and roots that are in good shape. Plant them in good soil and shelter from full sun until they begin to show new growth. They can also be planted in containers and placed in a sheltered location as a transition before planting out.

Be sure to plant them out as early as possible in the spring (sheltered from frost if necessary) so they have time to re-establish themselves, create a new root system, produce flowers and ripen seed before the end of the growing season.

Resources

How to Save your own Seeds, A Handbook for Small-Scale Seed Production. Published by Seeds of Diversity Canada. Order your copy online from seeds.ca. 68 pages. \$20.00 includes postage.

A Seed Saving Guide for Gardeners and Farmers. This free 30-page download is similar to the above publication but lacks some vital information. Published by the Organic Seed Alliance:
<https://seedalliance.org/publications/seed-saving-guide-gardeners-farmers/>

Seed Saving Tips and Crop-by-Crop Growing Guide: <https://www.seedsavers.org/learn>

Seed to Seed, Seed Saving and Growing Techniques for Vegetable Gardeners. Published by the Seed Savers Exchange in Iowa, USA. 228 pages, \$20US + post, ordered online from seedsavers.org

The Seed Ambassadors in Oregon offer this folksy e-handbook:
<http://www.seedambassadors.org/seed-saving-guide/>

Vegetable Seed Saving Handbook. <http://howtosaveseeds.com/index.php>

Seeds of Diversity Canada. seeds.ca - Become a member and join a community of seed savers. Member benefits include access to the seed exchange catalogue (online or print versions) from which you can request and share seeds from other member gardeners across Canada, an online seed talk forum, and opportunities to participate in seed trials and to grow out varieties for their seed bank. Membership is free.



