

Basic Seed Saving

from Seeds of Diversity Canada

Seed saving is the simple act of helping plants to do what they do naturally: grow seeds and reproduce. When you grow your own seeds, you can grow your favourite varieties every year without buying them. You can maintain your own supply of unusual, or hard-to-find seeds. You can even try your hand at breeding your own new varieties! It's fun and it's easy. **The plants do all the work.**

People have been saving seeds for about 10,000 years. Long before there were any seed companies, long before professional seed-growers existed, ordinary people grew seeds for their own vegetables, grains, fruit, and flowers. There are many people alive today who can remember when most Canadian farmers and gardeners saved their own seeds as an ordinary part of their fall routine. They weren't experts in genetics, or university graduates in biology, but they knew a few simple things about plants. You can learn them here, and grow your own seeds too.

There are four main aspects of good seed saving:

- 1) Choosing varieties to meet your expectations
- 2) Controlling pollination
- 3) Selecting the most desirable seeds at harvest
- 4) Cleaning and storage

Choosing Varieties

Seed catalogues usually distinguish two general types of plants: **hybrid** and **open-pollinated**.

In typical garden vegetables, an **open-pollinated** plant variety is a "true" or "purebred" variety. Both of its parents were the same variety, and all of its offspring will be the same too. Since every generation is identical to the generation before it, you can collect and replant their seeds over and over for many years and still have the same variety.

In some crop species, notably ornamentals and grains such as corn or rye, **open-pollinated** often means that the variety is a mixture of many slightly different plants. For instance, open-pollinated annual flowers can simply be a mixture of colours. Open-pollinated corn varieties such as Golden Bantam frequently have some variation from one plant to the next. Even though the plants are not exactly uniform, they are considered to be all part of the same variety.

A **hybrid** variety is a crossbreed. Its parents were different varieties and it is a combination of the two. A combination of two different open-pollinated varieties is called an **F1 hybrid**. A combination of two hybrids is called an **F2 hybrid**. F1 hybrids are known for being very uniform (each plant is exactly like the others), partly because of the pollination control that is needed to create them. Some hybrids show greater vigour than open-pollinated varieties of the same species. This "hybrid vigour" is especially evident in grasses and cross-pollinating species, but less strong in species such as beans and tomatoes that normally self-pollinate.

There is a problem with saving seeds from hybrid plants. Since their genes are a combination of their parents' genes, their offspring will receive a mixture of an already mixed bag. A seed collected from a hybrid plant might produce a plant similar to the hybrid, or it might resemble one of the hybrid's original parents, or it might be an altogether new combination. To make matters even more unpredictable, two seeds from the same hybrid fruit will not necessarily contain the same combination of genes, so will not necessarily grow up the same.

Controlling Pollination

If two non-identical plants cross-pollinate (one is fertilized by pollen from the other), the seeds will be hybrids. They will consist of some combination of the two parent plants. Sometimes this is alright. For example, if you have a bed of mixed annual flowers and you plan to save some of the seeds to plant another mixed bed next year, it doesn't matter if the flowers cross-pollinate. The colours are already mixed anyway.

There are times when you want to prevent cross-pollination. Say you have two favourite varieties of tomato, one orange and one red. You want to replant the same two every year, so you want to keep each variety pure. Another example might be an heirloom bean variety that you want to keep pure, since you can't buy it from any seed company.

Cross-pollination can be prevented by:

- 1) Separating different varieties by enough distance so that pollen, or insects carrying pollen, can't travel between them.
- 2) Making a physical barrier to prevent insects from carrying pollen from one plant to another.

First you have to look at the anatomy of the flowers. There are three basic types of flowers:

- 1) Complete, self-pollinating
 - e.g. tomato, bean, pea, lettuce, wheat, barley
 - each flower has both male and female parts close together. Petals are tightly closed to keep insects out. These flowers almost always pollinate themselves, automatically preventing cross-pollination. In some cases (about 1 out of 20) a determined insect can crawl inside and cross-pollinate the flower, so a short isolation distance is still recommended.
- 2) Complete, cross-pollinating
 - e.g. petunias, onions, hollyhocks, rye
 - each flower has both male and female parts, but they are far apart and the flower is open, allowing insects in easily. These flowers are generally able to self-pollinate, and sometimes do, but they are cross-pollinated by insects just as often. Large isolation distances or insect barriers are required to prevent cross-pollination.
- 3) Incomplete, cross-pollinating
 - e.g. melons, cucumbers, corn
 - each flower is either male or female. Pollen must be carried from a male flower to a female flower for fruit and seeds to be produced. Large isolation distances or insect barriers are required to ensure that pollen comes from plants of the same variety as the female flowers.

Self-pollinating flowers are tightly closed, so insects and wind-blown pollen can't get in easily. They are also **complete** with both male and female parts in every flower. They (almost) always pollinate themselves, making it easy to keep varieties pure. In fact, it's fairly difficult to make hybrids of self-pollinating species.

In some rare cases, these plants can cross-pollinate over short distances. Pollen can drift for a few feet from any plant, further if the pollen is light and dusty, or an insect can sometimes push its way into a tightly-closed flower. We recommend that different varieties of self-pollinating plants should be separated by at least 10-15 feet in the garden, but the further the better to ensure that they remain pure.

Note that if two identical plants cross-pollinate, it has the same result as self-pollination.

Cross-pollinating flowers are open, allowing wind and insects to transfer pollen to any plant within several hundred feet. Most cross-pollinating garden plants have heavy, sticky pollen so they need insects such as bees to carry it. Since bees can travel up to a quarter of a mile from their hive, it is usually recommended to keep different varieties of these plants separated by a quarter of a mile to prevent them from crossing. Other plants have fine, dusty pollen which is carried by wind. Spinach, beet and grains such as corn and rye are among these. They must be separated by a greater distance of a mile or more.

Incomplete flowers are always the cross-pollinating kind. The name means that each flower is either male or female, but never both. Squash, cucumber, melon, corn, and spinach are examples. Pollen is not only able to move freely, by wind or insects, the plant requires something to move pollen from the males to the females. Without insects, no fruit would set on these flowers and no seeds would be produced. The best way to control pollination of these varieties is to learn the difference between the flowers and to hand-pollinate them.

Insect barriers are easy to make with spun-polyester row cover material, old nylons, paper or fine cloth. Cover a few flowers or entire plants, preventing insects from reaching the flowers. Don't use plastic film to cover plants, since it will trap heat from the sun and fry them! If the flowers are self-pollinating, they will pollinate inside the bag and the seeds will be purebred. If the flowers are incomplete, they will need help to transfer their pollen.

Usually, plants will only cross with other plants of the same species. For instance, different kinds of squash can cross with each other, but they cannot cross with cucumbers. However, some species are related closely enough that they can pollinate each other. For example, broccoli and certain kinds of wild mustard can cross-pollinate, producing an inedible hybrid. Lettuce can cross with its wild cousin, so learn to identify wild lettuce if you want to grow lettuce seed. Radishes can cross with mustard and chinese cabbage. If in doubt, consult a seed-saving book. These relationships are well-known and documented.

Selecting Seeds

Seeds must be allowed to ripen fully on the plant or they will not germinate. It's important to know at what stage the seeds are ripe. Flower seed heads are usually only ripe when they turn brown and dry. Fleshy fruit such as tomatoes and cucumbers should generally be very ripe, or even over-ripe before they are picked for seed-saving.

Although green tomatoes turn red and soft after they are picked, they do not continue to grow and develop. Immature seeds cannot mature unless the fruit is fed from the vine. Shelf-ripened tomatoes don't have true vine-ripened flavour, nutrition and may not have viable seeds.

If you aren't sure what your mature seeds will look like, keep a few seeds back in the spring. Then you can compare them to the ripening seeds. Compare size, colour and especially plumpness.

Collect seeds from the plants that are most like the plants that you want to have in future years. If you are trying to preserve an heirloom variety, choose seeds from many plants to maintain the natural diversity of characteristics. For example, some varieties of beans have natural variations in colour within their population. Some of each colour must be saved to preserve the variety completely.

If you want to try to create your own new variety, collect seeds from the plants that are closest to your ideal. For example, you might collect seed from the first tomato to ripen each year. Theoretically, you should be able to select early-ripening genes this way and eventually all of the resulting tomato plants should bear fruit a little earlier. Another example is to collect seeds from your favourite colours of a mixed planting of annual flowers. Cross-pollination may make this difficult, but every year that you repeat this you should get a higher proportion of that colour in your own special mix.

Choose seeds from plants that are free from disease since some disease organisms can survive on the seed surface and re-infect the whole planting next year. Seeds that are lumpy, mouldy or discoloured should not be kept for seed, unless absolutely necessary.

Cleaning

Seeds that are dry when collected (such as most flower seeds) should be freed from chaff and bits of the flower, which can harbour fungus spores, and should be stored in paper envelopes. Seeds from fleshy fruit such as tomatoes and cucumbers need to be cleaned well. These seeds are surrounded by a jelly-like substance that should be removed before storage. This seed jelly is meant to inhibit germination so that the seed does not sprout in the fall when the fruit drops. In nature, the jelly would rot during the late fall, and by the time the seed had been exposed, it would be too cold for it to sprout until spring.

To remove the seed jelly, simply scrub the seeds with your fingers or a towel. If you are saving a large number of seeds, you can use a method called "fermentation". Seed companies which grow and package many thousands of seeds cannot scrub them all with towels, so they use this simple, though disgusting, method. Place the seed pulp in a closed container and keep it in a warm place for 3 or 4 days. Don't let it dry out, but don't add water unless you have to. Soon, mould will cover the surface of the pulp and the jelly will rot, creating a delightful aroma. Holding your nose with one hand, strain the pulp through a sieve with lots of water and the seeds should come out clean. While the seeds are being rinsed, see if any of them float. Especially with tomato, cucumber and melon seeds, if they sink they're good; if they float, they're duds.

Storage

The best conditions for storing seed are, not surprisingly, the opposite of the conditions required for germination. Seeds germinate best in warm, moist conditions and store best in cold, dry conditions. Most seeds can remain viable for a few years in paper envelopes in dry air at room temperature. You can extend their lifetime considerably by keeping them cold in a refrigerator.

Inside every seed is a tiny plant embryo that lives by "eating" a stored quantity of starch. When the food runs out, the embryo dies and the seed will not germinate. The way to keep a seed alive for a long time is to slow down its metabolism. The lower the temperature and humidity, the slower the seed consumes its food.

A simple rule of thumb is that the sum of the temperature in degrees Fahrenheit and the percent relative humidity should be less than 100.

Temperature (degrees F) + Relative Humidity (%) < 100

More or less, for every 10 degrees that the temperature is reduced, seeds will live for twice as long. Humidity is very bad for seeds. If they absorb moisture, even from the air, they start to prepare for germination, and use up a lot of their stored food. **Never** store seeds in a humid greenhouse, a damp basement or garage, a laundry room, or a growing area where there are plants evaporating water into the air.

Seeds should be well-dried before they are put into storage. Open air drying is easiest. There are a few simple methods for testing seed dryness.

- * The hammer test: hit one of your seeds with a hammer. If it shatters, it's well-dried. If it just mashes, it needs to be dried further. (or rather, the others do)
- * The al dente test: a well-dried bean or pea should feel hard when you bite on it. If you can easily make tooth marks, it needs to be dried further.

If air-drying doesn't work, for instance if the air is too wet in your area, you can dry seeds in a food dehydrator or a slightly-warm oven, but avoid temperatures over 95F, since the seeds can be damaged by too much heat. Seeds do need a little moisture to stay alive, so don't try to make them dryer than they would naturally become in the open air.

Paper envelopes allow moisture to escape, preventing deadly condensation. Seeds can also be stored in jars, but it is a good idea to put a little silica gel in the jar too, to absorb excess moisture. Silica gel can be purchased at most craft

stores (it's used for drying flowers) for about \$10/kg. Most brands contain a few indicator crystals which turn blue when the gel has absorbed a certain amount of moisture. Heating the gel in an oven at about 200F dries it out again

A good system is to store your year-to-year seeds in paper envelopes in a cool, and especially dry place. Keep long-term backups in tightly-sealed glass jars in a consistently cool or cold place (humidity in your basement doesn't matter if the jars are well sealed). Note that plastic allows more moisture through than you might think – use glass jars. If you really want to keep seeds for a long time, you can jar them as above, and store them in a freezer. As long as they are well-dried, they will keep for many years. Frozen seeds should be kept in well-sealed jars, since the freezer can over-dry them, similar to freezer-burn, and fatally dehydrate the seed.

Isolation Distances and Seed Viability

The statistics on the following page are typical of those found in seed-saving books. They are provided as a guideline only, since there can be a lot of variation from garden to garden. Your own experience is the best teacher.

Isolation distance for bee-pollinated plants really means "how far will a bee travel while collecting pollen and nectar?" The actual distance depends a lot on the geography of the area, the types and quantities of flowers available and the distance from the hive. A guideline of 1/4 mile is usually given for these plants, but the actual required distance can be anywhere from 100 feet to 1/2 mile.

Isolation distance for wind-pollinated plants really means "how far do the plants have to be separated so that there is an 'acceptably small' chance of pollen being blown from one to the other?" Again, the actual distance depends on the usual direction of the wind, nearby wind blocks such as trees and fences, the weight of the pollen, humidity, and the amount of pollen being produced in your planting. One or two miles is often recommended, but as little as 1000 feet is sometimes enough, especially for large plantings.

Seed viability, or "shelf life" varies greatly with temperature and humidity. The figures given below are typical for seeds stored in a dry, cool place such as a dry cellar (or a humid cellar with the seeds in dry jars). Seeds stored at room temperature, but still dry, will usually last about half as long. Seeds stored in a humid location can lose their viability within a few months to a year.

A germination test can be helpful if you want to know how good your seeds are. Sprout 10 or 20 seeds in a small pot of potting soil or vermiculite, or wrap them in a paper towel and keep them moist in a warm place (wrapped in plastic on top of the fridge is good). In a week or two, some of the seeds should sprout. If less than ¼ of them do, you should consider regrowing them. If fewer than half of the seeds sprout, the rest of the batch is probably close to dying; time to plant them and collect fresh seeds.

The isolation requirements below are taken from How to Save Your Own Vegetable Seeds, by Seeds of Diversity Canada.

The seed storage statistics are typical for seeds stored in a dry, cool place.

	distance	shelf life(yrs)			distance	shelf life(yrs)	
		avg	max			avg	max
Angelica		1	3	Marjoram		3	7
Asparagus		5	8	Melon, Musk	1/4 mile	5	10+
Basil		8	10+	" , Water	1/4 mile	6	10+
Bean	15-20 ft	6	10+	Mustard	1/4 mile		
" , Kidney	15-20 ft	3	8	Nasturtium		5	8
" , Lima	1 mile			Okra	1 mile	5	10+
" , Runner	1/2 mile			Onion	1/4 mile	2	7
" , Soy	10 ft	2	6	Parsnip	1/4 mile	2	4
Beet	1/4 mile	6	10+	Parsley		3	9
Borage		8	10+	Peas	15-50 ft	3	8
Broccoli	1/4 mile	5	10	Peanut		1	1
Brussels Sprouts				Pepper	500 ft	4	7
	1/4 mile			Pumpkin	1/4 mile		
Cabbage	1/4 mile	5	10	Radish	1/4 mile	5	10+
" , Chinese	1/4 mile			Rhubarb		3	8
Calendula		3	7	Rosemary		4	?
Carrot	1/4 mile	4	10+	Rutabaga	1/4 mile		
Catnip		5	6	Sage		3	7
Cauliflower	1/4 mile			Salad Burnet		3	9
Celeriac	1/4 mile			Salsify	1/4 mile	2	8
Celery	1/4 mile	8	10+	Savory		3	7
Collard	1/4 mile			Sorrel		4	7
Corn	1/4-1 mile	2	4	Spinach,	1 mile+	5	7
Cucumber	1/4 mile	10	?	" , New Zealand		5	8
Cress, Garden		5	9	Squash	1/4 mile		
Dill		3	5	Strawberry		3	6
Eggplant	50 ft	6	10	Sunflower	1/4 mile		
Gourd		6	10+	Sweet Cicely		1	1
Horehound		3	6	Swiss Chard	1/4 mile		
Hyssop		3	5	Tansy		2	4
Kale	1/4 mile			Thyme		3	7
Kohlrabi		5	10	Tomato	15-20 ft	4	9
Lavender		5	6	Turnip	1/4 mile	5	10+
Leek	1/4 mile	3	9				
Lentil	10 ft	4	9				
Lettuce	15-20 ft	5	9				
Lovage		3	4				