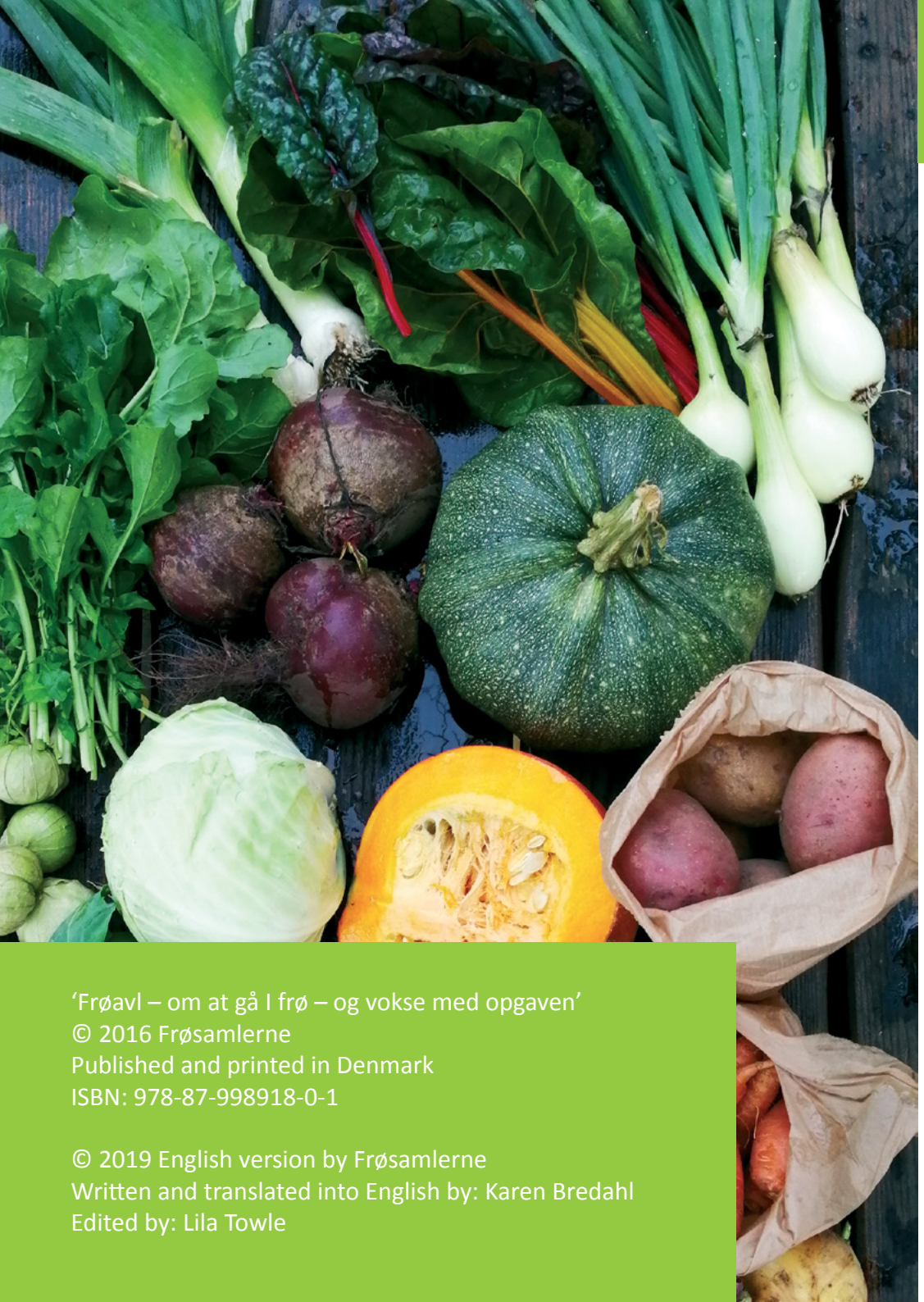
GUIDE TO SEED SAVING



‘Frøavl – om at gå I frø – og vokse med opgaven’

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1 WHY BECOME A SEED SAVER?

As for me – I was looking for tall peas and did not find them in the shops where I used to buy seeds. After five years in Australia, I had returned to Denmark and there were simply no tall peas to find. I turned to Google and the first hit was The Seed Savers Association of Denmark.

Therefore, I joined and got my tall peas – even two different kinds of tall peas, both sweet and delicious. Moreover, I found, that The Seed Savers had more than twenty different kinds of tall peas. What an abundance!

And abundance is not common in the ordinary seed market these days. In fact, the supply of seeds to home gardeners has shrunk substantially over the last 50 years, especially since EU legislation on seed marketing began to make traditional varieties less profitable. The purpose of this legislation is to protect and develop commercial seed production and to secure the uniformity of seeds supplied to commercial growers. However, the result for private gardeners is that all the wonderful vegetables of our childhood have disappeared. Except that some stubborn families keep on growing their own wonderful pea, bean or carrot variety, and to do so they have to save their own seeds. These families are the source of the Seed Savers abundance.

The Seed Savers educate their members on how to secure the old varieties against genetic “contamination” from other varieties, and on the numbers of plants needed to maintain a healthy variety.

Therefore, one good reason to become a seed saver is to get wonderful old varieties, another good reason is to fight the uniformity introduced by the commercial seed companies, and thirdly, by doing so you can help keep the old varieties alive.

On top of all that, when you grow your own seeds you get locally produced seeds. Most commercial seeds are produced hundreds of miles away, and you cannot know anything about the conditions under which they have been transported and stored. Locally produced seeds will germinate better and they will be better adapted to the local climate.

Finally, when joining the Seed Savers I found myself becoming part of a network of dedicated people who gladly share their knowledge, their experience and their seeds.

2 BASIC PLANT KNOWLEDGE

To experience success growing your own seeds, you must have some basic knowledge of the life cycle of plants and their strategies of reproduction.

The lifespan

Annuals: Some plants go through the whole cycle – germination, growing, flowering and setting seeds – in just one year. Then they die. (E.g. lettuce, peas, beans, spinach)

Biennials: These plants live for two years, producing a strong plant the first season, and then flowering and setting seeds the following year. The first year they store energy either in the root (e.g. carrots, beetroots, parsley) in the stem (kohlrabi) or in the leaves (leeks, kale, and cabbages).

Perennials: These plants can flower and set seeds every year for many years. Most of them survive the winter underground.

The structure of flowers

The male parts of the flower are the stamens with the anthers at the end, where the pollen (plant sperm) is produced and from where it is spread.

The female parts are at the bottom - the ovary, then the style, and at the top the stigma where the pollen must land. From here, the pollen grows down through the style and into the ovary to fulfill the fertilization.

In some plants, all flowers have both male and female organs. They are called perfect flowers.

Other plants have separate male and female organs in different flowers, though still on the same plant (e.g. pumpkin, melon, cucumber, maize (US corn). They are called *monoecious*.

In a few plants, the male and female flowers are found on different plants, so that the whole plant is either male or female (e.g. asparagus, kiwi, spinach). They are called *dioecious*.

Pollination

Self-pollination
Self-pollinating plants can use their own pollen to fertilize their own flowers. In some of them the pollination even happens before the flower is open (peas, beans, lettuce, and most tomatoes). The pollen grains simply fall from the anther to the stigma, and when the flower opens the whole thing is over and done. So visiting insects cannot interfere with the fertilization. In principle, you can grow viable seeds from just one single plant of this type, but it is always better for genetic diversity to take seeds from several plants.

Most self-pollinators can use pollen from other plants of the same species. In some cases (mentioned above) this happens very rarely, but in other cases the risk is much bigger.

Some self-pollinators are also popular with insects and therefore at risk of being contaminated with pollen from other plants (chilli, pepper, broad (fava) bean, eggplant).

Cross-pollination
These plants are also called outcrossers. They primarily use pollen from other plants and hence need someone or something to bring the pollen from one plant to another – most commonly insects or wind.

Insect pollinated: E.g. cabbages, carrots, pumpkins, squash, leeks, onions

Wind pollinated: E.g. maize, spinach, beetroot

A special group of outcrossers is self-infertile. This means that one plant cannot use its own pollen to fertilize other flowers on the same plant. It must have pollen from another individual. Self-infertility is a good protection against spontaneous inbreeding. E.g. Cabbages, carrots, maize, rye

Species and varieties

Species are the biological units in the world of plants.

Examples of species are carrot, lettuce, pea, garden bean, runner bean, fava bean, soybean, cucumber, tomato.

Species have a binomial botanical name in Latin – for example, carrots are *Daucus carota* (genus name + species name) – which is always in italics. The name of the genus starts with a capital letter and the species name with a small letter.

Species are biologically defined and a "typical example" exists in a scientific collection somewhere in the world.

Varieties are a subdivision of species.

For example: Carrots, *Daucus carota*, come in many varieties, e.g. Nantes, Nikki, Negovia. The term "varieties" is only used for cultivated plants and only in recent times. A variety is a group of individuals of the same species and with similar characteristics. There is no "typical example", only a more or less precise description.

Garden beans belong to a species that comes in two types – bush beans and pole beans – and each type comes in many varieties.

Cabbages - *Brassica oleracea* – all belong to one species, and all the different kinds of cabbages – kale, cauliflower, Brussels sprouts, etc. – are varieties. Hence, they are very likely to cross with each other. At the same time, cabbages are self-infertile and very sensitive to inbreeding, so you need many cabbage plants to grow viable cabbage seeds and you need to know whether there are other flowering cabbage plants in the neighbourhood.

3 F1 HYBRID OR OPEN POLLINATED VARIETIES

F1 hybrid

The word "hybrid" derives from the Latin word *hybrida*, which means bastard. The origin of the Latin word is the Greek word *hybris*, which means obscenity or rape. In the world of plants, a hybrid is normally the result of a crossing between different varieties.

Hybrids often happen spontaneously between plants as well as between animals. From early times, humans have experimented with crossing varieties and species.

The modern F1 (filial 1 or "first children") hybrids we find in commercial seed production are made by crossing two completely pure and very inbred varieties with different very attractive properties - although they have other very weak properties because of the inbreeding. By crossing these two varieties, you get seeds with the very best and strongest genes from both parents. These seeds are sold as F1 hybrids.

The plants you get in your garden from F1 seeds are usually stronger, faster growing, more resistant to diseases, and uniformly alike. Hence, they would be attractive to commercial growers, and often to home gardeners too. The problems appear in the next generation.

Some F1 hybrids do not produce viable seeds at all, but if they do, you will not see the same kind of uniformity and strength in your plants the following year – the F2 generation. Now all the genes have been mixed again in many different ways and some of the bad properties of the "grandparents" will appear. Of course you can select the best plants (and remove those with unwanted properties) and grow seeds for a F3 generation and so on, but it will take many years to obtain a stable variety with the properties you want.

Therefore, if you want to grow the strong, fast-growing, resistant plants of the F1 generation you must buy the seeds from the seed company every year – and that is exactly what they want you to do.

F1 hybrids are expensive to develop and produce, which means that seed companies want to reduce the number of available varieties in order to cover their expenses.

Therefore, seed companies prefer to develop seeds that are suited for commercial growing. Commercial growers make a much more profitable market than home gardeners do, but they want other properties from their plants.

4 CONSERVATION OF THE PROPERTIES OF A VARIETY

Commercial growers often use machine picking, which means that the whole harvest has to be ripe at the same time. Home gardeners want a long harvest season.

Machine sorting and transport by lorry are big challenges to delicate vegetables, but necessary for the commercial growers. Therefore, they want robust fruits and vegetables. Home gardeners have no need for transporting their veggies other than from the garden to the kitchen.

Commercial growers and supermarkets want veggies to look fresh on the shelf for many days – or even weeks. Home gardeners pick fresh when they want to eat.

Home gardeners want variation in tastes and textures, whereas commercial growers prefer uniformity, resistance to injury, and good looks.

On top of that, all commercial seeds on sale in the EU have to be registered and that is very expensive. Another good reason for the seed companies to reduce the number of varieties they produce.

Consequently, the old tasty varieties so well suited for home growing are disappearing from the market.

Hybrid seeds have to be labeled clearly with F1 on the seed packet; sometimes it is printed on the front, but in other cases, it is hidden away on the back.

Open pollinated varieties

Open pollinated varieties are all the plants that produce offspring with the same appearance and properties as the parent plant. They can all be used in your own seed saving.

Seeds of open pollinated varieties do not carry any special labelling on the seed packet, but the word “Heirloom” is a guarantee.

To make sure that old varieties do not deteriorate, seed savers have to know how to avoid losing parts of a variety’s gene pool, which could lead to inbreeding and loss of vitality. At the same time, we also have to know how to avoid contaminating these varieties with pollen from another variety of the same species.

To avoid inbreeding it is important to know how many plants you need to grow for seeds. See table 2, page 17. The more plants you grow, the better the chance that all the original genes are represented. This does not mean that you have to take seeds from each and every plant. If all the plants have participated in pollination, their genes will be represented in the seeds you get.

To avoid contamination from other varieties, you have to know about your crop’s “sexual preferences” and how far apart from other pollen sources the plants will have to grow. See minimum distances in table 2 on page 17. However, if your garden is too small for safe distances, there are some tricks you can use to ensure purity of your varieties.

Self-pollinating varieties
These varieties are the easiest to handle. Here you need only a couple of meters between varieties and 5 – 10 plants of each variety.

- Lettuce, peas and most tomatoes are safe self-pollinators.
- Garden beans, fava beans, runner beans, capsicums, and scorzonera self-pollinate, but are also popular with insects and therefore prone to contamination with foreign pollen.

Distance in time or space

As mentioned above, distance is one way to secure your plants from unwanted crossing. Grow only one variety each year and keep an eye on what your neighbor is growing. Most seeds stay alive for at least a couple of years, so you can grow two varieties in alternating years.

Covering

Self-pollinators can be kept pure by covering. Pull a bag (paper or thin cloth – absolutely not plastic) over the whole plant, or if it is too big to cover, over a branch with a few flower buds. The bag must be tied closely around the stem so that no insects can enter. Make sure you do this before the flowers open. To ensure a good pollination, you can shake the bag now and then, and when fruit is developing inside you can take away the bag and attach a marker to the branch to remind you where to harvest your pure seeds.

Shielding

You can grow two varieties – one on either side of the house or a tall hedge - and so reduce the risk of unwanted pollination /contamination.

Cross-pollinating varieties.
Cross-pollinating varieties are more complicated to deal with. Distances have to be much greater. Foraging insects fly far and wide – bees can fly up to 3 km away from their hive. Moreover, plants that are dependent on visiting insects do whatever they can to attract them. They use scents and colour and they offer pollen and nectar.

Pumpkin and squash (*Cucurbita* species), cucumber (*Cucumis* sativus) and melon (*Cucumis* melo) are two different genera (plural of genus) and several different species, which do not cross with each other, but they cross energetically with other varieties of their own species. The *Cucurbita* family contains several species which do not cross with each other (e.g. *C. maxima*, *C pepo*, *C. mixta* and *C. ficifolia*). There are only small visible differences between them. Therefore, you have to know the Latin name to make sure which ones cross and which ones do not.

In this group, the male and female flowers are separate, but they are so big that hand-pollination is a possibility.

Hand-pollination

To be successful you have to keep an eye on your plants. The day before the flowers open, you cover them with a bag tied around the stem. You need at least one female flower and 4-5 male flowers – all bagged. The next morning when the flowers have opened, you pick the male flowers and strip them of the petals. Then you remove the bag from the female flower and smear the pollen from all the male flowers on the stigma. Finally, you cover the female flower again. When fruit is developing, you can remove the bag and put a marker on the fruit so you do not forget where the pure seeds are.

- Cabbage (Brassica oleracea) is a troublesome species, which is insect-pollinated. Everybody crosses with everybody and you need at least 20 – preferably 40 – plants to avoid inbreeding. Therefore, if you want to grow seeds of a certain variety of kale, you have to keep an eye on all kales, cabbages, cauliflowers, Brussels sprouts, - - in the neighborhood. If they flower at the same time, they will cross.

- Carrots (Daucus carota) are also insect-pollinated, and even more troublesome. They cross not only with other carrot species but also with wild carrot. To avoid inbreeding you need at least 40 plants, and being biannual, they must survive a winter before producing any seeds. Carrots do not like frost so you have to protect them either with a thick layer of straw or by transplanting into a greenhouse for the winter. If you want to play with carrots, it can be recommended to have an experienced seed saver handy.

Shielding as mentioned above is not enough to protect a cross-pollinating variety, but it can reduce the necessary distance between two varieties.

Covering is a possibility with cross-pollinating varieties, but you need to cover the whole row and add some insects to secure pollination.

5 SELECTION OF PLANTS FOR PROPAGATION

In order to make a successful selection of which plants to take seeds from, you must consider the purpose of your seed saving.

Basically you never take seeds from sick or weakened plants. These specimens should be removed from the bed before flowering. In this way, they cannot participate in fertilization and spread their pollen to the strong and healthy plants.

Since late in the Stone Age, farmers and gardeners have worked to improve the quality of their crops. Maybe they wanted bigger fruit, stronger plants, or earlier harvest. This process is called selection, or if it is done using modern methods, plant breeding. If you want to improve a certain variety, you select the plants with the desired properties.

Conservation

If the purpose of your seed saving is conservation of a certain variety, you have to think otherwise. In this case, you must take into consideration the whole gene pool of the variety. This means you will have to take seeds from a broad spectrum of plants, as long as they carry the characteristics of the variety.

Improvement

Let us look at three examples:

- If you grow peas for your own use, you want pods to develop earlier and you want a longer harvest season. Consequently, you take seeds from the plants that produce the first pea pods and from the plants that keep on producing for the longest time. To keep track of which plants and which pods you have selected for seed saving, you mark them clearly. When the selected pods are ripe, you have seeds with the best properties of your variety.

  Lettuce, on the other hand, you want to stay crisp and tender for as long as possible. Therefore, you take seeds from the heads which both are largest and last to bolt (“run to seed”).

  Carrots are biennial. The first year you harvest for eating, and the following year the remaining plants will bolt, flower and set seeds. However, some carrots may bolt the first year, and the seed saver might think that this was a good way to harvest seeds without having to wait another year. But if you do, you increase the possibility that all your future carrots will bolt the first year, and they will not be worth eating.

6 HARVEST, CLEANING AND STORING

Seeds must be ripe before being harvested. However, if you wait too long, they might mould or fall off.

Some seeds are harvested wet and others must be dry.

Wet seeds

Wet seeds are tomatoes, cucumber, pumpkin, melon and capsicum.

Tomatoes
The fruit must be very ripe. Do not choose the first fruit, but the best ones in the first clusters. If the fruit is unevenly developed, it means that not all ovules are properly pollinated. Put a marker on your chosen fruits to avoid losing them to a hungry mouth.

There are two ways to handle tomato seeds.

1. **a**. Cut the tomato open and squeeze the seeds and juice into a cup. The rest of the fruit can be eaten. Add some lukewarm water to the cup and leave it in a warm place.

   b. After a couple of days a mouldy surface has formed. Now you can pour water, mould and seeds into a strainer. Rub gently with your fingers under running water until the seeds are clean.

   c. Tip seeds from the strainer onto a piece of non-absorbent / sandwich paper.

   d. When dry you can scratch them off with a knife and store them in a paper bag.

2. **a.** Cut the tomato open and distribute the seeds evenly on a piece of kitchen paper towel. The slime around each individual seed will glue it to the paper when dry.

   b. Let the paper dry completely and store it in an envelope.

   c. When you are going to sow your seeds, you just remove the extra layers of kitchen towel. Then spread the paper over your seedbed, cover it with a little soil and add water. The paper will disappear while the seeds are germinating.

The advantage of the first method is that your seeds take up very little space. The advantage of the second method is that the seeds are very easy to sow and your plants grow with your chosen distance.

Cucumber
A ripe cucumber is yellowish and rather soft, but do not wait too long. The seeds might germinate if not harvested in time. Scrape out the seeds, wash, and dry them on a piece of non-absorbent / sandwich paper.

Pumpkin and melon
There is no need to remove the seeds until you want to eat your pumpkin or melon. Just scoop out the seeds, wash them clean and dry them on a piece of non-absorbent / sandwich paper.

Capsicum
Harvest seeds from ripe pepper and chilli fruits. Seeds are dry in a day when left on a piece of paper or a plate. Do not forget to wear gloves if your chillis are hot.

Dry seeds

Most other seeds are to be harvested dry.

It is important to pay attention to your seed plants, because dry seeds will mould if they get very wet. Furthermore, some plants ripen their seeds successively over a long time, and you have to harvest the first before the last are ready. Rub with your hands or cut with a pair of scissors into a paper bag or bowl.

The autumn weather often does not cooperate with seed savers. If your dry seeds are in danger of getting very wet, you can pull the whole plant gently from the ground, brush or rinse the roots free from dirt and hang the plant upside down in a dry and airy place. A carport is well suited for this purpose. Do not forget to put a paper bag over the top of the plant to prevent seeds from being lost if they drop off while they are drying.

Seeds die at about 35 degree Celsius, so do not dry them in direct sunlight or in an oven. Slow and airy is better for drying seeds than hot and fast.

Seed cleaning
Describing in words the different techniques for cleaning seeds might make it sound difficult, but it is not necessarily that bad. It takes some creativity and practice to make it happen - the easiest way to get the idea is by watching an experienced seed saver in action.

A pair of working gloves with rough palms is a great help in rubbing seeds from their hulls. Ripe pea- or bean pods can be beaten or walked upon in a cloth bag or pillowcase. A set of sieves with holes in different sizes is handy too. Finally, you can winnow seeds using baskets or bowls.

The most important thing about seed cleaning is getting rid of insects, including larvae and pupae, and any other wet stuff. If your seeds are completely dry and free of any pests, they have a good chance of germinating next year.

Germination test

Test your seeds this way:

Place several layers of paper kitchen towel in a plate and water it thoroughly. The paper must be wet all over but not soggy. Place 20, 30 or 50 seeds separately on the paper, cover with kitchen foil, and put it in a warm place. Do not forget to label the plate with variety and date.

Remember to check your seeds once or twice a day and add water if the paper is getting dry. After a few days, you might see the first germination, but be patient; it might take up to 3 weeks before your seeds germinate. When no more seeds are germinating, you can count and calculate the percentage of your seeds that are likely to germinate in the garden (usually a little less than in the kitchen).

Storing

Dry, dark and cool – and out of reach for mice. These are the key words for storing seeds.

7 RECOMMENDED DISTANCE AND CROP SIZE FOR SAFE SEED HARVEST

The following tables make recommendations for two types of seed saving goals – hobby and conservation/sale.

Hobby

Hobby means that your seeds are for personal use only, or you share them with other amateurs. Furthermore, you are saving seeds of varieties which are easily replaced.

Conservation/sale

Conservation/sale means that your seed saving is about conserving the whole gene pool of a special variety, or your seeds are for small-scale marketing.

Distances

In the column for distances, you will sometimes find two numbers. This does not mean you have a free choice. It means that you have to consider the topography of your garden. Do you have buildings or tall hedges to shield different crops from each other? Do you have very few or many insects in your garden, and do you have a lot of flowers all over the place to distract the insects?

8 LITERATURE FOR SEED SAVING

Outcrossers
Outcrossers are quite another story.

Some species like cucumber can make healthy seeds from a few plants over several years, but to make sure that the whole gene pool is intact, you had better have 10 plants.

Cabbage is at the other end of the scale. In a few years with too few plants, you will have lost the variety or degraded it substantially. They are self-infertile / self-incompatible.

A good trick to increase your available gene pool is to mix some seeds from this year's harvest with some seeds from last year's harvest and maybe even some from the year before that.

Therefore, never sow the last seed of a special variety unless it really is the very last seed.

** marked books are books for in-depth knowledge*

Seed saving books:

Back Garden Seed Saving.
Sue Stickland. Eco-logic books, UK, 2001. A good beginners book, can be ordered from www.eco-logicbooks.com, England.
ISBN 189923091

Seed to Seed.
Suzanne Ashworth. Seed Savers Exchange Publications, Decorah. USA. 2002. Very good on original American vegetables: pumpkin, corn, beans etc.
ISBN 1-882424-58-1

***The Manual of Seed Saving**
Andrea Heistinger, in association with Arche Noah and Pro Specie Rare. Originally in german from 2003, in English in 2013. European book covering many growth zones and very easy to use. Timberpress.co.uk.
ISBN 9781604693829

***The Seed Garden. - The Art and Practice of Seed Saving.**
Lee Buttala. Comprehensive book from Seed Savers Exchange in USA. 2015. The newest and most comprehensive book on seedsaving.
ISBN13: 9780988474918

The seed savers' handbook.
Michael & Jude Fanton. Seedsaving book by the founders of Australia's Seed Savers' Network. 2000.
ISBN13 9780646102269

9 WHAT YOU NEED TO KNOW ABOUT SEED-BORNE DISEASES AND PESTS

Other relevant books and companies:

The Vegetable Garden.
Vilmorin-Andrieux. A classic in garden history with names, information and engravings on hundreds of European vegetables and herbs from 1885. Names of species in several languages. A book to consult for verifying that the heirloom vegetable varieties still look as they did.

Breed Your Own Vegetable Varieties.
Carol Deppe, Chelsea Green, USA 2000. For advanced. Saving seeds on your own new varieties.
ISBN13 9781890132729

Seed-companies recommending that you save your own seeds and how to do it:

The Real Seed: http://www.realseeds.co.uk/

Company selling heirlooms/Heritage varieties:

Thomas Etty Esq.: http://www.thomasetty.co.uk/

In most cases, propagating plants by taking seeds will be the safest way to avoid pests and diseases. Most problems with mildew, mold, fungus, viruses, or pests are transmitted through tubers or fresh plant material.

However there are some problems to be aware of, and there are general rules of precaution, when you select, harvest, and store seeds.

Be aware
Discolored leaves, pods, or plants.

Misshapen leaves, pods, or plants.

Holes, dust or other signs of insects in the seeds.

Discolored seeds.

Rules of precaution
Rinse seeds well to take away insects, eggs, or fluff, which may house fungus or insects. Dry thoroughly.

Beans (well dried down) can be frozen for 2 to 3 days at minus 18°C to prevent bean weevils.

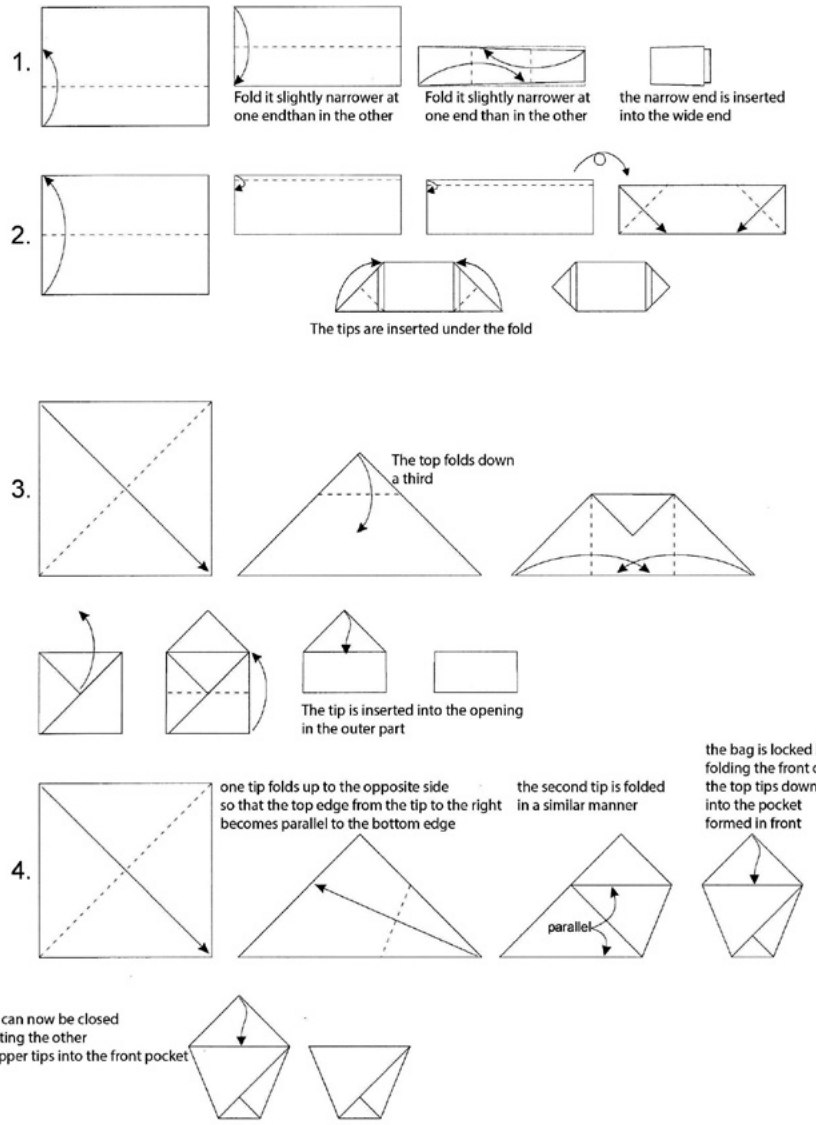
Read more:

The Seed Garden - The Art and Practice of Seed Saving.
Lee Buttala. ISBN13: 978-0-9884749-1-8
The newest and most complete book on seed-saving also provides a comprehensive list of common seed borne diseases of vegetable and grain crops.

The new vegetable & herb expert.
Dr D G Hessayon. ISBN: 978-0-903505-75-8
Shows and describes diseases and pests on vegetables and herbs.

Non-tolerance diseases and pests
There are also non-tolerance diseases and pests, which are regulated through EU from 14. December 2019: https://eur-lex.europa.eu/legal-content/DA/TXT/PDF/?uri=CELEX:32016R2031&from=EN
These will require precaution if you plan to import seeds.

4 DIFFERENT SELF-SEALING ENVELOPES



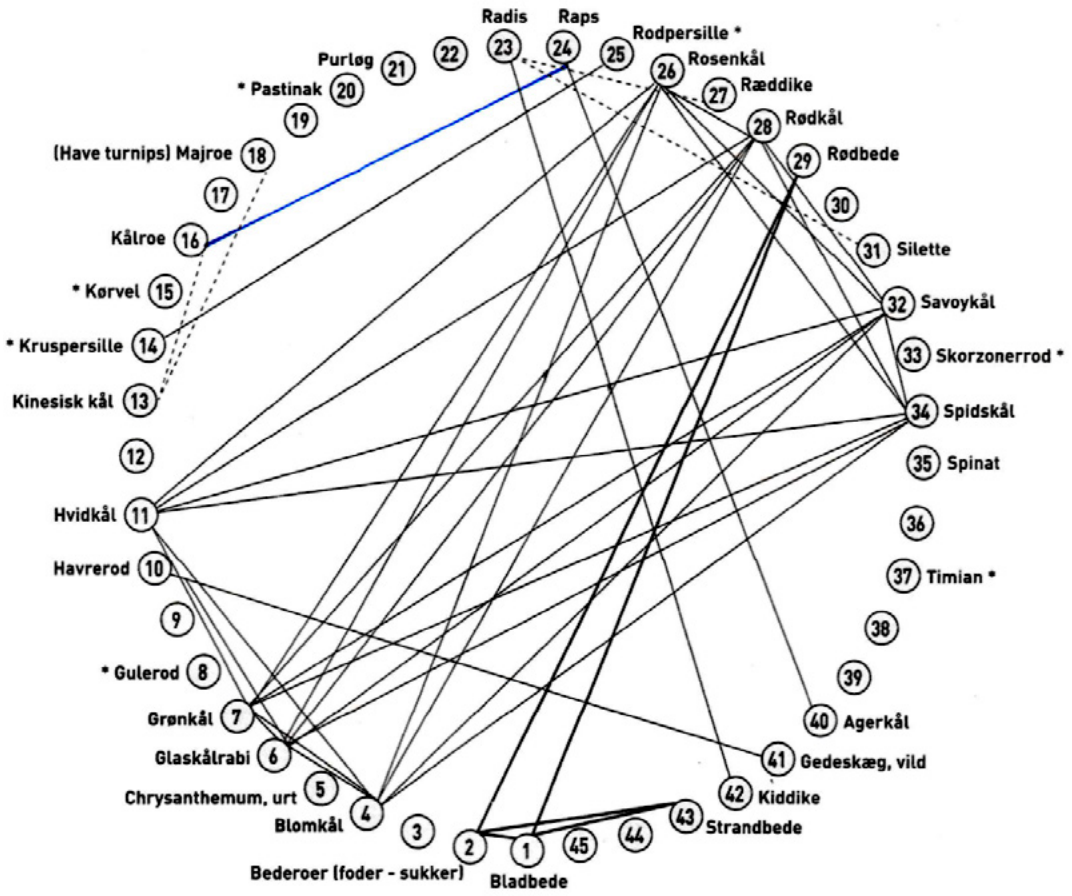
GROWING
SEED SAVERS

Nordplus

Risk-Circle of inter-vegetable and crop wild relatives crossing

No.	Danish	Scientific name	Common English name
1	Bladbede	*Beta vulgaris*	Chard, Pepetual spinach
2	Bederoer (foder-sukker)	*Beta vulgaris var. altissima*	Mangel beet / Mangold
3			
4	Blomkål	*Brassica oleracea botrytis*	Cauliflower
5	Chrysanthemum, urt	*Chrysanthemum coronarium*	Garland chrysanthemum
6	Glaskålrabi	*Brassica oleracea gongylodes*	Kohl rabi
7	Grønkål	*Brassica oleracea acephala*	Kale/borcole
8	Gulerod*	*Daucus carota*	Carrot
9			
10	Havrerod	*Tragopogon porrifolius*	Salsify/Goatsbeard
11	Hvidkål	*Brassica oleracea capitate alba*	White cabbage
12			
13	Kinesisk/kina kål	*Brassica rapa ssp. pekinensis*	Chinese cabbage, Pé-tsai
14	Kruspersille*		
15	Kørvel*	*Anthriscus cerefolium*	Chervil
16	Kålroe	*Brassica Napus var. Napobrassica*	Swede, Rutabaga,
17			
18	(have turnips) Majroe	*Brassica rapa var. rapa*	Turnip
19			
20	Pastinak*	*Pastinaca sativa*	Parsnip
21	Purløg	*Allium schoenoprasum*	Chives
22			
23	Radise	*Raphanus sativus radicula*	Radish

No.	Danish	Scientific name	Common English name
24	Raps	*Brassica napus*	Rapeseed
25	Rodpersille*	*Petroselium crispum Tuberosum*	Parsley root, Hamburg parsley
26	Rosenkål	*Brassica oleracea gemmifera*	Brussels sprouts
27	Ræddike	*Raphanus sativus var. niger*	White radish
28	Rødkål	*Brassica oleracea capitate rubra*	Red cabbage
29	Rødbede	*Beta vulgaris*	beetroot
30			
31	Silette		
32	Savoykål	*Brassica oleracea sabauda*	Savoy cabbage
33	Skozonerrod	*Scorzonera hispanica*	Salsify black
34	Spidskål	*Brassica oleracea capitata conica*	Spring cabbage
35	Spinat	*Spinacia oleracea*	Spinach
36			
37	Timian*	*Thymus Vulgaris*	Thyme
38			
39			
40	Agerkål	*Brassica rapa*	
41	Gedeskæg, vild	*Tragopogon dubious*	Goatsbeard
42	Kiddike	*Raphanus raphanistrum*	wild radish / white charlock
43	Strandbede	*B. vulgaris subsp. maritima*	Sea beet
44			
45			



Risk-Circle of inter-vegetable and crop wild relatives crossing

Brassica rapa crops also include Broccoli rape, Turnip rape, Mizuna and Bok choi/Pak choi.

Plants with * has got a wild relative they have descended from and still can cross with.
Dotted lines show a possibility of crossing, those with the solid lines between them, it is the norm they will cross.

Varieties within all species can cross.

Plant families usually have their crop wild relatives in countries/areas where they originate, so plants like tomatoes, pumpkin, most beans and corn have their wild ancestors in North/Central America and are therefore not in the circle.

Achocha (Kaihua)	*Cyclanthera pedata*	long
Artichoke, Cardoon	*Cynara scolymus L./ Cynara cardunculus L.*	long
Aubergine	*Solanum melongena L.*	long
Bean (bush,pole-)	*Phaseolus vulgaris L.*	middle
Beetroot	*Beta vulgaris L.*	middle
Broad bean (fava)	*Vicia faba L.*	middle
Carrot	*Daucus carota L. subsp. sativus*	short to middle
Celery	*Apium graveolens L.*	short to middle
Chard	*Beta vulgaris L. var. cicla L.*	middle to long
Chicory, Belgian endive, radicchio	*Cichorium intybus L./ Cichorium endivia L.*	middle
Chilli pepper	*Capsicum annuum L.. + other Capsicum species*	short to middle
Coles (broccoli, kale, cabbages, Brussels sprouts, etc.)	*Brassica oleracea L. cultivar groups*	long
Corn salad	*Valerianella locusta*	middle
Cucumber	*Cucumis sativus L.*	(very) long
Dill	*Anethum graveolens L.*	middle
Fennel	*Foeniculum vulgare*	short
Leek	*Allium porrum L.*	short
Lettuce	*Lactuca sativa L.*	middle
Maize (sweetcorn)	*Zea Mays L.*	short to middle
Melon	*Cucumis melo L.*	long
Onion family	*Allium cepa L.*	short
Parsley, leaf and root	*Petroselinum crispum var.*	short
Parsnip	*Pastinaca sativa L.*	(very) short
Pea	*Pisum sativum L.*	middle
Pepper	*Capsicum annuum L.*	middle
Radish	*Raphanus sativus L.*	middle to long
Rucola / rocket salad	*Eruca sativa*	middle
Runner bean	*Phaseolus coccineus L.*	middle
Salsify	*Tragopogon porrifolius L.*	short
Scorzonera	*Scorzonera hispanica L.*	(very) short
Spinach	*Spinacia oleracea L.*	middle
Squash, courgette, pumpkin	*Cucurbita species*	long
Tomato	*Solanum lycopersicum L*	long

Table 1: Average storage life expectancy of vegetable and herb seeds

(Healthy, fully ripened and dried seeds, stored under cool, dry conditions):
Short = 1-2 years Middle = 3-4 years Long = 5+ years
(some herb and annual flower seeds must be sown the same year, i.e. shortly after harvest)

Guide to Seed Saving Recommended distances

English name	Botanical name	Life cycle, seasons	Pollination type	Primary pollination method	Isolation distance, meters (hobby)	Isolation distance (conservation, sale)	Number of plants (min. for viable seed)	Number of plants (swaps, sale, conservation)	Notes
Cucumber	*Cucumis sativus L.*	1	O	insects	150-250	800	1	6-12	Does not cross with melons or squash/marrows.
Aubergine	*Solanum melongena L.*	1	S/O	self, insects	20	100	1	5+	-
Chard (”Swiss chard”)	*Beta vulgaris L. var. cicla L.*	2	OO	wind	300-500	1500	5	20	All species in genus Beta can cross.
Barley	*Hordeum vulgare**	1	SS	self	0-3	3-6	1	6-12	*Crosses are very rare – possibly more frequent in the exotic species of grains, because the plants may be stressed during growth.
Chilli pepper	*Capsicum annuum L. and other Capsicum species*	1	S/O	self, insects	10-20	250	1	5	Most Capsicum species can cross-pollinate. Chillies and mild peppers can cross. Capsicum baccatum + C. frutescens are more often pollinated by insects than C. annuum.
Chicory, Belgian endive, radicchio	*Cichorium intybus L.*	2	OO	insects	150-250	800	5	15-20	Can be pollinated by wild chicory and the related endives.
Endive	*Cichorium endivia L.*	2	S (/O)	self, insects	150-250	800	1	6-12	Can pollinate but cannot be pollinated by chicory.
Fennel, leaf and bulb (“Florence fennel”)	*Foeniculum vulgare varieties*	2	(S/) O	insects	150-250	800	5	15-20	All varieties of fennel can cross.
Squash, courgette, marrow	*Cucurbita species*	1	O	insects	250	800	1	6-12	Cross only within each species – and never with melons or cucumbers.
Carrot	*Daucus carota L. subsp. sativus*	2	OO	insects	150-250	800	10	30-50+	Cross with wild carrots. Never save seeds from plants that flower in the first year.
Garden beans (bush, climbing, eating fresh or drying)	*Phaseolus vulgaris L.*	1	SS	self	2-3	6	1	6-12	Some crossing does occur, about 1 %. Some varieties and types, especially climbing beans, are probably more likely to cross.
Cabbage family (broccoli, kale, heading cabbage, kohlrabi, Brussels sprouts etc.)	*Brassica oleracea L. cultivar groups*	2	OO	insects	250	800-1000	5-6	seeds from 15-20 plants, chosen from at least 30	Broccoli can be treated as an annual, if you have a very long season. All forms of cultivated cabbage (B. oleracea) cross freely and must be isolated for pure seed.
Orach / Orache	*Atriplex hortensis*	1	S/O	wind	150-250	1500	1	6-12	Varieties and possibly colour variants can cross. To preserve a historic variety, it is best to grow only one each year, as the plants are difficult to isolate.
Lettuce	*Lactuca sativa L.*	1	SS	self	2-3	5-6	1	6-12	Crossing can occur but is very rare.

English name	Botanical name	Life cycle, seasons	Pollination type	Primary pollination method	Isolation distance, meters (hobby)	Isolation distance (conservation, sale)	Number of plants (min. for viable seed)	Number of plants (swaps, sale, conservation)	Notes
Oats	*Avena sativa**	1	S	self	0-3	3-6	1	6-12	Wind pollination can cause very occasional crosses. *Other Avena species can have different pollination patterns.
Salsify	*Tragopogon porrifolius L.*	2	O	insects	150	?	5?	15	
Broad (fava) beans	*Vicia faba L.*	1	S/O	self, insects	150	1000	5	20-30	Expect quite frequent crossing by bees – but under1 % at a distance of 150 meters. The safest method is to grow only one variety each year.
Wheat	*Triticum species**	1	S	self	0-3*	3-6	1	6-12	Some Triticum-species can cross-pollinate. *A small distance ensures that plants of 2 varieties cannot touch.
Swedes (rutabaga) and 'Russian/Siberian kale' such as 'Red Russian'	*Brassica napus subspecies*	2	O	insects	150-250	800	1-5	5-25	Not the same species as kohlrabi, though the names are sometimes confused. Some leafy plants called "kale" are B. napus and some are B. oleracea. NB: Will cross with rapeseed!
Root and leaf parsley	*Petroselinum crispum varieties*	2	O	insects	150-250	800	5	20+	All forms of parsley, leaf and root, will cross.
Onions	*Allium cepa L.*	2	OO	insects	150-250	1500	5	15-25	Can cross with shallots and spring onions (A. fistulosum) but not with leeks.
Turnips, Chinese cabbage, Mizuna	*Brassica rapa subspecies*	2	OO	insects	150-250	800	5	15-25	All subspecies and varieties of B. rapa can and will cross-pollinate.
Maize / Sweetcorn	*Zea Mays L.*	1	OO	wind	400-500	1000+ (op til 5 km i nærheden af majsmarker)	10	100	NB: Different types of maize – field corn, sweetcorn, popcorn - and different types of hybrids cross easily. This will affect eating quality in the same season.
Melon	*Cucumis melo L.*	1	O	insects	150-250	800	1	6-12	Cannot cross with med watermelons, courgettes, squash, or cucumbers. Some so-called exotic "cucumbers", however do belong to the same species as melons.
Parsnip	*Pastinaca sativa L.*	2	O	insects	150-250	800	5	15-20	Will cross with wild parsnips.
Peppers	*Capsicum annuum L.*	1	S/O	self, insects	30	250	1	5-20	Can ross with other Capsicum species, including almost all chili peppers. In a field, crossing is limited to the outer rows.
Leeks	*Allium porrum L.*	2 (or perennial)	O	insects	150-250	1500	5	20-50	
Runner beans	*Phaseolus coccineus L.*	1 (2)	(S/) O	self, insects	250	800	4-5	20-30	Crossing occurs between varieties and very rarely with other Phaseolus species (garden beans).

English name	Botanical name	Life cycle, seasons	Pollination type	Primary pollination method	Isolation distance, meters (hobby)	Isolation distance (conservation, sale)	Number of plants (min. for viable seed)	Number of plants (swaps, sale, conservation)	Notes
Radish, winter radish, daikon	*Raphanus sativus L. varieties*	1 or 2	OO	insects	250	500+	5	15-30	All these types/varieties can cross.
Beetroot	*Beta vulgaris L.*	2	OO	wind	300-500	4-5 km	5	10-25	Cross with all types of beets (fodder, sugar and leaf beets/chard).
Rucola, rocket salad	*Eruca sativa*	1	OO	insects	200	800	5	1 m²	Probably varying types or origins rather than highly bred varieties. If you want to keep their characteristics, grow only one each season.
Mustard greens (”Green in Snow”) and other mustards	*Brassica juncea*	1-2	O	insects	150-250	800	5	1 m²	Asian mustard greens and yellow and black mustard seed varieties are all B. juncea.
Celery, root/stalk/leaf	*Apium graveolens L. varieties*	2	O	insects	150-250	800	5	20-50	All forms of celery can cross-pollinate.
Scorzonera	*Scorzonera hispanica L.*	2 (or perennial)	O	insects	150	?	5?	15	NB: Do not save seed from plants that flower in their first season.
Spinach	*Spinacia oleracea L.*	1	O	wind	200	1000+	10	25-50	Only female plants give seed, so it is important to grow more plants than are needed for seed.
Tomato	*Solanum lycopersicum L*	1	SS	self (insects)	?	3-12	1	2-12	Distance depends on fruit type – if the style extends beyond the stamens, crossing is possible, but very rare. Shake vining types mid-day to promote self-pollination.
Garden pea	*Pisum sativum L. subspecies*	1	SS/S	self (insects)	0-3*	3-6	1	6-12	*This distance is primarily to prevent mixing of different varieties under growth and harvest. Occasional insect pollination is possible but peas are generally self-pollinating.
Rye	*Secale cereale*	1	OO (most)	wind	300	2500*	5	1 m2	*Use greater isolation distances for large fields.

SS: Almost exclusively self-pollinating.
S: Primarily self-pollinating, men will sometimes be pollinated by insects or wind.
S/O: Can self-pollinate, but will also frequently be pollinated by other plants of the same species.
O: Outcrosser, but can also self-pollinate for a few generations, before being weakened by inbreeding.
OO: Outcrosser, strongly self-infertile/self-incompatible. Few or no viable seeds from a single plant, suffers from inbreeding very quickly if too few plants are grown.