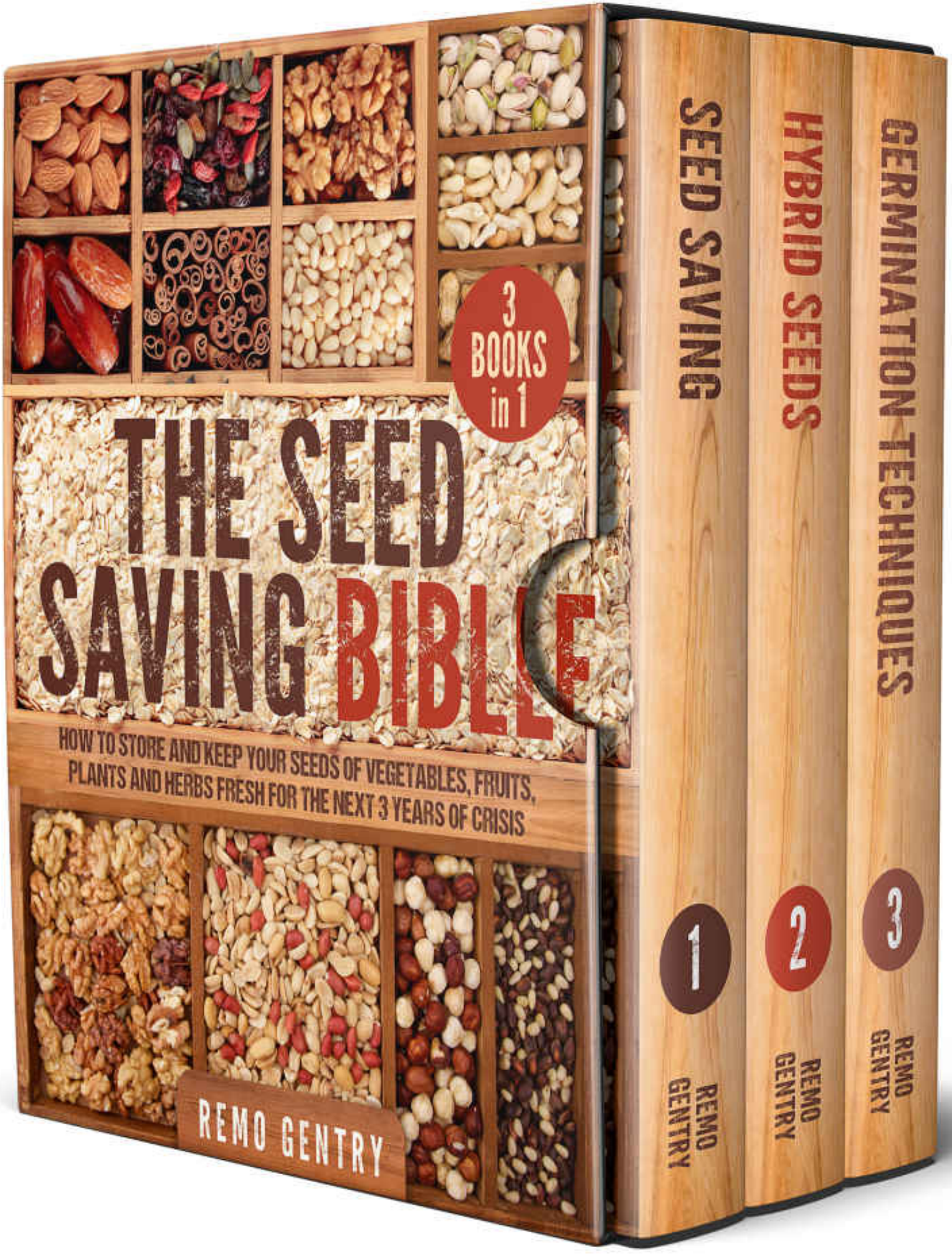
3 BOOKS in 1
THE SEED SAVING BIBLE
HOW TO STORE AND KEEP YOUR SEEDS OF VEGETABLES, FRUITS, PLANTS AND HERBS FRESH FOR THE NEXT 3 YEARS OF CRISIS
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THE SEED SAVING BIBLE

3 IN 1: HOW TO STORE AND KEEP YOUR SEEDS OF VEGETABLES, FRUITS, PLANTS, AND HERBS FRESH FOR THE NEXT 3 YEARS OF CRISIS

Remo Gentry

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Introduction

You've probably seen it and maybe even eaten or planted some of it, but how much do you know about these tiny but complex living organisms known as seeds? Consider how these tiny seeds can grow into large, tall trees or even the smallest shrub or plant that produces delicious food for us to eat, such as flowers and fruits. Isn't it amazing?

Saving seeds is a fun activity that helps preserve heirloom varieties while saving money. Saving and cultivating your seeds will provide you with the satisfaction of producing the same healthy harvest year after year. Seeds yield better crops, such as tastier fruits and more beneficial flowers. You'll enjoy strolling through your lovely garden and gathering tasty fruits, flowers, and seeds. Seed saving also brings communities together, encourages self-reliance and helps to identify and stimulate the development of locally adapted varieties.

You may be ready for any situation by keeping a selection of seeds that can be cultivated in all seasons. Because most seeds need to be planted in the spring, most seed savers will be helpful if an emergency arises in the early spring. On the other hand, how many individuals would be ready if the same event happened during the dead of winter? You'll need either cold-hardy plants that can survive the entire winter in your area or plants that can be started indoors and grown in containers.

The importance of seeds is demonstrated by the proliferation of seed plants in various ecological niches such as grasslands, forests, jungles, savannas, and so on, as well as how they aid in crop

development. Some seed species can also be consumed. Edible seeds include grain, bean, and nut seeds, to name a few. These seeds are part of a healthy diet. Seeds can also be used to make oil and vinegar.

Most importantly, saving seeds allows you to grow plants to maturity, which allows them to grow larger and live longer than usual. So, when planting, leave a little more space around them. Saving and raising seeds is an annual part of evolution. Saving seeds from heritage plants or plants native to your region is an excellent way to preserve environmental diversity. Saving garden seeds can be a great way to save money at the end of each growing season and replicate the delicious harvest from the previous year.

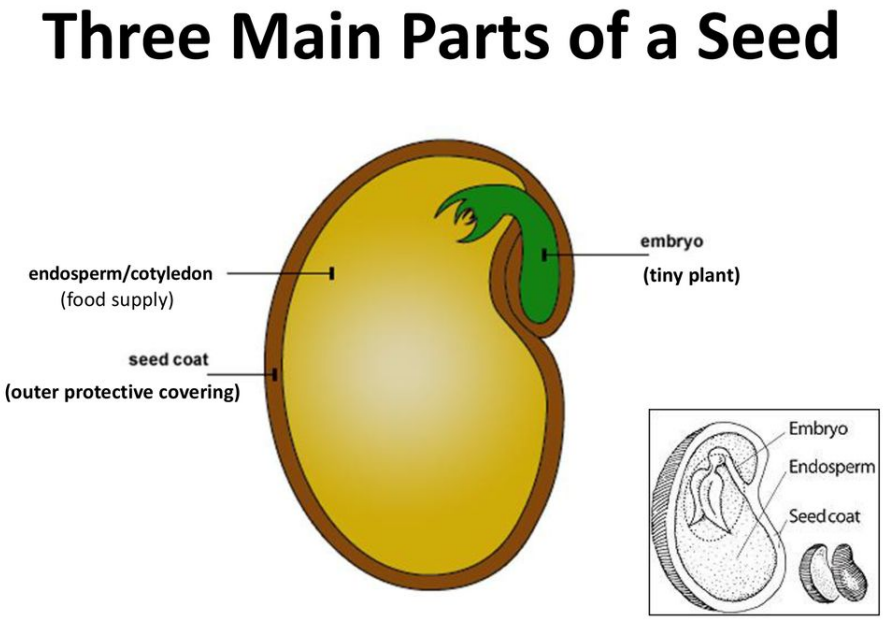
This book will focus on seed saving and growth, as well as various suggestions or methods for ensuring that seeds grow into seedlings.

Let’s get started!

Book 1: Seed-Saving Basics

A Seed

If you are a gardener or farmer, you have probably interacted with hundreds or even thousands of seed varieties. Nevertheless, one needs to have knowledge on what is inside those seeds and how they are formed in the first place. No matter the size, each seed has a complex structure that gives it the capacity to grow and transform into a plant. Essentially, each seed has three parts: namely the embryo, seed coat and endosperm.



These are not the only parts of the seed, though. The developed ovule of a plant is a tiny seed covered in a seed coat for protection. It has food stored inside, as well as an embryo. In seed plants, reproduction is completed by the formation of seeds. Because seeds may multiply, they are frequently sowed to produce new crops. Primarily, a seed is of two types. The two types are monocotyledonous seed and dicotyledonous seed. A

monocotyledonous seed, as the name suggests, has only one cotyledon. That is, there is only one outer layering of the seed coat. On the other hand, a dicotyledonous seed has two cotyledons.

Both a monocotyledonous seed and a dicotyledonous seed have different structures. A monocotyledonous seed has the following parts: Seed coat – Cereals seeds such as maize, the seed coat is generally membranous and fused with the fruit wall called the hull. Endosperm – It is bulky and stores food. Generally, monocotyledonous seeds are endospermic. Aleuron layer – This is the outer covering of the endosperm that separates the embryo by a proteinous layer. Embryo – It is small and situated in a groove at one end of the endosperm. Scutellum – It is a large and shield-shaped cotyledon. Embryonal axis – Plumule and radicle situated at the two ends. Coleoptile and coleorhiza – The plumule and radicle are enclosed in sheaths.

A dicotyledonous seed has the following parts: Seed coat – It is the outermost covering of a seed. In a dicotyledonous seed, it has two layers, the outer testa, and the inner tegmen. Hilum – It is a scar on the seed coat through which the seed was attached to the fruit it came from. Micro Pyle – It is a small pore present above the hilum. Embryo – The embryo consists of an embryonal axis and two cotyledons. Cotyledons – They are often fresh and full of reserve food materials. Radicle and plumule – These are present at the ends of the embryonal axis. Endosperm – In some seeds, the endosperm is formed as a result of double fertilization, and it is a food-storing tissue. An example of these plants is castor. In other plants such as grams, beans, and peas, the endosperm is not present in the matured seed. These plants are known as endosperms.

Origin of Seed Saving

Seed-saving activities go as far back as the Stone Age period. This is shown by the drawings on caves showing that our ancestors during the Stone Age period collected seeds of wild plants and domesticated them. This process made it possible for people to hand-select the best wild plant varieties to grow in the gardens of that era. Over the years, they learned to select seeds that were the best performing in the ancient gardens and save them. That is, instead of planting all the seeds that they collected, they stored some for backup in case of crop failure.

The seed-saving activity has continued from those ancient times to date. It has also had many approaches in recent times. People have created many tactics to save seeds and grow plants.

Reasons for the Seed Saving Practice

Beyond having backup seeds in case a crop fails, there are many other reasons that different people have to practice seed saving which include:

- Seed saving as a source of food for fresh eating, cooking, and even preservation - This can be termed as the major reason why people practice seed saving. Many seeds are edible for both humans and animals hence the practice.
- Seeds are also saved for use as medicine, dyes, and even cosmetics – There are many seeds that have medicinal importance for the cure of different diseases that either humans or animals may suffer from. Others are used for making different cosmetics, for example, murumuru seeds found in the Amazonian rain forest.
- For barter trade or Selling – During the past years, people and societies used to practice barter trade whereby they exchanged

goods for other goods. In recent times, there has been the buying and selling of goods using money. People do save seeds for this purpose too.

- To grow crops that are not commercially available – There are many seeds that have become almost extinct. Persons that are currently in the hold of them do their best to save them.
- Saving money is another reason for the practice of seed saving. Instead of purchasing seeds, the practice of seed saving is being used by many people to aid them in saving money.
- Being self-reliant and being used in experiments with crossing specific plants have also been major reasons for seed saving.

Overview of Seed-Saving

The seed-saving activity is undertaken when seeds are mature, that is, ready for harvest. Mature seeds are of two types. The first type is non-albuminous; these seeds do not contain any residual endosperm to store the food. Examples include groundnuts and peas. The second type is albuminous – As opposed to non-albuminous seeds, these seeds consist of an endosperm to function as a storage of food. Examples of albuminous seeds are wheat and maize.

Seeds on their own also have parts to protect themselves. These parts are the seed coat, endosperm, and embryo. The seed coat protects the seed from mechanical, physical, temperature-related, and water damage. Cotyledon is an embryonic leaf present within the seed of a plant which later sprouts under good conditions. Embryo also protects the seed as it consists of precursor tissues for different parts of plants.

Nevertheless, seeds need saving by human beings too. Seed saving can be categorized into three depending on one's expertise in the field. These categories are Super Easy (beginner), Easy (experienced), and Difficult (expert). Super Easy seeds to save are recommended for beginners, that is, persons with little or no experience in the field of seed saving. These seeds can be gleaned from beans, lettuce, tomato, peas, and pepper plants. Easy seeds for experienced persons include corn, cucumber, melon, radish, spinach, and pumpkin. Lastly, difficult seeds for persons who are experts in the field include chard, cabbage, beet/swiss chard, carrot, cauliflower, kale, onion, endive, and turnip.

In order to practice seed saving, one has to have knowledge about the various plants they want to save seeds from. Plants are of a large variety depending on various factors that are considered, such as growth cycle, type of pollination, and others. Annual plants complete their full life cycle from germination, reproduction, and death in one growing season. A biennial plant is a plant that requires vernalization. It completes its life cycle in two growing seasons, that is, growing vegetative during the first season, then producing flowers and seeds and dying during the second season. Perennial plants are plants that can live for more than two years, usually flowering and producing seeds for many years.

Based on pollination, there are open-pollinated plants and hybrid. Open-pollinated plants are stable varieties and result from pollination between the same or genetically similar parents. On the other hand, hybrid varieties result from natural or artificial pollination between genetically distinct parents.

Before practicing seed saving, one has to put into consideration the viability of the seeds. A viable seed is generally one that will germinate and produce a healthy, vigorous plant. Seeds should be harvested when they are mature enough for them to be viable. Based on different seeds, there is a wide variation in points of maturity at which a seed can be harvested and yet be viable.

Most flower seeds can be easily stored. Simply gather the seed pods, place them in a paper bag, and shake the bag to release the seeds. However, this is a simple task to do. The seeds have to be later stored under good conditions for their survival. There are many microorganisms that destroy the seeds. The most common being fungi. If the atmosphere content of the seed is higher, it results in the

growth of fungus in the seeds. The fungus causes damage to the seed by the seed rotting.

When a plant, such as an iris, grows from a corm, the corm can be divided by cutting or breaking it in between dense groups of leaves. If the plant grows from the bulbs, as lilies do, leave the bulbs in the ground and allow it to produce more plants and bulbs organically.

You don't want heirloom varieties you plant for seed saving accidentally cross-pollinating. You want the seeds to be "true to type," which means they should grow into plants that look like their parents. Because identical plants naturally cross-pollinate, you must follow the safe planting distance recommendations. These recommendations include practicing distance isolation, plant spacing, and timing you're planting so that flowering and, thereafter, pollination will be staggered. Plants in your neighbors' yards are included. This necessitates the reading and comprehension of plant Latin names as well as their meanings.

You can find a plant's genus, species, and variety from its Latin name. Cauliflower is an example of Brassica Oleracea botrytis. Brassica is the genus (family), Oleracea is the species, and botrytis is the variation. Other cultivars of the same plant will have Latin names that begin with the exact two words (Brassica Oleracea) but a different third variety. When you look at the Latin vocabulary, you will see that Kohlrabi and Brussels sprouts are also subspecies of Brassica Oleracea, which indicates they will cross-pollinate with cauliflower. As your plants grow, keep a constant check on them. Any plants that don't seem to fit their description must be removed. Because you are eliminating wayward plants, this is referred to as rouging. Some gardeners who save seeds let the plants flower and

set seeds, which causes the fruits to fall to the ground and perish. The following season, they will grow and organically sprout. Some plants respond to this technique more favorably than others.

When saving seeds from a specific plant, give them your undivided attention. Healthy parent plants produce healthy seedlings and, if possible, avoid saving seeds from weak or damaged plants. You can keep your plants healthy by removing weeds and stray plants and providing them with adequate soil, water, and sunlight. Plants become more susceptible to insect pests and plant diseases when stressed, which can occur when there is too much heat, dryness, or even too much water.

Choose seeds from plants that have the desired characteristics. For example, the best lettuce, Brassica, or beet is the most recent to bolt (flower and set seed). The most productive bean, pepper, cucumber, or other plant varieties are excellent choices. Many gardeners save seeds from fruits grown in the middle of the season when fruiting is at its peak for plants that grow for a long time.

When your seeds are mature, harvest them. Ensure the seeds are fully mature before removing them from the parent plant. If you pick them too early, they will not be fully grown and will most likely stop growing. To maximize seed fertility, wait until they are overripe, well past the point at which you would eat them.

Allowing a minimum number of plants to flower and develop seeds can help ensure good pollination and seed production while preserving genetic diversity among your plant species. The bare minimum will change depending on the kind and species of plant.

The availability of seeds is directly impacted by the previous planting season's poor weather. Wet weather encourages the spread of various fungi diseases in your garden and mold. Downy mildew also develops almost as thick as oil due to the damp and rainy weather, striking plants rapidly and badly. The pure amount of water the soil absorbs during a wet growth season can also cause or drown plants.

Many experts recommend purchasing seeds as soon as possible because some types will be in high demand due to the limited number of viable seeds available. And, while we can often buy seeds from Europe in America, their season was just as bad as ours, so we won't be able to buy from our neighbors in front of the lake this year. Cucumbers, onions, carrots, and sugar snap peas are some of the seed producers that will be difficult to find this year.

But mixing and searching for good and healthy seeds would be unnecessary if all (or at least the majority) gardeners saved their seeds. Seeds, if safely stored, can be kept for many years! So, if we have a bad growing season - or even two or three in a row - the wake seed would be ideal because they have a lot of seeds saved for the following growing season.

Of course, the seeds you're holding must be open-pollinated. Hybrid seeds will not produce a good harvest the second year, if at all, leaving you in an endless cycle of having to buy and plant new seeds every year, regardless of the previous year's growing season. You will have vital seeds that will grow and produce healthy food for you and your family if you plant and save pollinated seeds outside. Furthermore, because these seeds were saved from a plant that grew in your garden the previous year, they are already one step ahead of the game because they are more suited to your garden

environment. Forcing yourself to buy seeds from other parts of the country, or even from Europe, is dangerous because you don't know how these seeds will grow in your garden.

Finally, think about the money. Most of us are more "attached to money" than we were a few years ago, and any opportunity to save money should be welcomed. We save an average of $2.00 per seed pack by saving our seeds. I know it doesn't sound like much, but the average gardener can spend $ 24.00 on a dozen varieties of seed packs in a year. I don't know about you, but there are many things I'd rather spend $24.00 on than seeds, especially since I can save seeds for free.

One of the usual comments you hear every year about this is that there are not enough vegetable seeds for sale to compensate for demand due to the worsening food shortage. Although I do not think this idea contains serious controversy, it reminds us that using renewable garden seeds would be better. With these seeds, we offer you the possibility of saving our seeds from one culture to another.

Even people who eat only organic raw foods will find that the seeds of these foods can be effectively saved for replanting if they wish.

Starting Seeds

There is always a choice of purchasing mature plants from a nursery; it is a great choice, but why use extra money when you can grow them yourself? Starting from seed gives one a wider range of plants to choose from than when you purchase at a nursery. It also allows you to be a witness to your plants' transformation to maturity; hence you are able to make future choices.

Generally, the seed-starting process is the same for many plants that need starting, and it is as follows:

1) Select your seeds – Plants with big seeds are the easiest to start. These plants include peas, beans, corn, squash, cucumber, and melon. There are other plants with small seeds, and they are, therefore, hard to start, although it's possible. These plants include most greens, carrots, tomatoes, pepper, eggplants, cauliflower, radishes, turnips, and Brussel sprouts. There are also flower seeds that can be started, such as marigolds, petunias, zinnias, poppies, and nasturtiums.

2) Choose container/s – Instead of sowing seeds directly in outdoor fields where they may face many difficulties growing, such as being eaten by birds and many other critters, it is better to sow them indoors. Planting them indoors guarantees safety. Seeds can be started in tiny pots or even egg cartons as long as holes are poked into them for drainage. After doing this, place a drip tray under the containers to catch dirt and excess moisture.

3) Addition of seed starting mix in the containers – Seed starting mix contains peat moss or coco coir, vermiculite, perlite, and also compost if need be. It is important as it provides great drainage,

eases sprouting, and avoids fungal diseases as it is sterile. Moisten your starting mix with water before filling the container with it. So as to know whether the water ratio in your starting is good, squeeze a handful of the mix, and if water streams out, then it is too wet. On the other hand, if no water flows out, then it's too dry. The starting mix, when squeezed, should remove a few drops of water. When the starting mix is ready and well moistened, fill your container at least a quarter-inch on the top, and compress it in a way that it is firmly packed and flat on top.

4) Seed planting – Read the instructions from your seed packet carefully to know the planting depth and spacing for the seeds that you want to plant. Bury the seeds according to the given instructions and tamp the soil firmly with the palm of your hand. Some types of seeds, for example, lettuce seeds, require light to germinate. Therefore, you should leave them on the surface.

5) Cover the container – The container should then be enclosed with a layer of plastic wrap. This is done so as to lock in the moisture and heat necessary for seed germination. It is good to store the container in a warm place where it still receives indirect sunlight. Be sure to check the seed packet, as some seeds require total darkness in order to germinate. So as to speed up germination, you can use a heat mat to warm the starting mix.

6) Seed watering – Keep checking once in a while whether the starting mix is still moist. When it is dry, use a spraying bottle to spray a layer of mist over the mixed surface. Do not use a watering can, as it may wash away the delicate seeds. When your seeds sprout, immediately remove the cover from the container.

7) Caring for the seedlings – This generally involves keeping the seedlings in the correct temperature range, as indicated in the seeds packet. The seeds should also be watered regularly. The process of fertilizing the seedlings should start once their second set of leaves forms. So as to fertilize the seedlings, one should dilute a liquid fertilizer to one-quarter of the recommended dosage. The dilute should then be administered from a tray below the seedlings so that it soaks up through the drainage holes.

8) Seedling hardening – This refers to the process when the indoor seedling is exposed once in a while to outdoor conditions such as wind, colder temperatures, and direct sunlight. This process should begin 10 to 14 days before you transplant the seedlings.

9) Transplant the seedlings outdoors – This should be done when the weather is ideal, and the seeds have adjusted to outdoor conditions. When transplanting the seedlings to the outdoor garden beds, make sure to look at the required spacing. Also, make sure to carefully spread out the delicate seedlings' roots. Lastly, one should water the seedling bed.

How to save various Seeds

Globally, there are very many plants, both edible and non-edible. Many, if not all, of these plants produce seeds; hence there are a lot of seeds that require saving, some more important than others. Therefore, it is important to have knowledge of how to save the different plant's seeds. A wide variety of these seeds are discussed below.

Corn Seeds

When considering corn seeds, consider that corn will experience depression due to inbreeding. If you use the same seed for several plants, the plants will grow prickly, mature late, and yield less. To combat this issue, consider planting 200 corn seedlings and collecting seeds from at least 100 of the best.

Pollination of the corn plants is through self-pollination. At the top of the corn plant, tassels emerge, which are the male flowers. The tassels produce pollen that is so light that the wind can blow for a very long distance. The silky strands that emerge from the tips of the baby ears are the female flowers. When choosing corn seeds, it's important to check the variety description carefully as most of the con seeds sold are hybrid. It is also advised that one chooses the planting site wisely, mostly a mile away from other corn plantations. This is typical because corn pollens may travel many miles away hence leading to hybrids. So as to combat or reduce the issue of hybrid pollination, a community can decide to do a community plot project. This can be done by selecting a large community garden to plant corn and sharing the harvest equally later.

Corn seeds can also be saved by the use of hand pollination. As discussed earlier, this will be done by putting bags over the baby corn ears before the silks emerge. Bag tassels should also be put on many corn plants to collect pollen. The farmer/s should keep monitoring the baby corn ears. Once the silks emerge, one should then gather pollen from as many plants as one can. Mix the collected pollen together in one bag. After mixing the pollen well, pour some of the pollen mixtures on each ear of the baby corn and re-bag them. For one to get maximum seed production, you should consider choosing the straightest and longest baby corn ears for hand pollination.

Corn seeds are typically harvested six weeks after the corn has reached its feeding stage, which should occur immediately after the shells have been browned. If one waits longer after the corn has browned and is met by the wet season, the corn may wither, leading to the loss of corn seeds. It is advised that if you can't wait for the corn to reach this stage or there is a prediction of the wet season coming early, you should pick the corn sooner after it is mature and dry them, remove husks, in a cool, mouse-proof/free dry place. You can also simply remove the skins and allow the drying process to complete.

Cucumber Seeds

Cucumbers, though not as severely as corn, are also prone to depressive inbreeding. When one wants to grow cucumbers for seed saving, one must control pollination. Insects often, if not always, pollinate cucumber plants, and these insects can travel for many miles leading to cross-pollination. Other plants, such as squash, can

also pollinate cucumber plants. So as to have the best cucumber pollination and avoid cross-breeding, allow the cucumber vines to intertwine across the soil instead of training them up a trellis where the flowers are highly exposed. By allowing the vines to intertwine on the soil surface, the male and female flowers are put in close proximity; hence insects are able to pollinate them easily.

Cucumber plants also have other challenges that face them other than cross-pollination. Another challenge is pests and diseases which afflict cucumber vines. This makes it very difficult to keep the cucumber vines healthy until the end of the growing season. This problem can be curbed by either starting the seeds indoors or/and covering cucumber seedlings with unripe cover until they are well established. This way, cucumber beetles and other pests that destroy the seedlings can't reach them.

Seeds should be collected from at least six cucumbers grown on six plants. By doing this, you will be able to keep your cucumber seeds genetically vigorous. Nevertheless, when one wants to grow wide varieties of the cucumber plant or if there are other cucumber plantations in close proximity, one should plan early to do hand pollination. The cucumber vines should then be kept well-watered.

There are other considerations when making the choice of cucumber seeds to save. The fruits should only be picked from healthy vines; the color and shape of the chosen fruits should also be consistent and true to type. Fruits with stubby tips should be avoided at all costs, as this is a sign of incomplete pollination. Leaves of the vines to pick the fruits from should also be considered. Mottled, misshapen, and wrinkled leaves are signs of cucumber mosaic virus which can be carried on seeds, resulting in them being infected,

therefore, unlikely to thrive. Cucumbers are of widely different varieties, some of which are seedless and should be avoided when one is considering practicing seed-saving. Remember that the cucumbers you grow for the seed cannot be eaten. At the end of their feeding phase, cucumbers must be left on the vine for at least five weeks to ripen. When ready to collect seeds, they should have turned a golden color. To collect the seeds, slice the fruit and scrape the seeds with a spoon during processing. Allow the seeds to soak up more jelly liquid in a jar at room temperature for about four days. A fungus will form on top, so daily stirring or kissing is sufficient. The seeds will eventually sink to the bottom as the gelatin dissolves. Dry the seeds by spreading them out on a few paper towels.

Tomato Seeds

Tomato seeds are in the category of easy seeds to save. A tomato fruit has very many seeds hence the more reason to save a lot of the seeds. The tomato seeds are already ripe when the fruits are ripe for picking. Although tomato seeds are easy to save, they also require a little treatment to be ready for storage/saving. This treatment is done by the process of fermenting the seeds. If you are a beginner in seed saving, I would suggest this as one of the fruits to start with.

Most of the tomato varieties are self-pollinating; hence there are low chances of cross-pollination. Although chances of cross-pollination are low, if one is planning to plant different varieties of tomatoes on the same piece of land, they should be well-spaced, about 15 feet or more apart.

For one to save the best seeds, there are considerations that one should make while choosing the fruits that one wants to get the

seeds. These factors include choosing large plants from healthy and vigorous plants. Another consideration that one is likely to make is the reason one is saving seeds for. For example, if you are looking for early-ripening seeds, you should consider choosing fruits from plants that are ripening earlier than the others. Another consideration can be resistance to harsh conditions, diseases, and pests.

After selecting the best fruits, one wants to save seeds, cut open the fruits, and scoop the seedy pulp using a spoon into a jar. Add water in accordance with the size of pulp one has collected in the jar. Put the jar containing the pulp out in direct sunlight. Keep the jar out in direct sunlight for three to four days while stirring it on a daily basis. After three or four days, white mold appears on the surface of the jar containing the water and pulp mixture. This is a sign of fermentation, and it helps in the preparation of the seeds for storage. After fermentation is complete, pour out the pulp, which now has floating seeds. The floating seeds do not germinate. Lastly, filter out the seeds and rinse them well before pouring them on a paper plate. Make sure the seeds are totally dry before storing them. While properly stored, the seeds can remain viable for up to five years.

Muskrat Seeds

Muskrat, unlike some of the plants mentioned above, does not suffer from depressive inbreeding. Ripe musky melons can be harvested for their seeds. Simply wash the seeds instead of drying them with a towel.

Radish Seeds

Radishes are considered challenging seeds for seed saving. Radishes belong to the vegetable crops family known as the brassicas/cabbage family. Being in this family unlike many of the other plants in the same family, radishes do not cross-pollinate. Insects such as bees pollinate radish plants, both domesticated and wild. So as to achieve the best quality of seeds for seed saving from radishes, plant only one variety and, if not, separate the different varieties at least 250 feet apart. With radishes, collect the three-inch stems that contain the seed pods when the pods are brown and appear dried. Pull the whole plant and hang it in the same place to finish the drying process. Open the pods by hand to remove the seeds. Winnow the seeds and then store them in a cool, dry place.

Radishes cannot be eaten and saved for seeds at the same time. They are insect pollinated and can cross with all varieties of wild and domesticated radishes, although they will not cross with any other member of the Brassicaceae family. Radishes are self-incompatible, although the pollen seeds are viable. While one wants to plant two or more varieties of radishes, it is recommended that they are separated by one and a half miles or grown using caging techniques.

After the radish flowers are pollinated, the seed pods form. At first, the pods are green but later turn tan as the seeds mature and as the plant starts drying up. At this stage, the radishes are ready for harvesting, whereby they are harvested as whole stalks. The radish seeds are then dried up and cleaned. Removing the seeds from the pods using thrashing can be time taking and tiresome. Therefore it can be done by pounding the pods using a hammer or a wooden

maul. Thereafter, radish seeds require no further processing but rather just storing in a cool, dry place.

Bean Seeds

Bean seeds are considered as easy to save seeds. Dry beans such as kidney beans and pinto beans are the best variety when one is considering saving beans. Although dry beans do not cross-pollinate easily, they usually do when bees visit them. They should also be planted alone if one is considering seed saving. Nevertheless, if one wants to plant different varieties on the same piece of land, they should be separated by at least 25 feet. One can also consider planting a tall crop, such as corn, between the different bean beds.

It is important to consider the plants one wants to save bean seeds from. The plants that flower first and are the sturdiest are the best to select from. These plants should then be marked with tags marking them as seed-stock plants. In order to collect seed stock, it is important to leave the bean pods untouched until they reach full maturity. This is usually about six weeks after one has picked beans for fresh eating.

In order to know that your seed stock is ready, the pods should be dry and brown. At this point, you can try shaking the pods and listen to whether you can hear a rattling sound. If there is a rattling sound, then the beans are ready. Nevertheless, sometimes it is impossible to leave the seeds to dry up completely while still in the fields due to humid and wet seasons. In this case, the plants should be cut at soil level and moved into a cool, dry place, either spread out or hanging upside down from a rafter, checking them on an occasional basis. When the beans are ready, they are easy to thresh out while putting

them in a bowl. In cases of saving seeds on a large scale, one can put the seed plants into a sack and hit them gently using a masse and afterward winnow in order to remove the chaff. The seeds should then be stored well in a cool, dry place.

Spinach Seeds

Spinach is a day-length sensitive species that require long days for them to flower. Therefore, spinach growing areas are mostly in the northern latitudes, where these conditions usually occur simultaneously. Spinach is an annual crop.

While growing spinach, there is the likelihood of cross-pollination between the different varieties leading to hybrids. This problem can be solved by growing the different varieties in different plots and separating them by 800 feet to half a mile.

It is recommended that when doing seed saving for spinach, and in order to ensure you save viable seeds, one should save seeds from at least ten plants. In addition, if one wants to save seeds over many generations, it is recommended that seeds are saved from 20-50 plants. When saving seeds to preserve a particular gene of a rare variety, one should save seeds from 80 plants or more.

It is difficult to determine the flowering pattern of spinach. This is because spinach continues to grow, flower, and set seeds as long as there are favorable conditions. The seeds that are located on the lowest portions of the branch do ripen fast as maturity progresses up the rest of the stalk. When the seeds are mature, they turn from green to tannish brown. Also, on checking the endosperm of mature spinach seeds, it is firm and solid white.

Spinach seeds do not ripen at the same time; therefore, there is always a combination of mature and immature seeds on the stalk. The spinach plants should be harvested when at least two-thirds of the seeds are fully mature. Harvesting can either be done by clipping individual branches or cutting the whole plant at the base. After harvesting, the spinach plants should then be relocated to a well-ventilated, protected place to continue drying for about ten days. They should be spread in a single layer on a row cover or breathable landscape fabric for the best drying.

In order to process the spinach seeds, one can run a gloved hand along the lengths of the stalk with a collecting container placed underneath to catch dislodged seeds. The stalks should then be discarded. In the case of larger lots and whole plants, one can place them on tarps and then gently tread upon them. After the seeds are dislodged from all the stalks, the dry seed clusters can be broken apart by rubbing them between your hands. Finally, the seeds should be screened and winnowed.

To store spinach seeds, put them in dry containers and store the containers under cool, dry conditions. When these conditions are met, spinach seeds can remain viable for about six years.

Pea Seeds

The pea's plant seed-saving process is also termed as easy and can be practiced by beginners in the field. If one wants to save peas seeds for planting, then he/she has to resist the temptation of picking every one of the green pods. If one wants to save the seeds, then they have to wait till they are tough, fat, brown, and dry.

The pea's plants are self-pollinated, but still, bees do visit the flowers and may, in some cases, transfer pollen. So as to ensure that plants don't pollinate, the pea plant varieties should be planted about 25 feet apart. The pea plants should not be allowed to trail on the grown as they won't dry up and rather can rot. The pea plant should be set up with supports or on a sturdy trellis.

The pea plants should be left to turn brown and dry. As the peas pods dry up, they should be closely monitored as if they may split open and lead to seed loss as they fall to the ground. To clean the pea's seeds, the shells should be removed by hand while separating all the small and discolored seeds. The seeds should then be stored in glass jars with tight lids.

Pumpkin Seeds

Saving pumpkin seeds is an easy task. Make sure that when collecting pumpkin seeds, the plants are entirely mature. Hardening of the outer shell usually indicates this. Let the plant heal for another four weeks after harvesting. Cut the hard shell open and remove the pulp inside the pumpkin and place it in a colander. The colander should then be placed under running water. The seeds start separating themselves from the pulp, and one can hand-pick them with ease. After picking all the seeds, rinse them again in the running water. Once you have a good amount of seeds, look over them and choose the largest seeds. It is important to save three times more pumpkin seeds than the number one wants to grow in the next growing period. The big and healthy seeds will have higher chances of germination. Place the seeds on a dry paper towel while well-spaced out so that they don't stick to one another. They should then

be placed in a cool, dry place or in direct sunlight for one week in order to dry. Finally, when the seeds are dried up, they can be stored in envelopes.

Pepper Seeds

Pepper seeds are also easy to save. For this plant, all that one has to do is to cut the fruits open, collect the seeds and dry them up before storing them. Pepper plants mostly grow in warm, sunny areas with rich soils. Pepper plants are self-pollinating, but they can also cross-pollinate via insects such as bees which visit the plant's flowers. So as to prevent cross-pollination between the pepper plants, different varieties of pepper should be planted in different plots separated by at least 500 feet.

Just like the other plants discussed, when selecting pepper plants for seed saving, there are several factors that should be considered. Seeds should be saved from healthy plants with large fruits and growing in good form.

So as to clean the pepper seeds, one can rinse their seeds; the seeds are then crumbled between one's fingers to separate them when they are dry. Afterward, you have to spread the seeds in direct sunlight to dry up.

Keep a Variety of Seeds

Whoever said variety is the spice of life probably wasn't talking about seed saving, but the adage holds. You'll need various seed types to give you the best shot at survival. The more different types of seed you have on hand, the better prepared you'll be for any situation.

The first consideration you need to make when choosing seeds to grow is the time of year the seeds have to be grown. Seeds need to be planted during a particular season to grow to maturity successfully. Plant a seed too early or too late in the year, and you aren't going to get good results. Depending on the climate in the area you're planting them, the planting window in which you can successfully sow and grow a seed to maturity could be very small or very large.

Moderate climates are more forgiving, as you can get away with planting seeds earlier in the year, and plants can often be grown well into the winter. Try to do this in an area that experiences extreme cold or extremely hot weather, and your plants will die long before you get any product from them.

Depending on your location and whether or not your city's utilities are up and running, water could be plentiful or very scarce. You'll be in big trouble if water is scarce, and all you have on hand are seeds that grow into plants that require heavy watering. It's OK to have seeds that require heavy watering on hand, but you need to ensure you don't only have those seeds. Keep some drought-resistant seeds handy as well.

The more situations you are prepared for, the better off you will be. Seed packets aren't too expensive, so try to cover as many bases as possible by keeping a diverse selection of seeds in your cache. You never know where you'll end up or your needs until a survival situation arises, so don't limit yourself to seeds that cover only one type of situation or climate zone. You should stock up on the seeds you think you'll need in your area, but don't forget the ones you don't think you'll need. The seeds you don't have will be the ones you need most.

Propagation and Fertilization

Fertilization

Fertilization in plants is the process of sexual reproduction, and it occurs after pollination and germination. It can also be defined as the fusing of the female gametes in plants (ovum) with the male gametes, known as pollen which results in the formation of a diploid zygote. Flowers play an important role in the fertilization process as they are the reproductive structures of angiosperms/flowering plants.

For the seed to fertilize, pollen must be transferred from the anthers to the ovary. The term "parthenocarpic plants" (Greek: Parthenos, Virgin; Karpos, Organic product) refers to a few exceptions, although they are unimportant in this context. In flowers, pollen grains develop grains germinate after pollination of the carpel has occurred. The carpel then grows into the style by creating a pathway for the pollen grains to move down to where the ovary is located. Upon reaching the ovule, the pollen tube opens through the micro Pyle and bursts into the embryo sac. At this point, the male nucleus from the pollen

unites with the nucleus of an egg inside the ovule, therefore, forming a diploid zygote. The diploid zygote later swells up and develops into a fruit.

There are three types of fertilization based on the entry of the pollen tube into the ovule as follow:

- Porogamy – This is the most common type of fertilization carried out in all flowering plants (angiosperms). This is the type where the pollen tube enters the ovule through the micro Pyle.
- Chalazogamy – All casuarina species of plants do carry out this type of fertilization. In this type, the pollen grain enters the ovule through the pollen tube.
- Mesogamy – Cucurbit plants such as pumpkin, bitter gourd, and ridge gourd extra carry out this type of fertilization. In this type of fertilization, the pollen tube enters the ovule through the integuments of the ovule, that is, the middle part.

Separately, ovules and pollen carry genetic information between male and female plants. Sexual generation reorders these messages, endowing future generations with traits that are a mix of their parents. Assume that there are different types of pollen and ovules. In that situation, the resulting seed won't be a unique individual from either of those two assortments but rather a hybrid of the two (for example, not consistent with type).

In some cases, double fertilization may occur. This occurs when a female gametophyte fuses with two male gametes. The mechanism here is that one sperm cell fuses with the two polar nuclei to make the endosperm, while another fuses with the egg-producing zygote.

Seed savers can preserve an assortment's purity by restricting the pollen source to the same variety as the ovule. Some ideal flowers bloom on their own. As with nasturtiums, the stigma can either vanish past the anthers or continue to grow there, as in the case of tomatoes. In some cases, preparation happens before flowering, as in the case of the pea; this procedure is known as cleistogamy (self-fertilization occurring within a closed flower.).

Self-preparation may make life easier for seed savers, as in peas and most tomatoes; however, these can also be cross-pollinated in certain conditions. Finally, a blossom may exhibit naturally contradictory behavior; it is incapable of pollinating itself and must be cross-pollinated.

Most often, cross-fertilization implies that something would transfer pollen from one bloom's anthers to the stigma of the following bloom. That something could be the wind, water, an insect, or another creature. The wind is the hardest element to manage – but dust is ideal and can travel long distances. On the other hand, water has no role in pollinating domestic plants. Insect pollinators, like honeybees, are easier to manage.

Plant Propagation Methods

Plant propagation is the multiplication or production of more plants. Commercialization of crops has made it important to come up with several techniques to grow plants. Each technique has various goals it is based on. These goals include increased productivity, uniformity in crops, and the development of disease-resistant crops and plants with desired characteristics for the farmer.

Plant propagation techniques are mainly divided into two. The division is based on the means of propagation. There are sexual means and asexual means of propagation.

Sexual propagation involves fertilization of the egg by pollen leading to the formation of seeds. Therefore this form of propagation can also be referred to as seed propagation. It is an easy and effective technique for ornamentals, fruits, vegetables, and medicinal plants. It is also an old method of propagation. Sexual propagation allows for diversity in plant species and the creation of new cultivars and varieties of plants. Sexual propagation is advantageous as seeds can be stored for long periods of time. On the other hand, it has disadvantages such as:

- Delayed flowering and fruiting
- Identical plants are difficult to produce
- Plants that do not produce seeds cannot be propagated using this method
- Mass production is harder to achieve using this method

Considering the disadvantages of sexual propagation, asexual propagation methods have/are being developed by many culturists

and hobbyists from all over the world.

Propagating New Plants with Your Seeds

Propagating plants from seed is what nature does all the time. Most seeds have specific basic requirements to germinate successfully – the right amount of moisture, warmth, air, and light, although most will germinate in the light or dark.

For smaller seeds, you'll want to sow them in containers to get them started. Use shallow trays filled with a good-quality potting mix. Some gardeners like to mix the potting mix 50/50 with sand. If the seeds you are planting are tiny, you can try adding sand and sprinkling them onto your tray.

For bigger seeds, you can sow directly into furrows you've made in your tray or place them individually into small pots. Cover your seed with a good quality seed-raising mix and water lightly with a mist spray, so you don't displace your seeds. Keep the tray moist until the seeds germinate. Water very gently until your plants become stronger.

Some seeds take a long time to germinate, so don't give up on them too soon. For example, parsley seeds can take 4 to 6 weeks! Others will germinate very quickly, such as lettuce and radish. Remember that seeds will take longer than during warm spells if it's cooler weather. Large seeds can be sown outside, but you can give them the best start for the rest by sowing them under glass or in trays or pots.

ASEXUAL PROPAGATION

The asexual propagation of plants is also referred to as vegetative propagation. This is because it involves the use of vegetative parts of plants such as stems, leaves, roots, branches, and other modified organs. This method can be said to be the best to use for cloning your plants. This generally means that by the use of this method, you can produce plants completely identical to their parents. Asexual propagation methods are commercially exploited in order to produce horticulture plants.

They include cutting, layering, division, grafting, budding, and tissue culture techniques. Although asexual propagation has many advantages, they also have the following disadvantages:

- There is difficulty in the production of new varieties.
- There are practices and skill sets required to follow these methods.
- Plants may be prone to any kind of stress.

Propagation with Cuttings

This method involves the cutting of the vegetative parts of the plant, for example, the stem, and then planting it again, leading to the regeneration of another whole plant. There are three types of cuttings that are named after the plant part they are derived from, namely: stem cuttings, leaf cuttings, and root cuttings.

Gardeners who try to replicate their favorite plants will be rewarded. It's both satisfying and cost-effective! When propagating by rooted cuttings, it is critical to be organized. Before cutting, prepare the soil

or other rooting medium in the container. Soils of various types can be used, including:

- Sand
- High-quality potting soil with perlite
- A combination of two parts dirt, one part peat moss, and one part sand
- One part peat moss and one part perlite combined (my favorite mix)

For best results, when employing a combination, combine the ingredients with water to create moist but not soggy soil. It should form a ball when compressed, but not one that is damp. In a container, put the medium. This can be an insulated ice box, a nursery pot, a box, a can, or even a nursery flat. Whatever is used, it must unquestionably have some decent drainage holes.

Prepare the soil for the cutting by making a hole with a pencil, stick, or knife. If more than one cutting is inserted into the medium, ensure the holes are spaced apart sufficiently to prevent the cuttings' leaves from touching. After that, insert the cuttings into the holes and firm them in place by pressing down on the dirt. To help the cutting sit firmly, water the medium.

Plants can be rooted without using hormones, but they root faster with these. Hormones are available in both liquid and powder forms. Before using the hormones, pour some of them out of their container and into a different cup. This keeps the hormone safe for future cuts. Insert the tip of the plant cutting into the hormone, covering about a quarter of the stem's bottom.

The best times to collect cuttings from the current year's growth are in late May, June, and July. From May through March, cuttings can take root, but hardwood cuttings take longer. During this time, a softwood cutting will solidify, making it less likely to break when bent.

Avoid taking too-soft cuttings except for some potted plants like geraniums and jade. While stiff but not hard, a semi-hardwood cutting will bend more and break if bent too far. A hardwood cutting is made of mature wood that is harder to break. It is usually best to cut hardwood in the fall or winter. A leaf cutting is a clipped stem with one leaf attached. These can also be rooted but will take longer to grow into large plants. On the other hand, seeing a new bud develop on a one-leafed cutting is extremely satisfying!

Remember that three to six inches is a reasonable cutting length. A clipped stem with three to five leaf nodes is ideal. It's crucial to keep it moist, so after cutting, put it in a plastic bag or wrap it in a wet paper towel. Recut the bottom of the cutting at an angle slightly below a leaf node when you're ready to insert it into a rooting medium. After removing the leaves at the base, leave two or three leaves at the top of the cutting.

When obtaining hardwood cuttings, "wounding" should be considered. Wounded hardwood cuttings will have more space for roots to grow. One slice of the bark, the tan or brown outer layer, should be sliced at an angle to create a "wound." The green layer, or cambium, should remain intact. Take note of the layers first. Just below the bark is the green cambium layer. Never remove the cambium layer.

It's time to put your cuttings in your rooting area once you've collected them all. Put a piece of plastic on the ground where the

rooting containers will be placed to create this space. This will stop roots from other trees or plants from ascending into the container. The rooting area should be shaded beneath a tree or against the structure's north side.

Place the moist rooting medium in the container after preparing it, and use a pencil or knife to make holes for the cuttings. After that, insert the cuttings into the holes after being dipped in the rooting hormone. Make sure that the leaves don't contact one another.

Next, cover the entire container with plastic. Use wire or sticks to keep the plastic from coming into contact with the foliage. Secure the plastic by tucking it beneath the container. It's a good sign that water droplets are forming on the inner surface of the plastic since it shows that the medium is still moist. Except if the medium is drying out, avoid opening the plastic. If the soil is too dry, lift the plastic, add more water to keep it moist but not soggy, and then cover everything with plastic once more.

Most cuttings take three to five weeks to begin to root. Gently pull on a cutting to check on the development and see if roots have formed. It will cling to the earth if it has roots. Replace the plastic cover gently if it hasn't and check again later.

Replace the plastic cover and fasten the cutting if roots have sprouted. Make a few holes with a knife to allow fresh air to enter. Make a few extra air holes in the plastic after another four or five days. It is OK to take off the plastic after another seven or eight days. This procedure aids in the newly rooted cutting's acclimatization to the environment.

The rooted cuttings can be moved into pots with quality potting soil when they have rooted and become fully adapted. Keep the transplanted containers in the shade until the plant begins to grow. After that, put it in a bright area.

A rooting bed is a more permanent place for cuttings to take root. Select a location for your rooting bed under a tree or in another shaded area and cover it with a large piece of black ground cover plastic to keep tree roots out. Cut 10-foot lengths of PVC flexible pipe. Drive one pipe end into the ground next to the black plastic. Bend the pipe into an arch or an upside-down "U," then drive the other end into the ground. Using all of the pipe lengths, make arches about three feet apart. The number of pipes determines the length of the rooting bed.

Next, make the plastic cover for the rooting bed. Cut a length of plastic film that is both long and wide enough to cover the arches and reach the ground. It should also be four to five inches on all sides and six to seven inches on each end. Set the plastic cover aside when it is finished.

Place all the cuttings into trays or containers with moist potting soil to prepare them for the rooting bed. Place the trays or containers on the ground cover made of black plastic, and water them as necessary. Pulling the clear plastic over the arches will now cover the roots bed loaded with cutting containers. Along three sides and both ends, secure the plastic cover by covering the excess plastic with soil, pebbles, bricks, or boards. Keep in mind that checking the cuttings will be required in a few weeks, so make one of the sides simple to open up at that time by utilizing weighted objects that are

simple to pick up. Accessing the bed from this side of the frame will be simple to add or remove cuttings.

Propagation Through Division

Propagation by division is mostly practiced for herbaceous and woody perennials. It is a relatively slow method of propagation; nonetheless, it is simple and inexpensive to perform. It involves dividing the crown into several sections. Each section contains a portion of the root system. In tuberous roots or stems, the modified storage is divided into several crown buds called eyes.

Outdoor herbaceous perennial crowns are usually divided while dormant. This is mostly in the spring, just before their growth begins in late summer or autumn. The plants are dug out from the fields or removed from the containers they were planted in and divided into sections using a knife, saw, or even an axe depending on their sizes. Nevertheless, for some offsets, division can be done by the use of hands.

For some species, such as the peony, the division is the only acceptable way to do propagation. The crowns are then divided into several sections that contain the crown buds. The tuberous roots are then removed so as packaging or planting into containers is made

easier. Plants that are dug directly from the fields are also divided into sections while dormant and stored in coolers.

Division is also the only viable technique used for propagating some herbaceous plants that are variegated chimeras. Variegated plants such as those of African violet (Saintpaulia) and Sansevieria are propagated by the use of leaf cuttings. The shoots that arise from the leaf cuttings will be non-chimeral, though. These plants must be divided so as to maintain the variegated pattern.

Propagation by Layering

In this method of propagation, the new plant still remains partially attached to the mother plant. The new plant is also partly attached to the ground in order to produce roots. This method of propagation does not require special skills or even controlled environmental conditions. Layering also allows vines, shrubs, and indoor plants to be propagated using less space. Layering is also advantageous as hard-to-root plants usually generate roots faster using this method than when using cuttings.

Layering is mainly done in the winter or early summer seasons. The daughter plant is ready to be separated from the mother plant after two to three months. It can later be transplanted or allowed to continue growing depending on the farmer’s wishes.

There are many layering methods available for farmers who wish to use this propagation method which include:

- Tip layering – While layering plants using this layering method, a flexible stem of the mother plant is bent to the soil surface in that only the shoot tip is buried in a hole. The shoot tip is then pegged with stakes if need be and covered with a media of soil.

Plants that can be propagated through this method include blackberries, loganberries, raspberries, and other members of the *genus Rubus L*.

- Simple layering – It is almost similar to tip layering except that in this type of layering, a 6 to 12-inch section that contains the shoot tip is left above the ground. Plants that one can try this type of layering on include climbing roses, boxwood, honeysuckle, jasmine, abelia, wax myrtle, and forsythia, among others.
- Compound layering – This type of layering is also based on the same technique as simple and tip layering. The difference comes in that in compound layering, a section of the step is buried at several points along its length, leaving stems in between uncovered. One should make sure that at least one lateral bud is buried at each section and another is left uncovered. Plants that are best for practicing this type of layering are vine type and trailing ground covers. Examples of plants that one can try this kind of layering include rambler rose, grapes, willow, dogwood, pothos, wisteria, and many other vines and trailing groundcovers.
- Mound/Stool layering – This type of layering happens in several steps throughout the whole growing season. Either soil or substrates such as mulch are placed around the stem base of the plant for a given period of time, several weeks or months, depending on the kind of plant. Roots form, and shoots arise from the buds present on the main stem of the plant. Once roots develop on the lateral shoots, one should cut the shoots from the main stem making sure that the cut is made right

underneath the developing roots. The cut shoots are now ready to be planted in other areas of the farmer's desire. If the farmer would like other shoots to plant, then they can start the mounding process over again. Mound layering is mainly used by plant nurseries to propagate understocks for fruit-yielding trees. It can also be used on flowering quince and ornamentals such as spirea.

- Air layering – In this type of layering, the farmer finds a branch about midway up the trunk of a tree which is one to two inches in diameter. For more success in this type of layering, it is better to go for a larger branch than a smaller one. One should then make a cut in the upper parts of the stem, followed by two horizontal cuts at the top and bottom of the vertical one made earlier. The bark should then be peeled off along the entire circumference of that part of the stem. If available, auxin can be applied to aid in faster rooting. The cut area should then be wrapped with moist peat moss and plastic wrap and tightened with either twist ties or rubber bands. After roots appear from the peat moss, that is, they penetrate the peat moss, then it is the right time to plant the cuttings. The cutting should be cut off just below the roots and transplanted. Plants that one can try this type of layering on include: dumb cane, croton, dracaena, rubber plant, azalea, magnolia, roses, and Oregon grape holly.

There are several ways to improve layering success which include:

- Wound induction – This is where the farmer intentionally wounds the part that they want to practice layering on. One can make slanting cuts on the bottom of the stem. The cuts should be less than half the diameter of the stem such that the phloem

is slightly severed. Auxin is an important natural hormone that can be applied to cuts to induce root formation.

- Blanching/Light restriction – While doing layering, make sure the selected stem sections are well covered with substrate before wrapping them. Wrapping the sections with aluminum foils can also help in reducing light penetration as it reflects light and heat away. After doing this, you should also ensure that the section is completely covered with soil.
- Plant selection – While choosing plants to use in layering, the select plants should have stems that are pliant enough to bend to the ground without causing any damage. If the plants are damaged while bending them, it can cause pathogen contamination and destruction by insects.
- Rooting hormone – As mentioned earlier, the application of auxin can and will increase the probability of success as it aids in the fast rooting of the shoots.

Problems Growing Flowers

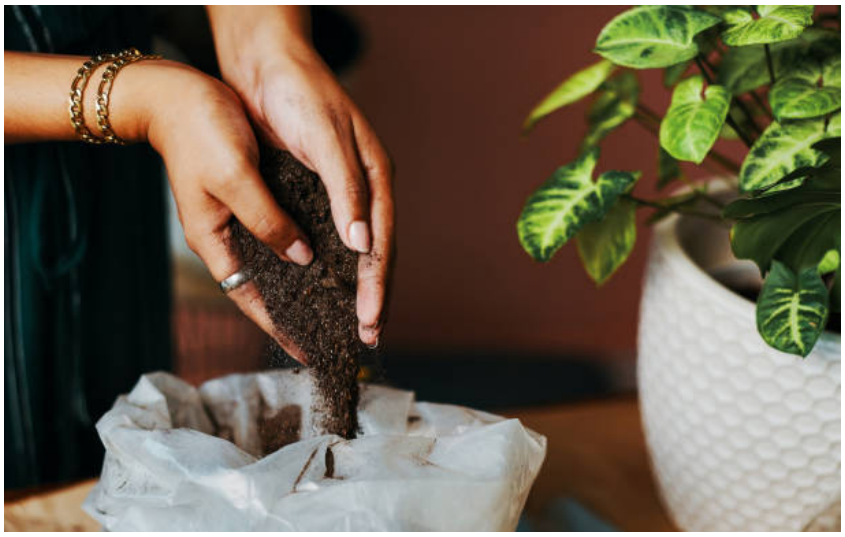
Even in the best care for gardens, things sometimes go wrong – it is utter nonsense to assume that pests and diseases will only target sickly plants. You must be on guard against outside invaders; however nice the beds and borders look, there are insects and fungal diseases that can destroy your plants and ruin all your efforts. Your plants are likely to be infected by an adversary from inside rather than by an external marauder – these internal causes may be the bad quality of your soil, lack of water, hunger, wind, frost, picking the wrong plants, or doing the wrong things. Before it starts, the golden rule for having healthy flowers is to avoid trouble and deal with it quickly once it is noticed.

Here are a few pointers to avoid problems while growing flowers:

- **Prevent problems before deciding.** Buying a good stock won't be effective if you put it in the wrong place. Avoid forms that are too delicate for your garden. Plant annuals that thrive in the sun in appropriate locations; planting them under trees or shady areas will yield disappointing results.

- **Prepare the field thoroughly.** A healthy plant is more likely to recover from a plague or disease attack than a weak one. Waterlogging is one of the most serious issues with clayey soils due to poor preparation. Remove all weed roots before planting perennials and apply Bromophos to the soil if rodents have gnawed roots elsewhere in the garden.
- **Plant or sow accordingly**. Seed sowing implies doing the right thing at the right time. Plant too early, and the seeds will rot; plant too late, and the results will be short-lived. When the seed is sown indoors, note that “hardening” is necessary before the seedlings are moved outdoors.
- **Never allow garbage to lie about.** Boxes, old flowerpots, etc., are slugs and woodlice breeding sites. Rotting plants can be an infectious source and can potentially attract pests to the garden. So, make sure your area is clear.

Plant Growth and Nutrition



Plant Nutrition

Although there may be a need for supplements, the soil is the major source of nutrients needed for plant growth. Three of the major nutrients needed by plants are nitrogen, potassium, and phosphorus, which together make up NPK. There are also many other nutrients in the soil that plants need in smaller quantities, as discussed below:

1. Nitrogen – It is a key element for plant growth. Nitrogen is found in plant proteins and hormones, all plant cells, and even in chlorophyll. The main source of soil nitrogen is atmospheric nitrogen. Plants such as legumes fix atmospheric nitrogen in their roots. So as to supplement the soil with nitrogen for use by other plants, factories that make supplements such as fertilizers use nitrogen from the air to make fertilizers such as ammonium nitrate, ammonium sulfate, and urea. Once introduced into the soil, nitrogen is converted to nitrate for plant intake.

Podzolic soils have lower nitrogen than chocolate soils which are rich in organic matter. Heavy rains lead to nitrogen being leached out of the soil, causing soil acidification. Nitrogen should be applied in small amounts that the plants can exhaust or in organic forms, such as the use of composted manure in order to reduce leaching.

2. Phosphorous – Phosphorous is another important nutrient as it helps in the transfer of energy from sunlight to plants. It also hastens maturity and stimulates early root and plant growth. All manures contain phosphorus, particularly manure from grain-fed animals is a very rich source
3. Potassium – Not only does potassium increase vigor in plants, but it also leads to disease resistance. It is also important in another way, such as helping in the formation and movement of starch, sugars, and oils in the plant, and it can improve fruit quality. Intensive grazing and intensive planting of horticultural crops such as custard apples and bananas can lead to heavy removal of potassium from the soil. Fertilizer companies produce muriate of potash and sulfate of potash to supplement soils with potassium
4. Calcium – This nutrient is basically important for the growth of new roots and root hairs, good root health, and also essential for the development of healthy leaves. Lime is the cheapest supplier of calcium in the soil. Others include dolomite, gypsum, and superphosphate which is a mixture of calcium phosphate and calcium sulfate. Although dolomite is useful in providing the soil with calcium and magnesium, if used for long periods, it leads to an imbalance in the calcium/magnesium ratio.

5. Magnesium – It is a major component of chlorophyll. Chlorophyll is the green coloring matter of plants which is vital for the conversion of the sun's energy to food for the plants (photosynthesis). Magnesium deficiency may occur in sandy soils in areas with high rainfall and where intensive horticulture and dairying are practiced. Magnesium deficiency may be solved by the application of dolomite (mixed magnesium-calcium carbonate), Epsom salts (magnesium sulfate), and magnesite (magnesium oxide).
6. Sulfur – It is a major constituent of amino acids available in plants. It is also a player in energy production processes in plants. Many flavors and odor compounds in plants, such as the aroma of cabbages and onions, are the responsibility of sulfur. Soils with high organic matter are rich in sulfur. Sulfur leaches very easily. Fertilizer sources for sulfur include gypsum, atmospheric sulfur, superphosphate, elemental sulfur, and sulfate of ammonia.
7. Iron – It constitutes many compounds that regulate and promote plant growth.
8. Manganese – It is important for the photosynthesis process. Lime can be used to remedy manganese toxicity in the soil.

Nutrient shortages can lead to many problems – poor growth, undersized blooms, reduced resistance to disease, and discolored leaves.

The following can help prevent these issues:

- **Check plants periodically.** If treated promptly but can be difficult or impossible to control if left to get out of hand due to

ignorance or neglect, act quickly – most pests and diseases can be checked quite easily once you've put a name to the problem.

- **Hand-remove occasional problems whenever you can.** Minor attacks can often be handled by handpicking a caterpillar or leaf miner out of your garden. If a plant dies unexpectedly, dig it out and closely examine it to find the cause. Examine the roots of soil pests and the ground, then take remedial action if the cause is detected.
- **Spray appropriately**. When pests or diseases begin to take hold, immediate action is required. Read the label carefully and ensure the treatment is approved for the plant you want to spray.

  Pick a period when the weather is neither sunny nor windy and apply the spray in the evening when the bees have finished working during the flowering season. Using a strong spray, proceed until the leaves are coated and the liquid has just started to run out. Do not aim the spray to open delicate blooms. Wash out appliances after spraying and wash your hands and face. Place the packages safely, and do not leave the items unlabeled. Do not store pesticides or weed killers in a bottle of beer or other tubs.
- **Recovering with foliar feeding.** Like people, plants are vulnerable to illness, which pests or other diseases may bring. Applying a fertilizer suggested to be sprayed on the leaves, like Instant Bio or Fillip, is the simplest way to get things moving again.

- **Catch pests before they show up.** The most serious problem with crop pests is that they go unnoticed. If you suspect pests or the site was previously a lawn or rough grassland, spray Bromophos into the soil before planting and apply Slug Guard around the stems.

Common Garden Pests and Diseases

Garden Pests

- **Root leatherjacket or greyish-brown grubs.** These can be a serious nuisance on poorly drained soil in herbaceous borders. During a rainy winter, leatherjacket attacks are often worse, but they're rarely a nuisance in sandy areas. Sprinkle slug guard over the ground and lightly rake in if grubs are found at the roots of sick plants.
- **Millepede.** Both spotted and black soil varieties can be found in the soil. Their targets of choice are places that have been compromised or infected. They curl up when startled, and they should constantly be eradicated since they harm many plants' underground sections. Slug guard can be used to control this pest.
- **Wireworm.** These rough, glossy insects are a problem in new gardens and areas adjacent to grassland. They're slow-moving - not like the active, friendly centipede. They consume the roots of most flowering plants, and they can burrow up chrysanthemum stems. Sprinkle bromophos over them.
- **Black root rot.** A common disease that affects antirrhinum, begonia, sweet pea, geranium, etc. The leaves turn yellow and wilt on the grass. The roots are blackened underground. There is no solution, so avoid the causes: unsterilized indoor compost, un-composted outdoor leaf molds, and replanting the same kind of plant in polluted soil.
- **Moles.** An invasion of moles will wreak havoc. The hills thrown up by their tunnels are unsightly and cause significant damage to the surface. Small plants may have their roots dug up. Moles

are difficult to eliminate, but you can try smoking them out. A professional exterminator can do this job best because it may be necessary to set traps or use gas.

- **Cutworm.** These are soil-living green, grey, or brown caterpillars, maybe 2 inches in length. They gnaw both roots and stems, but their tell-tale effect is to cut down on the ground-level seedlings and young bedding plants. When this happens, the cutworms near the targeted plants must be searched for and killed. Rake in bromophos as a preventive.
- **Chafer grub.** These wrinkled white grubs attack the roots of many plants, such as ferns, pot plants, and alpines. If a rock plant suddenly dies, search in the soil for the vine weevil's rolled-up grub. If there is one, pick and kill it. You can get rid of them using hexyl garden spray.
- **Fat-curved grubs.** These feed on the roots of herbaceous border plants throughout the year. There are times when both chrysanthemums and dahlias are killed. If you notice these grubs in the dirt or intend to plant them in freshly damaged grassland, sprinkle bromophos onto the dirt and rake in lightly as a precaution.
- **Club root.** This serious vegetable garden disease may affect wallflowers and stocks. The roots prevent wallflowers from growing on the same spot yearly.
- **Cats.** They are an annual, perennial pest. Their scratching disturbs seedbeds and freshly set up bedding plants. The resulting damage to the root can cause seedlings to die. Safety is not easy if cats have chosen your flower bed for their toilet,

but you can sprinkle pepper dust liberally around the disturbed ground.

Controlling Garden Pests

Garden pests are a nuisance and cause the destruction of crops hence leading to lower or no harvest. They should therefore be controlled at all costs, and below are some of the ways:

1. Taking advantage of pests' natural enemies – Some insects are of an advantage to the farmer in pest control. Ladybirds, parasitic wasps, ground beetles, and spiders prey on insects that destroy plants hence being beneficial to the farmer. One should look for these insects that are garden friendly and try to entice them into the garden by, for example, planting nectar and pollen-producing plants.
2. Companion planting – This is planting plants that produce natural insect repellant alongside the plants that are likely to be infested by pests. For example, aphids, Japanese beetles, and spider mites can be deterred by planting garlic among vegetables on the farm. Marigolds planted alongside cucumbers or squash repel cucumber beetles and nematodes, and tomato hornworms can be repelled by planting basil near the tomato plantation.
3. Use of barriers – Physical barriers can also be used as a way of preventing pest infestation. There are many ways to do this, for example, by the use of a fine net. The net should be positioned over the plants while still leaving ample space for the plant's growth. Another physical barrier that can be used is a cardboard collar. This one is placed around the stems of a plant and then pressed into the soil for about an inch deep. This will help in the prevention of burrowing insects and cutworms.

4. Keeping the soil healthy – It is very important to make sure that your soil has the required nutrients for the crop you want to plant. Before planting, add organic matter and any other supplements that the soil requires. The soil being healthy leads to the production of strong plants that can resist any damage incurred from pest infestation.
5. Hand-picking larger pests – Pests such as caterpillars, slugs, and snails can easily be spotted and removed from the plants by the use of the hand. This method is only efficient in a small garden. While doing hand-picking, it is important to wear gardening gloves.
6. Crop rotation – This is the planting of different kinds of crops in different sections of the farm each year. There are some insects that spend time in the soil during the winter season and come out to search for food during spring. If crops are rotated, and the crop that the insect feeds on is relocated, the insect is forced to move to look for food making it exposed to its prey, such as birds and other insects. The insect may also die from hunger.
7. Use of pesticides – Many pesticides have become available over the years. These pesticides help in combating unwanted insects that destroy plants on the farm. Some pesticides include organic pesticides, spray chemicals, and slug pellets.
8. Traps – An example is the slug beer trap. Pests can be lured into traps put on the farm by the farmer.

Garden Diseases

There are many diseases that cause the destruction of plants leading to loss of produce. These diseases include:

Black spot

This is one of the most common plant diseases and is mostly found on roses. It also occurs on other garden and ornamental plants all over the world. It is a fungal disease that can be spotted by the evident black, round spots on the upper side of the leaves. Leaves on the lower parts of the plant are usually the first to be infected. Once the leaves are severely infected by the disease, they turn yellow and fall off. Black spot usually occurs during extended seasons of wet weather or when the leaves stay wet for more than six hours over a long period of time.

Black spots on leaves can be controlled by:

- Planting crops in well-draining soils – It is important to keep using organic fertilizers, which help the soil to keep well drained hence preventing fungal diseases.
- Remove the infected dead leaves and canes that fall off around the plant. These leaves should be discarded into the trash to avoid the spread of the disease. They should not be added to the composite pile.
- One should also disinfect pruners every time after use. This can be done by the use of household disinfectants. Some examples of these disinfectants are isopropyl alcohol and ethanol.

While watering, apply water directly to the roots rather than on the leaves. This is because water is the cause and spreader of fungal spores. The use of a soaker hose pipe to water plants is advised for plants that are prone to the disease.

Other leaf spots

Black spots are not the only fungal disease that causes spots on the leaves. Many fungal leaf spot diseases also occur on both indoor and outdoor plants. They occur during the warm and wet seasons. Leaf spots may cause defoliation of leaves, and the same measures taken for black spots also apply here.

Powdery Mildew

It is also a fungal disease. It mostly affects outdoor plants, fruits, flowers, and vegetables. It is easily identifiable as infected plants display a white powdery substance mostly evident on the upper surfaces of leaves. Powdery mildew can also appear on any other part of the plant, including flower buds, fruits, and even on the stems. Powdery mildew thrives during high humidity levels on the upper parts of the plant surface in combination with low soil moisture conditions. This disease tends to affect plants kept in shady areas mostly.

These are the ways in which powdery mildew can be controlled:

- Inspect crops that you buy from greenhouses for powdery mildew and other diseases and pests.
- Trim and remove all infected plant parts.
- Do not use the debris as compost manure or till them into the soil.
- Practice the recommended spacing of different plants to increase air circulation and reduce humidity.

Downy Mildew

Downy mildew differs from powdery mildew. Powdery mildews are fungal pathogens that cause a white powdery substance on the upper parts of leaves, whereas downy mildews are related to algae and do produce grayish fuzzy-like spores on the lower rather than the upper surfaces of leaves. In order to identify downy mildew, one is supposed to look for yellow spots or pale green surfaces on the leaves. On the lower parts of the leaves, downy mildew appears as a white to grayish yet cotton-like substance. This disease occurs mostly during cool, moist weather.

Downy mildew can be treated in the following ways:

- Downy mildew is caused by moist conditions on leaves. Therefore it is very important to keep water off the leaves.
- Another way to control downy mildew is by keeping the areas around your plants clean. Remove the dead leaves around the plants and dispose of them well rather than using them as compost.
- Lastly, one can use fungicides. Note that not all fungicides control downy mildew; Earth's Ally's fungicide controls both downy and powdery mildew.

Blight

This is a very common disease among many plants. In infected plants, for example, potatoes, it can cause death to human beings. An example was in the 1840s when there was a potato famine that killed about one million people. Apart from potatoes, blight also affects other plants, such as tomatoes. It spreads through spores that are windborne, and it is a fungal disease. As it is windborne, it can affect a very large area over a short period of time. Blight spreads when there are warm, humid conditions.

To control blight, a farmer can use the following tactics:

- There are early varieties of crops that one can grow. A farmer, for example, when planting potatoes, can plant varieties that grow before mid-summer as this is the period that blight occurs.
- Resistant varieties – One is advised to plant varieties such as Sarpo Mira and Sarpo Axona, which are blight resistant. Practicing good garden hygiene is also important.

- Once you note that some parts of your plant are blight infected, it is very important to destroy those parts to prevent them from spreading. Fallen debris should also be cleaned away from your plants and discarded as trash rather than using them as compost.

Mosaic Virus

There are many mosaic viruses, but the most common are tomato mosaic virus and tobacco mosaic virus. Tomato mosaic virus, as the name goes, affects tomatoes, among other plants such as pepper, potatoes, pears, cherries, and apples. On the other hand, the tobacco mosaic virus infects tomatoes, cucumbers, lettuce, beets, pepper, and tobacco. Mosaic virus is identified by looking at the leaves; mottled yellow and green leaves, which are sometimes curled and distorted, are its evidence. On some plants, the mosaic virus causes stunted growth, yellowing, malformed fruits, and reduced harvest. It mostly occurs during hot weather.

The most favorable solution for the mosaic virus is planting resistant varieties, as there are no chemical controls available. Another solution is to remove and destroy infected plants or plant parts and do crop rotation. Tobacco is a carrier of the mosaic virus, and therefore persons who smoke should wash their hands thoroughly before handling plants.

Damping-off Disease

It is caused by soil-borne fungi. It mostly occurs during wet, humid conditions. The damping-off disease is associated with seedlings, whereby it makes them collapse and decay. It mostly occurs indoors/in greenhouses but can also occur outdoors.

As the adage goes, prevention is better than cure, and the latter does not work for this disease. By the use of cultural practices, this disease can be prevented. These practices include using new pots, trays, or cell packs or disinfecting with 10 percent bleach.

Pollination

An essential step in plant reproduction is pollination. Plants can only procreate if flowers are pollinated.

The male reproductive component of a flower is referred to as a "stamen," and it is made up of a stalk (also known as a "filament") and an "anther" at its tip, wherein pollen is produced in a space termed a "microsporangium."

The "pistil," or feminine portion of the flower, consists of three parts: the "ovary," or "stigma," which houses one or more undeveloped seeds (or "ovules") waiting to be fertilized, is located at the base of the pistil. The "stigma" is the top of the pistil, a sticky receptive surface to which pollen clings during pollination.

The "nectary," located at the base of the petals, pistils, and stamens, is where specific glands exude "nectar," a nourishing liquid with a characteristically pungent odor.

A pollen tube develops through the style, which is attached at its base to the ovary that houses one or more unfertilized seeds when

another pollen grain sticks to the sticky surface of the stigma (ovules).

The plant can now be fertilized, with the ovules turning into seeds and the protective layer of the ovary wall becoming its fruit due to the following "pollination."

Forms of Pollination

Pollination has different definitions depending on the type of plant it is being defined on. It is the transfer or placement of pollen from the anthers to the stigma of the same flower or another flower of the same kind in angiosperms. In gymnosperms, pollination is defined as the transfer of pollen from the male cone to the female cone.

The act of pollination is essential to Earth's ecosystems since humans and ecosystems would find it hard to exist without a sufficient number of pollinators. Pollinators include insects (the most well-known European honeybee), butterflies, moths, bats, birds, humans, wind, and water.

Hand Pollination

Hand pollination is another way to control pollination whereby individual flowers are pollinated. This is mostly done on plants with large flowers, such as squash. Melons and squash flowers that form in the early season are the best to pollinate. If one wants to broaden the genetic base of his/her saved plants, one should use a male flower from a plant other than the one to which the female flower is attached.

For Butternut squash or other squash which develops a hard rind, one can lightly cut a mark into the skin with one's fingernail so as to

identify it as hand pollinated. Even as the fruit enlarges and matures, the mark will still remain. One can also use bright color painted stakes as signposts.

The process of hand-pollinating a squash plant is very simple. You have to first identify healthy squash variety vines you want to save seeds from. Then you have to identify a few female and a few male flowers that have not yet opened. During the late afternoon hours of the day, before the expectation of the flower's opening, use strings or twist ties to tie the tips of the female flowers shut. Do the same for the male blossoms. Thirdly, in the early hours of the next morning, before there are flying insects, remove the tape and petals from a male flower in a way that the stamens are revealed. Then open the tip of a female flower to reveal the pistil and use the stamen as a brush to paint the pistil with pollen working quickly yet gently so that no insects can sneak in and add foreign pollen. Tie the female blossom again. Lastly, label the squash blossom as hand pollinated.

The cucumber family is easily pollinated by hand. The plants have a male and a female flower. The female is easily recognized by swelling at the base, which becomes the fruit (i.e., the cucumber, zucchini, or pumpkin).

The male flower has a long stamen, which has the pollen to fertilize the female flower

You can tell which female flowers will open the next day with a bit of observation. Cover them with a stocking or a piece of cotton (not too tight) so insects do not get there first.

The next day, pick a male flower and peel back the petals exposing the stamen. Open your selected female flower(s) and rub it with the

stamen. One male flower is good for pollinating several female flowers.

Once you've done this, you will need to re-cover the female flower for five or so days to prevent insects from undoing your good work. You can use male and female flowers from the same plant with the cucumber family.

The seeds from the cucumber and nightshade families all benefit from being fermented in lukewarm water for a few days. This method destroys several virus diseases and frees the seed's pulp. After several days, dry the seeds thoroughly on absorbent paper towels, label, and store.

With small seeds, such as tomato or chili, you can leave them on the paper towel while storing.

This way, you can place the paper towel (with seeds still attached) directly on the sowing medium (they fit nicely on the shallow potting trays). Seedlings can be 'pricked out' into their own grow tubes when large enough.

Self-Pollination

Some plants (including many orchids) can self-pollinate and therefore do not need an agent/vector to transfer pollen from the male part of the flower to the female part. These plants fertilize themselves, but only a few plants have this characteristic.

Self-pollination takes place when pollen from one flower pollinates the same flower (autogamy) or another flower on the same plant (geitonogamy).

Self-pollination can also occur even before a bud opens (cleistogamy).

Most self-pollinating plants have relatively small, inconspicuous flowers that shed pollen directly onto the stigma. Since self-pollinated plants don't need external influences to pollinate them, they can often be found growing in areas where potential pollinators are absent, such as in Arctic regions or on mountain ranges.

Cross-Pollination

Most plants are pollinated via cross-pollination (allogamy), which generally produces seeds that produce healthier and stronger plants.

With cross-pollination, plants need an external agent to transfer the pollen from one flower to another for fertilization.

Pollinating Vectors or Agents

As plants are passive, they must rely on vectors or agents to move pollen from flower to flower. Although some plant species depend on wind and water (abiotic forces) for pollination, most rely on animal pollinators (biotic pollination). These are mainly insects, but humans, small mammals, some birds, bats, and lizards can also act as pollinators.

There is a symbiotic relationship between plants and various pollinators – producing benefits for both. For many pollinators, flowers act as a food source. When they visit the flower for nectar (a solution of sugars mixed with mineral nutrients and fragrances for energy) or pollen (rich in protein), some pollen rubs off onto their bodies. It is deposited on the next flower they visit, consequently pollinating it so that fertilization can occur.

Some pollinators, such as butterflies, moths, and some birds such as hummingbirds and bats, search out the energy-rich nectar, and while they are feeding on this, they accidentally pick up and transfer pollen.

Other pollinators such as the honeybee deliberately gather protein-rich pollen to provide food for their young. Their bodies are covered with hairs to which the pollen sticks, meaning that they can pollinate many flowers as they fly from flower to flower.

Some pollinators are “generalists,” visiting many different flowering plants, while others are specialists, searching out plants of a particular species. Many pollinators can cover great distances, ensuring genetic diversity by transferring pollen to unrelated individuals.

Important Insect Pollinators

There are many different pollinators, but insects are the most important, some of which are “managed” pollinators (e.g., the Honeybee), while others are wild species. The main groups of insects that pollinate flowers are bees, wasps, flies, beetles, butterflies, and moths.

Flies

Flies are important pollinators; like bumblebees, they can be out and about when temperatures are low. Flies rather than bees often pollinate plants growing in damp shade such as woodlands, the latter not being attracted to that environment. In the UK, there are over 250 species of Hoverfly and, as well as acting as pollinators, several

hoverfly species have larvae that feed on aphids, consequently acting as pest controllers.

Beetles

Beetles were among the first pollinators to evolve when flowers first appeared, and they remain a significant group of pollinators today, especially for ancient plant species such as Magnolias. As they search for feed and nourishment from flowers, they can act as pollinators, although they don't have obvious means of carrying pollen. They have been called "mess and soil" pollinators as they often defecate in flowers.

Moths and Butterflies

These insects are "accidental" pollinators, meaning that as they visit flowers seeking out nectar, they pick up pollen as they feed and transfer it as they move from flower to flower. Butterflies tend to cover greater distances than bees so that they can pollinate flowers over a larger area.

Most of the flowers that butterflies visit have adapted to produce more nectar than pollen. Those flowers pollinated by moths are open at night and are usually strong-scented to attract them when they are active, although some moth species are active daily.

Bees

- **Honeybee**: The Western honeybee (Apis melifera) is the most well-known of the bee pollinators and is considered particularly important as honeybees can be "managed," meaning that their colonies, housed in hives, can be moved to different locations.

- **Bumblebee**: This is another bee that is easily recognized but is probably less well-known because there are quite several different species, 24 of which can be found in the UK. The Bumblebee is also another “managed” species. They are sometimes used in commercial greenhouses and polytunnels for pollinating crops such as tomatoes and crops that outdoors would be pollinated by wind. The vibration of their bodies around the flowers dislodges pollen. This is known as “buzz pollination.”
- Another advantage of bumblebees as pollinators is that they are often one of the first bees to appear in the spring and the last to hibernate in autumn. Unlike honeybees, they also forage when conditions are wet, and temperatures are low.
- **Solitary bee**: Unlike honeybees and bumblebees, solitary bees nest alone and not in colonies. There are several different solitary bees, including the Mining bee that excavates its nest in underground tunnels, the Leaf-cutter bee that uses bits of leaf to build its nest, and the Mason bee that uses mud to construct its nest. All these bees act as pollinators; however, many have particular habitat requirements that restrict them from covering great distances and, therefore, their ability to pollinate different plant species.

Wasps

These much-maligned insects perform an essential role in ecosystems. They act as generalist pollinators moving pollen from flower to flower as they seek out nectar to feed on. However, they are less efficient than bees as they are not covered with hairs to

which the pollen can stick. Wasps are predatory or parasitic, catching smaller insects to feed their young, helping to control many pests.

The Importance of Insect Pollination

The American Institute of Biological Sciences reports that native insect pollination saves the United States agricultural economy nearly an estimated $3.1 billion annually through natural crop production; pollination produces some $40 billion of products annually in the United States alone.

The FAO states that approximately 80% of all flowering plant species are specialized for pollination by animals, mostly insects, which affect 35% of the world's crop production, increasing the output of 87 of the leading food crops worldwide.

Insects are essential to fruit pollination. A joint FAO/WHO (World Health Organization) workshop on the promotion of the production and consumption of fruits and vegetables stated that:

Pollination and Crop Production

Pollination is critical to crop production. Everyone must know this essential ecosystem service – not just the general public and farmers but all local and international decision-makers.

Globally, land dedicated to growing bee-pollinated crops has grown over 300% in the last 60 years, while the number of bee colonies has declined by over 50%, putting tremendous pressure on existing bee colonies and beekeepers.

Pollinating insects also play a crucial part in maintaining natural plant communities and ensuring the production of seeds in most flowering plants.

“The growth of agriculture in Europe has provided a patchwork of diverse and multifunctional habitats, offering a variety of sources of pollen, and including open spaces such as meadows and field boundaries where wildflowers and other non-crop vegetation thrive.”

Crop production in Europe shows high diversity in pollination requirements. While insects and mammals pollinate many crops, cereal crops such as wheat, rice, and corn are wind or self-pollinated. In contrast, root crops such as potato and sugar beet and other vegetables such as spinach and onions do not require pollination.

Pollination and Fruit Production

Eurostat – European Commission shows that fruits such as apples, pears, and other stone fruits rely heavily on insect pollination; insect pollination can increase cherry and plum crops by 80% and 30%, respectively.

The Honeybee is the primary pollinator for these fruit crops; however, solitary bees, bumblebees, and other insects are also important contributors. Oilseed rape yields can be increased by up to 20% by pollination; even when unfavorable wind conditions offer minimal wind pollination (abiotic), insect pollination (biotic) can contribute an added 15% increase in yield.

Insect pollination adds variety, fruits, vitamins, and other benefits to our diets. A healthy and balanced diet is important, and a diverse intake of vitamins and nutrients is essential. In addition to tree crops, many berry and vegetable crops rely on insect pollination, such as watermelon, cucumber, pumpkin, raspberries, and spices.

Flower Shapes for Pollination

While food is often a sufficient enticement for pollinators, flowering plants use a combination of color, shape, or scent to lure them. Consequently, successful pollinators need to have good color vision, good memories for finding specific varieties of flowers, and, for those searching for nectar, a proboscis for obtaining it.

Over the millennia, flower shapes have evolved alongside insects, so much so that many plants have developed flowers and forms precisely organized to facilitate their pollination by a specific group of pollinators – a partnership (or symbiosis) beneficial to both groups.

For example, grasses, which are pollinated by wind, need to produce vast quantities of pollen to stand a chance of successful pollination and then allow their pollen to hang, lightly dangling so that any passing breeze can carry them away to a waiting recipient plant. By contrast, strawberry flowers lead a more relaxed lifestyle as they lie basking in the sun, waiting for any passing insect to drop by and pollinate them.

Animal-Pollinated Flowers

Pollination by animals generally takes place in two ways, either by the animal simply brushing past a pollen-heavy flower, or animal pollinators are often rewarded for their efforts with nectar.

Whichever method is preferred, it means that the pollen-carrying filaments of a flower must be strategically positioned (as well as being both long and flexible) so that the anthers can quickly dust pollen onto the animal's body as it brushes by the plant. Pollen is naturally slightly sticky and generally adheres well to its pollinator.

For animals specifically attracted by a flower's nectar, the flower must first have evolved so that the animal can access its nectar and

for the nectar receptacle to be sufficiently large for it to be a possible effort on the animal's part to be worthwhile.

As the animals drink the nectar, they inevitably pick up pollen on their heads, which they then pass on to the next flowers they drink. Surprisingly, and if nothing else, proof that these flowers have evolved to attract specific animal pollinators, the nectar of these plants is often foul and smelling of decaying flesh!

So, we see that flowers pollinated by animals must have evolved in two ways: by developing strategically positioned long and flexible filaments and/or by evolving largish nectar receptacles at the base of the petals accessible to specific animal groups. Interestingly, flowers that rely on animals to brush past them for pollination often have exceedingly small flowers surrounded by attractive, colorful leaves.

Bird-Pollinated Flowers

Among the most exotic of flowers are those pollinated by birds. These flowers have generally evolved to house their nectar (and pollen) in long, tubular/trumpet-like flowers.

The colorful flowers, sweet-smelling nectar, and flower shapes attract long, curved, beaked birds, such as the Bananaquit, to drink off their nectar as the flower's long filaments dust pollen onto the birds.

Birds probably evolved long, curved beaks to access these flowers' nectar, or perhaps it was the other way round. But, whichever came first, theirs is a long and successful relationship.

Some plants also have added security-pollination systems to ensure their pollen is transferred. Lobster-claws/Wild plantain/False bird-of-paradise (Heliconias) has special extra-sticky threads that help

pollen adhere to smooth structures such as birds' bills. The pollen of some African orchids is so tacky that it sticks to the feet of its visiting Sunbirds!

The iconic image of a Hummingbird hovering next to a flower belies the truth – which is that the bird is being tricked into being a pollinator – since, while it is hovering, the suspended, overhead anthers of its target flower douse the bird’s feathers with sticky pollen as the bird lines itself up to drink the flower’s nectar!

Insects-Pollinated Flowers

Plants and insects are perhaps the most productive pollination partners. From seemingly small ants to bees, beetles, butterflies, flies, moths, and even wasps, insects are used to pollinate plants. Among all insects, honeybees have the most fruitful relationship with plants.

The color, aroma, shape, and nectar of flowers attract insects. Pollen must be spread quickly before flowers wilt, and their stigmas become unreceptive, so insects quickly move from flower to flower, gathering and dispersing pollen.

Many of the flowers that birds also pollinate are pollinated by insects with long proboscises, such as honeybees, bumblebees, butterflies, and moths, which can typically access the nectar of tubular blossoms.

However, insects like flies, wasps, and beetles cannot—unless, of course, they are as small as ants, in which case they could fit deep inside a trumpet-shaped bloom but would run the risk of becoming stuck in any sticky substances or even drowning in nectar! More

accessible and exposed flowers tend to attract a greater number of little insects.

Both beetles and honeybees consume part of the pollen that they gather, but honeybees bring the majority of it back to the hive to feed their larvae.

According to Brian Capon (Botany for Gardeners), flowers typically manipulate their pollinators into awkward poses to ensure that a flower's pollen is successfully collected. You've probably seen bees hanging upside down; in some blooms, this position is necessary for the bee to access the nectar. The ingenious flower then disperses pollen onto the insect's fuzzy underside, which is a more reliable method of pollen delivery than a bee's shiny topside!

The anthers of the Kalmia latifolia bush's flower tenses when insects visit, and the flower's springy filaments hurl pollen in their direction. At the same time, many orchids require insect visitors to navigate a maze of small apertures, chambers, or tubes to reach their highly sought-after nectar. Pollen from flowers the bug has already visited is scraped off as it moves through the intricate flower structures, adding new pollen.

The most impressive and finest flower landing-strip guides are probably invisible to humans. These are the ones produced by unique pigments in flower petals that reflect ultraviolet light, luring insects to land on the flower with their eye-catching, iridescent patterns.

The canny family of Snapdragons (Antirrhinum) is an excellent example of a plant/insect symbiosis since they will only open to be pollinated if a Bumblebee falls on them. The less cunning Yucca

(Yucca) is another option, and like many other white flowering plants, it is typically pollinated at night by moths. However, the Yucca and the cunning Yucca moth, laying eggs in the Yucca blossom, have an odd connection. When the eggs hatch, they consume the Yucca's seeds, which their parents may have pollinated.

Wind-Pollinated Flowers

Wind pollination accounts for about 12% of flowering plants worldwide. The wind is a crucial factor in the dispersal and delivery of pollen for many naturally occurring species, including conifers and grasses, as well as cultivated crops like rice and wheat.

The oldest angiosperms on the earth are wind-pollinated plants. Since they do not need to draw pollinators, they typically do not have showy flowers, nectar, or perfume; yet, to make up for this and improve their pollination, they produce a lot of pollen. These species' pollen is extremely tiny and light (sometimes winged or feather-like), making it portable.

For their pollen to be easily picked up and carried by passing wind, trees and bushes that rely on wind for pollination have evolved to produce large numbers of flowers on their highest branches. This explains why, on flowering trees, you'll frequently see clouds of pollen floating from their topmost branches. This sort of pollination requires a lot of pollen because it is unpredictable whether or when the pollen will reach the right prospective recipients due to the whims of the wind.

Due to the same issue, grasses, reeds, sedges, and rushes have evolved to produce enormous amounts of pollen. However, because they are much closer to the ground than trees, they have developed

a strategy that allows even a light breeze to pick up their pollen easily. They produce delicate, feather-like stigmas that spread like birds' wings in the wind to capture any suitable passing pollen, while at the same time, their ultra-fine stigmas trap any. It should be no surprise that these plants must be as light and frail as possible in contrast to trees, which must reach the skies and hence must be as robust and sturdy as possible.

Gymnosperm Pollination

Gymnosperms are non-flowering seed plants – usually Conifers, Cycads, or their allies. They are called “naked seeds” because their seeds develop while exposed on the upper surfaces of cone scales. All wind-pollinated plants produce masses of male pollen grains (gametophytes) carried on the wind. The male pollen lands on the female cone, forming a pollen tube through which the pollen travels to fertilize the female gametophyte. The pollination system of this group evolved way before insects appeared on Earth and has not changed since. Gymnosperm plants are generally large with evergreen needles or scales for leaves.

Water-Pollinated Flowers

A small number of plants are pollinated by water. Not surprisingly, all these plants are aquatic species. These plants suffer the same problem as wind-pollinated plants - water–pollination is a bit of a “hit and miss.” This is why they have evolved to produce vast quantities of pollen.

This makes it extremely hard work for their usually small, inconspicuous male flowers, which have probably evolved this way

to avoid being damaged by strong-flowing water or aquatic animals so that the plant can dedicate all its energy to reproduction.

The pollen floats on the water, which is eventually caught by the large, feathery stigmas of suitable female flowers – although there is a lot of wastage.

The Importance of Pollinators

According to the FAO (Food & Agriculture Organization of the United Nations), “Pollination is critical for food production and human livelihoods and directly links wild ecosystems with agricultural production systems. The vast majority of flowering plant species only produce seeds if animal pollination moves pollen from the anthers to the stigmas of their flowers. Without this service, many interconnected species and processes functioning within an ecosystem would collapse.”

Pollination plays a vital role in our life on Earth. However, it's the most critical and often forgotten role in maintaining ecosystems. Without seed production, we wouldn’t have plants. Without plants, we would have insurmountable global food security problems for humankind and animals, and the balance of our ecosystems would collapse – imagine famines going global!

Pollination and Agriculture

Pollination is important not just because many countries’ economies depend on agriculture (and of those that don’t, agriculture still plays a sizable role in their overall economy) but also because we rely on pollination to feed the world.

For agriculture to be successful, plants need to be pollinated to produce (and continue to produce in future years) seeds, fruit, and fiber. Most crops are grown for their fruit, vegetables, nuts, seeds, and fibers, such as cotton and linen – these crops all require pollination.

This leaves us in a position where we need plant pollination to survive and ensure global food security, but we are the greatest threat to pollination!

Book 2: Hybrid Varieties

Hybrid varieties are achieved by plant breeding. Plant breeding is the science art of changing a plants traits to ones desired characteristics. It can be achieved through many techniques from a range of simply selecting plants that have desirable characteristics for propagation to more complex cultivation. Hybrid plants have the following characteristics: high resistance to harsh conditions, pests, and diseases, high yielding capacity, high productivity, and greater longevity.

Domestic gardeners are usually advised not to save seeds from hybrid crops because the offspring of hybrid plants, especially corn, is sometimes sterile. This seed will produce plants when transporting fertile seeds, unlike the mother plant. The product of a cross between hybrid plants often resembles one of its ancestors.

Since the reason for the growth of hybrid seeds is usually the exceptional vigor found in the first generation after crossing, there would be little to gain from reproducing hybrids towards their parents and grandparents.

There's certainly no harm in saving the hybrid seed, though. If you like to experiment, go ahead and plant these seeds. Don't expect big things from this second generation, but keep your eyes open, and you could grow something you want. You should not depend on the saved seed of a hybrid crop; however, if you want to, be sure to harvest what you need next year.

Records of the type and number of plants from which the seed is harvested, as well as any other relevant data, such as yield or early-onset assessments of parent plants, should be kept at the time of seed registration. This will help you evaluate the results of your seed-saving efforts after following the practice for a few years.

There are many good qualities to look for when selecting plants from which to save the seed. It is recommended to consider at least some of the following characteristics when choosing mother plants:

- Flavor
- Performance
- Color
- Size
- Length of life
- Resistance to disease
- Insect resistance
- Early bearing (fruits, heads, flowers, etc.)

- Late in bolting seeds (lettuce, etc.)
- Good germination in bad weather
- Absence of plugs
- Seeds - few and small in juicy fruits, large for sunflowers
- Consistency, tenderness, juiciness
- Employability. For example, a tomato should be dry and fleshy. Flint corn should dry well. Cursed Kraut would be solid. The flowers to be cut must remain erect.
- Stature - tall, dwarf, intermediate
- Weather tolerance, drought position
- Aromatic appeal

What is a Hybrid Seed Plant?

Even if you are presently an enthusiastic grower, chances are you either buy your seeds regionally or order them from one of the leading seed organizations. Chances are also great that the seeds you purchase and plant are hybrids. While a hybrid seed may provide exceptional vegetables and plants, you can't keep a hybrid seed from the vegetables they produce to plant the next spring (like our predecessors did for ages).

But what specifically is a hybrid seed?

Suppose a plant grower observes a good habit in a special plant, but the plant did badly in the heat. On the other hand, another plant did great in the heat but lacked other good characteristics. Both the plants would then be taken and self-pollinated, re-sowing the seed each year until twin plants appeared each time. Once this happens, it is known as the "pure line." If the breeder took two pure-line plants and cross-pollinated them, the result would be the F-1 hybrid, which may look and taste great, but once the season is over...then the season is over. This shows that hybridization and development of

hybrid varieties are not one and the same thing. While developing hybrid varieties, there is no attempt to produce a pure-breeding population of a particular plant. Here it is only the F-1 hybrid plants that are sought out. F-1 hybrid resulting from crosses between varying genotypes is often more vigorous than the parent. Hybrid vigor (heterosis) can be identified in many ways such as the growth rate, uniformity, earlier flowering, and greater yields.

Non-Hybrid and Heirloom Seeds

The term "heirloom" refers to the more classical classes of non-hybrid seeds. A seed variety can/is considered an heirloom if it still existed 50 or more years ago. If you come to think of it, a why? Poses into your mind. These seed have been grown for such a long time because of their special and unique characteristics that people like.

Both non-hybrids and heirlooms will give plants true to the mother plant because there has been no blending of genes. These seeds can be saved yearly, which means you will never be without seeds or the final food.

Heirloom seeds tend to have their special brand of built-in hardiness because they have been used year after year in a certain location, allowing them to develop a resistance to local diseases and insects and adapt well to the local soil climate. The need to preserve our heirloom and non-hybrid seeds is a significant sustainability component. By planting and gathering seeds from these long lines of food farmers, we ensure the continuation of our food supply. Aside from the convenience of having food every year instead of only one year, most people fancy the flavor of heirloom varieties. These gems have been found to have considerably more nutrition than either the hybrid or the GMO.

GMO Foods

Some researchers suggest that the human body does not even identify genetically altered food as being food. Combining inter-species genes, known as recombinant DNA technology, lacks the curbs and perspectives required by nature in traditional breeding, leading to genetic instability. No one can make any accurate foresight about the long-term effects of GMO food on our bodies and ecosystems. Nevertheless, there are already evident effects of GMO's on the human body. Due to our different DNA's, some people are affected by GMO's while others aren't. Those that are affected may experience risks like toxicity, allergic reactions, antibiotic resistance, immune-suppression, cancerous cells, and loss of nutrition.

Considering all this, it would make sense for all home growers to seek out heirloom and non-hybrid seeds and learn the art of saving them. Our forefathers were a flexible bunch of people who survived hardships we can only imagine. They carefully brought these enduring and hardy little seeds that fed them from year to year,

season to season. I, for one, don't want to let that kind of culture be buried, which could gradually strip away our health and ecosystem.

Are Non-Hybrid Seeds Good For You?

Plants grown from non-hybrid seeds will provide seeds that will form into the same crop type they were grown from. You can accurately judge the crop that will grow from each seed because the parent plant's genetic code is held predictably within it.

There are diverse levels of problems that are presented by hybrid seeds. One of the significant issues is that they do not present seeds to provide a true crop each year. If they grow, the plants these seeds provide will be, if not entirely awful, irregular at the very least. One year, we experimented to see what results the seeds from a hybrid squash vine would provide. The results showed nothing like the parent and were irregular and hideous. Even the taste of it was terrible when we tried to eat it.

Another predicament exists with hybrid seeds, but this one is more strictly linked to the community than the plan itself. Many people grew their gardens in the time before World War II. Some of these growers were small family-owned farms that provided the local area with nutritious and tasty natural foods on a limited local range. Even those who were not producers, however, very often gardened actively. The bulk of private yards contained at least a small vegetable patch from which the seeds were saved for planting the next year.

As well as hybrid seeds, there are now seeds available that are bio-engineered or modified genetically. The DNA of such seeds is altered by adding genes that often have no relation to the original

plant. For instance, some plants that are more sensitive to cold weather have been changed with a gene from a plant with better resistance to frost.

The majority of the genes used for plant bioengineering are derived from bacteria that are laboratory modified and then virally introduced into the DNA of the plant. Many inquiries about such modifications exist, such as whether or not the plant's pollen will carry the modifications and whether the changes will cause variations throughout the plants' generations. It seems controversial to use bacteria and viruses to modify food, especially in the problems that many of them cause. The high variation rate connected, especially within viral material, should also be factored in.

Are you aware there is a remarkably high expense to bring a new hybrid seed to market, so it is more valuable for advancement organizations to keep new varieties minimized? It may be a shock to many that there is a much more glorious diversity of plants offered by heirlooms, also known as open-pollinated seeds. The new plant varieties developed and evolved all open-pollinated, with minimal assistance from farmers. Usually, such plants grew quite well in their local areas as they were very well adapted.

Pros and Cons of Using Hybrid Seeds

One thing to note is that you can save the seeds from the hybrid plants. The offspring, though, will likely be quite different from the parents. It may grow or not at all, and it may look completely different or be second-rate compared to the parent plants. For example, the tomato plants from a land producing large fruit the year before may produce cherry tomatoes this year.

There are a few other things you need to study. The overall hardiness and resistance vary quite a bit among hybrid plants. Some have been formed to resist pests, and others believe that the farmers would use pesticides. If you notice "hardy" in the description, they can typically handle more cold weather than others. Hybrids almost always need a lot more water than the heirloom species. With water, there can be heavy fruit production. Without enough water, the plants usually die. However, heirlooms can get along with less water throughout their production, but they are more likely to last in drought situations.

Other than hardiness, there are many other advantages of hybrid seeds. Hybrid seeds as opposed to non-hybrid ones grow alike. All the hybrid seeds that are bought by a farmer in one packet have the same parent hence have the same genes. Therefore these seeds will produce similar plants. With hybrid seeds the farmer does not have to worry about characteristics such as small or nonexistence of fruits which are undesirable. While producing hybrid seeds, this helps the companies describe the seeds characteristics with a great degree of certainty.

Hybrid plants are easier to grow and have fast growth. This is because these seeds have been bred for pest and diseases yet adaptability to different weather situations. They therefore are able to grow faster than their counterparts.

On the other hand, hybrid seeds have their disadvantages. For instance, they are more expensive. There is a lot of work done on the seeds by the companies that produce them a lot of time is spent too. Therefore when one is paying for hybrid seeds, they are paying for all the work done on them hence they become more expensive.

Hybrid seeds may be less nutritious and less tasty. Production of seeds with desired characteristics may come at the expense of other characteristics. For example, seeds may grow to produce big fruits that have poor taste and texture. The larger fruit may have grown to that size due to more water which may be diluting its flavor. The problem may also be caused by the large production of the plants. A hybrid plant may have produced double the amount of yield it is supposed to produce while consuming the same amount of nutrients.

Growing vegetables is beneficial, but it is becoming more important to include self-sufficiency in our changing lifestyle. Whether or not

you plant hybrid or heirloom or both; whether you plant on several acres, in your backyard, in a community garden, or just a few herbs and tomatoes in boxes on your balcony, any food you can produce yourself will feed your body as well as your spirit.

Isolation Methods

Seed isolation means planting seeds of the same variety far enough apart to prevent cross-pollination. This is the easiest way to keep your plant varieties true to type and does not require special skills or tools. However, you cannot control what your neighbors grow in their gardens, so try to find out whether their plants might cross-pollinate with yours. You can find safe isolation distances on the Internet. The Department of Agriculture website is a good source.

In general, the recommended distances will depend upon how the plants are pollinated, how many you plant, and what sort of protection you provide, such as windbreaks and greenhouses. If you separate plants of the same variety with boxes, you might need to hand-pollinate them with a watercolor brush since you are preventing the pollination from all sources.

For example, bees pollinate cantaloupes, so the distance bee's travel determines the isolation distance. Corn is pollinated by wind, so the isolation distance is determined by the distance that wind will carry the seeds.

The recommended isolation distance for Swiss chard is five miles, which home gardeners certainly cannot achieve. However, you can protect them in a greenhouse or other enclosure. You can build a small greenhouse around your plants with pipes and plastic sheeting, so you don't have to construct a major building. The recommended isolation distance for corn is two miles, which can also be a problem, but a good windbreak can reduce that distance significantly.

Cabbage, cauliflower, broccoli, celery, garlic, chives, Brussels sprouts, and most beans require an isolation distance of up to one mile.

Carrots, cilantro, cucumber, kale, gourds, pumpkins, squash, cantaloupe, and most melons require an isolation distance of up to half a mile.

Some plants require isolation distances of 50 feet or less. If you plant them carefully, you can isolate them within your garden. For example, the distance for peas or eggplant is 50 feet, for potatoes 30 feet, and for lettuce 25 feet. Peppers need a distance of about 500 feet, so you will need to find out whether your neighbors are growing peppers.

The best way to provide adequate isolation is to use raised garden beds or build borders around your gardens and then provide windbreaks. A windbreak can be a wooden lattice doubling as a trellis for grapes or other vines or a wall made of wood, bricks, or other materials.

Seed Harvest

Many factors go into choosing the seeds you will preserve yearly. This is something that you will want to be exceedingly careful with, choosing and handling the seeds with the utmost care. You don't want to damage the seeds that you are hoping to store for the next growing season.

There are various methods of seed harvesting depending on the type of seeds one is harvesting. The method are majorly divided into mechanical and non-mechanical methods. Non-mechanical methods involve the use of hands. This is an arduous task and often seed yields are low. On the other hand, Mechanical methods involve the use of harvesting machinery such as combined harvesters, and vacuum harvesters.

Make sure you leave the harvesting of your seeds until they are mature. So just when are they ready? Most seeds are generally ready when their pod, capsule, or husk has dried on the plant. Wait until some seeds have fallen off or popped out of their pods.

You will have a much better germination rate if you wait till your seeds for saving are ‘dead ripe.’ One way to ensure you keep all the seed is to cover the seed head with an old pantyhose and rubber band. Make sure the rubber band is secure but not too tight.

The best time of day to harvest is mid-morning before the sun becomes too hot, but any moisture has dried out.

Select the healthiest and most vigorous plants from any planting group to harvest. You will have to give up eating that specific vegetable because you want it to mature, produce flowers, and set seeds for you to collect.

Saving seed from the best, disease-free plants gives next season's crop every advantage.

If you’re not covering plants for harvesting with a stocking or similar, tie a bright ribbon (as pictured on the leek below) on your selected plants so that they are not harvested by mistake before seeds have ripened.

Seed pods can be ruined for harvest if it rains several days before maturing. If seed capsules get wet at harvest, allow them to dry thoroughly by spreading pods on newspaper in a dry, shady place.

To dry out, you can hang larger seeds, such as beans, in hessian bags. Larger seeds will take longer to dry out completely.

Once you have selected the plants from which you intend to save the seeds, the first step is to identify the chosen plants so that they do not accidentally end up in the soup pot or the composition of the flowers before you have had the opportunity to collect the seed you want. Some gardeners attach a cloth or light wire to their individuals who produce elite seeds. Others mark the plant with a pole. Make

sure the rest of your family knows which plants should not be harvested.

Time

Your next concern will be determining the right time to harvest the seeds. Seeds harvested too early, before they have time to ripen, will not have had the opportunity to accumulate enough stored food to start well or even to last the entire winter. These seeds are likely to be thin and light in weight. It will be less likely to survive storage, germinate well, or produce solid seedlings.

Seed crops, such as corn, wheat, beans, and others where the seed is the edible part of the plant, usually hold their seeds for a while after reaching maturity, giving you the chance to make your collection more or less when you choose, until the seed has become completely dry. Mature plants with dry seeds that rely on wind or rain can be cut and stacked to heal and dry further before removing the seed.

Some plants break easily as soon as they reach maturity. Lettuce, onions, okra, mustard family members, and many flowers not only lay their ripe seeds as soon as they are dry; they also gradually ripen the seeds so that a single plant will usually have a good pair of hanging bitter seeds as the ripe seeds fall out.

To catch a good crop of seeds from these plants, you must inspect them daily and collect ripe seeds in small amounts in a paper bag as it prepares or attach a broken paper bag to the seed head. The seeds they collect in the bag may still contain immature specimens, but these can usually be scanned by pouring the seed from one container to another in a breeze. Some plants in this group,

especially those in the Mustard family, will need a pole to support the seed stem. When harvesting most seeds, try to do the work on a dry and sunny day after the dew has evaporated. However, the seeds of the plants in group three above are often harvested when wet to avoid seed loss. Although most of the seeds you harvest in the fall will not be affected by the low temperature of a slight frost, the frost can cause a build-up of moisture that will reduce the quality of the seeds.

Humidity

How much moisture is too much? Depending on their variety, seeds differ in their ability to absorb water from the air, even under the same temperature and humidity conditions. For safe storage, beans, peas, and cereals (including corn) should not contain more than 13% moisture. Soy should have a little less - 12.5%, and peanuts and most other vegetables even less moisture - about 9%, with 4-6% ideal for long-term storage.

Once the seed has been dried for storage, it must be kept as dry as possible. If the seeds get wet after the initial drying, they will lose part of their longevity even if they are dried again. Sealed and moisture-resistant containers, such as cans and jars, are the best place to store seeds, but only if the seeds are good and dry before being set aside. Wet seeds stored in covered containers deteriorate faster than dry seeds in open storage.

Silica gel can be used in the permanent storage container - equal parts weight of seeds and silica. Many gardeners put the seeds in well-marked paper bags and store them in tight containers with loose silica gel on the bottom.

Temperature

The storage temperature also affects the quality of the storage of seeds. Most seeds can tolerate cold conditions and even frosts that would kill the mother plant, sometimes from 0°F. (-18°C), as long as they are completely dry. Excess moisture in a seed subjected to freezing temperatures can freeze and damage the seed.

Therefore, heat, especially when combined with high humidity, is the enemy of seed quality. The high temperatures not only accelerate the internal chemistry of the seed; they also promote the activity of fungi, bacteria, and insects that further compromise the vitality of the seed by adding the heat of their breaths and sometimes by excreting chemicals or other by-products that harm the embryo or soften the tegument.

Long-term storage in the refrigerator or freezer is the best solution until the moisture content of the seed is low, and the container you use is vapor-tight. When removing the seeds from the freezer, leave the container closed while the seeds heat up to room temperature. Otherwise, condensation will form on the seeds.

Insect

Invasive insects can be prevented by storing seeds in tightly closed containers. Suppose the eggs of insects are already present in the seeds. In that case, they can be discouraged by maintaining a temperature not exceeding 40°F to 5°F. (From 5°C to 10°C), the level at which most insects that could affect the seed would be relatively inactive. Freezing, of course, destroys or completely immobilizes insects.

From the previous sections, you can see that the vitality of a seed, far from being an absolute value, strongly depends on the storage conditions — not only in the first year but for the seed's life. For example, onion seeds, generally considered short-lived, are stored for up to 12 years when they are dry and well-sealed but deteriorate within a few months when stored at high temperatures in a damp place.

Desiccation-Intolerant Seeds

These are seeds that do not store well for long periods. These seeds include aquatic plants, some trees, and large-seed plants, but the majority of common garden plants that you are familiar with are not desiccation intolerant. Desiccation intolerant plants do not go into stasis when stored. They must be stored in warm temperatures with damp paper towels, peat moss, or sand. The container they are stored in must either have the top loosened or holes poked in it to allow airflow. These seeds should be stored only for short amounts of time. If stored for excessive periods, these seeds will start to dry out and most likely die.

Desiccation-Tolerant Seeds

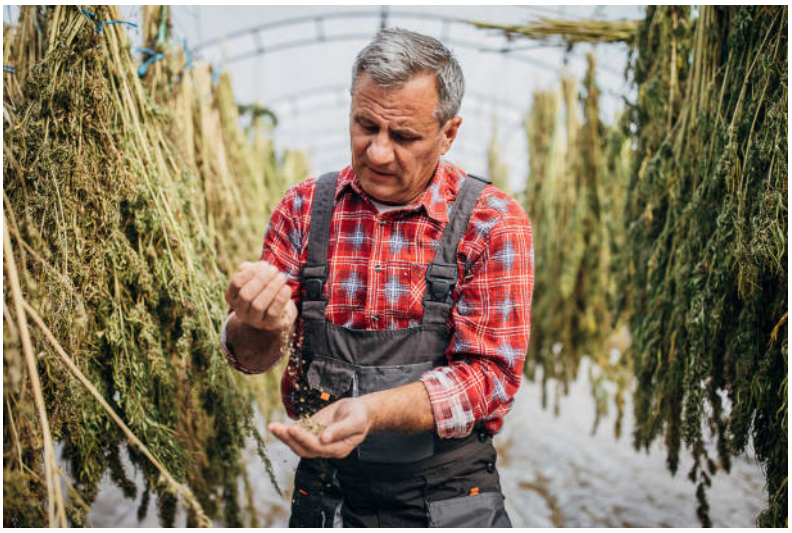
You will encounter these most common garden seeds while growing heirloom seeds. Desiccation tolerant seeds can be wet or dry. The term simply refers to the seeds' ability to hold up while in storage. Desiccation tolerant seeds can typically be stored for long periods without affecting germination during the next planting season or session.

The best way to store your seeds is by freezing them. This will protect them from any issues arising and keep them for longer periods. Freezing the seeds prevents any damage from disease, insects, and mold or mildew.

If you are not going to store your seeds in a freezer, it is of utmost importance to ensure that seeds are dried fully for storage and free of insects. Seeds that are not properly dried are the main reason mold or mildew builds up while in storage. Also, since the freezing temperature will not force insects into stasis, stored seeds must be free of insects that can also cause destructive results.

Temperature also plays a vital role in storage. Seeds that are in stasis become comfortable with their surroundings. Because of this, do not move stored seeds around often and especially do not alter temperatures frequently. If you are retrieving a sampling of seeds from a container, allow the entire container to rise to a warm temperature before opening gradually. This will prevent shock and death.

Seed Extraction and Drying



After harvesting fruits containing seeds such as tomatoes, peppers, pumpkins, and melons, your first job is to separate the seed from the pulp. Scrape off the lean part of the fruit and save the rest of the overripe meat for your hens or put it on the compost heap. Letting tomato seeds and pulp ferment for three or four days is a good idea to help control bacterial cancer. To do this, pour the lean tomato pulp into a saucepan, add about ¼ cup of water and observe that the light pulp and unnecessary seeds rise and flow heavier and more good seeds in the next few days.

Threshing usually removes peas, beans, soybeans, and lime from the dried pods. Don't be too rough on these seeds, though. Internal injuries of seeds are more likely with machine treatment but can occur when force is used to remove seeds from their envelopes. Damage to the seed may not be noticeable, but if the stem or embryonic root is bruised, the seed may germinate poorly or produce rickets seedlings.

Seeds of lettuce, sunflower, dill, calendula, and other dry-harvested plants can be shaken through a cloth screen to sift the sequins.

Removal of unwanted light seeds and parts of the stem and leaves, as well as the pulp, can be carried out by floating. When you put the seeds in the water, the "loss" of seeds and pulp increases, and the right seeds flow. Seeds other than tomatoes that you treat in this way should be quickly distributed for drying.

Moisture

You will not be able to tell the exact moisture content of the seed in house conditions, of course, but you can give your seeds a long period of complete drying before storage, which should be enough. The critical thing to remember is not to pack any harvested seed until it has had at least a few days of air drying after being removed from the plant. The larger the seed, the longer the drying period.

Most seeds, in most climates, dry properly for storage at home if they are spread on paper towels or newspapers in a ventilated place for a week. They must be turned over and spread on dry fresh paper (depending on the type of seed) several times during this period.

A much safer method of accelerating the drying process is to spread the seed on screens, on a flat roof, or on the sidewalk, in the sun, for a day or two of intensive drying.

Many Seed Savers use silica gel (available in many pharmacies, grocery stores, crafts, or hardware stores) as a desiccant. Mix the air-dried seeds in an airtight container with an equal weight of silica gel. Most of the silica gel is processed to transform the color when it has absorbed its maximum moisture. Silica Gel can be oven dried to be reused.

After the seeds have dried, do not let the seeds sit in the fresh air. Otherwise, they will absorb moisture from the room.

Characteristics of Healthy Seeds

There are a few things that you should look for when choosing seeds to store and replant each year. The first thing you want to look for is its viability. This ensures that the majority of the seeds you store are prone to germination. You don’t want to save and plant seeds that will not end up producing the plants you expect them to produce. This can be seen in the early growing stage. See what plants are the strongest and fastest to germinate and store seeds from those.

Another thing you want to look for is vigor when choosing your heirloom seeds. This correlates directly to viability. You want to watch your seeds thrive, not wilt, or worse yet, not grow. Make sure to look at how the plants thrived the previous year and pick seeds from the batches that grew the most vigorously. You want seeds that will grow well, and choosing from plants that grew well gives your seeds a fighting chance.

Healthy seeds should be pure. This is in terms of its genetic characteristics. It should be free from all sorts of contamination. In

general, the seed should be free from weed seeds, other crop seed and any other inert materials.

The moisture content of a seed can also be checked while identifying a healthy seed. A healthy seed should contain a definite moisture amount. For every seed, the moisture content depends on its variety, type, and even the seed species. For example, for cereals the moisture content should be 12-14%.

Weight of a seed can also determine whether the seed is healthy. With limitations of some seeds, a healthy seed should be heavy in its weight. A heavy seed shows that the seed contains more food material to aid in growth of embryo.

When a seed is over-age, it may not be so healthy. A good quality seed should be congenial aged. The longevity and germination capacity of seeds is reduced when it is more aged.

A healthy seed should be free from pests and diseases. Pests and diseases make a seed vigor-less, decrease its germination percentage and makes it less viable.

Maturity is also important when choosing the seeds you want to save. Fortunately, growing plants that are not chemically treated and grown commercially makes this step a little easier. Commercial farmers often pick seeds before ripening to ensure they stay good longer. Still, by growing your heirloom seeds, you can already allow your fruits and vegetables to grow to full maturity. This will then make the selection of seeds to keep for the next growing season easier.

The size of the seed goes hand in hand with maturity. You want to ensure that the seeds you are planting are saving a large size. The more mature a plant, the larger the seeds will be. Small seeds also

have less vigor and viability. Small seeds are more likely not to become germinated through pollination and will likely not reach the blooming stage. If small seeds do make it past pollination and manage to start to grow, they will be more likely to die or yield small amounts of produce.

These factors all correlate, and it is important to pay close attention to all as you start to grow your heirloom seeds and choose which plants you will save seeds from for the next year. You want to ensure you continue saving strong seeds to continue producing strong plants from year to year. If you choose weak seeds yearly, you will continue to produce weak plants. Choosing the strongest seeds will make growing your heirloom garden much easier and more satisfactory.

Consciously Choosing Seeds

Knowing the seeds you choose is crucial in choosing what will be best for your next planting season. You want to be sure that you are saving seeds that will provide the optimum output next year. You also want to make sure you are choosing seeds without prejudice. This means you are not choosing seeds that grow particularly well in your climate or grew well for you one season. Seeds can be manipulated to grow better in your living and growing conditions. You want to ensure you are saving an equal amount of seeds from each plant you wish to continue growing. This will allow you to have a large enough crop to choose from the next growing season. You would rather have too many seeds than too few.

Cleaning and Storing Your Seeds

After carefully selecting the seeds you will save, it is crucial to understand that you must carefully clean and store your seeds. This is the extra work with heirloom seeds versus GMS or GMO seeds. Cleaning and storing seeds can be a tricky thing and can cost you to lose your batch if not done properly or taken careful care of. Of course, if you vigilantly clean and store your seeds, you should not encounter any issues.

Cleaning

You will have to clean two different types of seeds after harvesting. Your heirloom seeds will either fall into the dry or wet seeds category. Dry seeds are harvested when dry and wet seeds are harvested wet. Wet simply means from pulp plants. These seeds are eventually stored the same way but are cleaned differently.

Dry Seeds

Dry seeds are the easier of the two to harvest and clean. Dry seeds are left on their plants until they have sufficiently dried out. It is important to leave these seeds on their husks or in their pods on the plant until fully matured and dried. These seeds can be gathered early if rain is threatening to ruin all your hard work, but it is best to try and let these seeds grow to fruition.

After harvesting, keep seeds in their husks or pods until they are fully dried for cleaning. The percentage of water left in the seed is between 4-7%. You don’t want to let your seeds shrivel completely

from water withdrawal, but you want to ensure they are close to that point.

The next step to cleaning these seeds is to remove the chaff from around the seeds. This is everything that is still encapsulating your seeds. The easiest way to do this is simply to put them in a bowl or bucket and swirl them around, allowing the chaff to separate, revealing the seeds you will be saving. There are a few other approaches you can take. One is to slide seeds down a slightly curved board, allowing the chaff to separate from the seed, but this does not work for round seeds. Another is to drop husks or pods from several feet up into a bucket or onto a tarp, letting the chaff blow off the seeds. You can also consider blowing on the seeds while in the bowl to ensure no chaff is left on them. After all the chaff is removed, these seeds are ready for the next steps in storage.

Wet Seeds

Wet seed harvesting is similar to dry seed harvesting. Before harvesting these seeds, you should still wait until the fruits or vegetables are fully mature. When wet seed fruits and vegetables are ripened for seed harvesting and storage, they are frequently too ripe for eating. Wet seeds do not dry out before harvesting because they come from pulpy fruits and vegetables.

Scoop the pulp and the seeds into a bowl of warm water to harvest wet seeds. Wet, healthy seeds sink to the bottom of the bowl, while dead seeds rise to the top. Most pulp will float to the water's surface with the dead seeds, making it simple to separate the seeds you want to save.

Place healthy seeds in a strainer. Once you have sufficiently gathered the number of healthy seeds you desire, dab the bottom of the strainer to draw out excess water. After this is done, store seeds on a hard ceramic or glass surface. Do not store them on any type of paper, not even wax paper, as they will stick. Once on the hard ceramic or glass surface, store your seeds in a cool, shaded, dry place for a few days to let them dry out.

Fermenting Wet Seeds

You may want to consider fermenting your wet seeds. This will help to prevent plant-borne diseases in your seeds, keeping them healthy for the next growing season. Fermentation is not a requirement but is recommended if you are worried about a disease spreading and ruining your future crop. The process is easy to do and is completed before cleaning your wet seeds.

You must scoop out the pulp and seeds of the fruit or vegetable you want to ferment, just as you would when cleaning it. Instead of placing the contents in a bowl of warm water, place them in a jar. For a few days, keep the pulp and seeds at a warm temperature (75-85 degrees Fahrenheit). A light layer of white mold will begin to form on the contents of your jars. This usually indicates the end of the fermentation process. When the process is finished, clean your seeds according to the previously stated instructions for cleaning wet seeds.

It is important to ensure that your seeds don’t start to germinate during fermentation. This can be seen through your seeds starting to swell with moisture. Seeds can be salvaged for storing at that point, but they cannot be once they have sprouted green roots

(germination). At that point, the only hope is to plant the seeds immediately and hope they grow. This will be hard if ideal weather conditions have passed.

Seed Baths

If you do not want to ferment your seeds, you could give them a hot bath instead. The temperature should be around 125 degrees F. The time length is seed specific, so look up the seed-specific instructions for the one you're boiling and figure out how long it takes to kill all the bacteria without harming the plant.

Humid Weather

Seeds dried in humid conditions may require additional treatment to ensure they are dry enough to be stored. Silica Gel can be used. Fill a container halfway with Silica Gel and seeds, seal tightly, and store in a freezer or cold, dry place for 7-8 days. This will remove any excess moisture from the seeds. Reading the Silica Gel brand's specific directions is critical to verify instructions and avoid errors.

Seed Storage

It's time to store your seeds now that you've grown, selected, harvested, and dried them. During the winter, poorly dried seeds can deteriorate significantly. Losing a year's seed crop can be disastrous if you rely on homemade seeds for spring plantations or try to perform an inherited strain of a particular vegetable.

Remember that seeds continue their basic vital processes, albeit very slowly, even when dormant. The moisture in the air that they absorb combines with the stored food to form soluble food, which

then combines with oxygen in the air to produce carbon dioxide, water, and heat.

Since your seeds exchange elements and gasses with the atmosphere while they are dormant, your goal in conserving them should be to limit these exchanges to the minimum necessary to maintain life in the seed. This means avoiding any stimulation that would encourage the seed to accelerate its metabolism or damage the embryo if the stored seeds need to be protected from moisture and heat and from insects and other animals that would like to eat them.

Specifics of Common Seeds

- **Amaranth**: Self-pollinating. Capable of cross-pollination. Isolation is not imperative. Dry Seeds. Collect seeds as they dry on the plants, remove them, and store them in a paper bag for further drying. Do not let seeds get wet after drying. It will last many years if stored properly.
- **Arugula**: Insect pollination. Capable of cross-pollination. 660 ft. isolation suggested. Dry seeds. Allow seeds to dry on the plant, but do not allow over-drying, or pods will shatter and disperse. It will last four years or longer if stored properly.
- **Basil**: Insect pollination. Capable of cross-pollination. Isolation is not imperative. Dry seeds. Harvest seed heads and let them dry in a warm area. It will last up to 5 years if stored properly.
- **Bean Family**: Self-pollinated. Rarely capable of cross-pollination. Isolation is not imperative. Dry seeds. Pick beans after they have dried on the plant. Do not let water dampen dried seeds to prevent bean seeds from sprouting in the pod. It will last up to 4 years if stored properly. The bean family

includes garbanzo, chickpeas, purple hyacinth, lablab, soybean, lentil, tepary, Lima, butter, common bush, pole, edible garden and field peas, mat, moth, adzuki, mung, cowpeas, yardlong, and fava.

- **Beet Family**: Wind pollinated. Capable of cross-pollination. Isolation is not imperative. Dry Seeds. Must be grown through winter to produce seeds. Must be caged for pollination. Gather dried seeds from leaves. It will last up to 5 years if stored properly. Beet Family includes beets, chard, lamb's quarters, epazote, magenta-centered lamb's quarters, quinoa, and spinach.
- **Broccoli**: Insect pollinating. Capable of cross-pollination. 660 ft. isolation suggested. Dry seed. Must be grown through winter to produce seeds. Harvest seed pods before they start to split open. It will last up to 5 years if stored properly.
- **Broomcorn**: Self-pollinating. 660 ft. isolation suggested. Dry Seeds. Allow seeds to dry on the plant before harvesting. It will last up to 4 years if stored properly.
- **Brussels sprouts**: Insect pollinated. Capable of cross-pollination. 660 ft. isolation suggested. Dry Seeds. Pods must mature and dry on the plant. It will last up to 4 years if stored properly.
- **Cabbage Family**: Insect pollinated. Capable of cross-pollination. 660 ft. isolation suggested. Dry seeds. Must be allowed to grow through winter to produce seeds. Harvest pods after they have dried on the plant and become slightly brittle. It will last up to 4 years if stored properly. Cabbage Family

includes mustard greens, black mustard, rape, Siberian kale, rutabaga, broccoli, Brussels sprouts, cauliflower, collards, kale, turnip, Chinese cabbage, Chinese mustard, arugula, roquette, rocket salad, radish, and daikon.

- **Cantaloupe**: Insect pollinated. Capable of cross-pollination. ¼ mile isolation is suggested. Wet Seed. Store cantaloupe for three weeks after harvest before removing seeds. It will last up to 5 years if stored properly.
- **Carrot Family**: Insect pollinated. Capable of cross-pollination. Isolation is not imperative. Dry seed. Allow the seed to dry on the plant before harvesting. Bagging or caging is suggested. It will last up to 3 years if stored properly. The Carrot Family includes celery, celeriac, dill, chervil, coriander, cilantro, carrot, fennel, and parsley.
- **Cauliflower**: Insect pollinated. Capable of cross-pollination. 660 ft. isolation suggested. Dry seed. Carefully cut cauliflower when harvesting to leave partial (1 or 2 branches) to flower in spring to produce seeds. Allow seeds to dry on the plant before harvesting. It will last up to 5 years if stored properly.
- **Celery**: Insect pollinated. Capable of cross-pollination. Isolation is not imperative. Dry seed. Leave a healthy portion of the stump in the ground to mature till fall or through winter to produce seeds. Let seeds dry on the plant before harvest. It will last up to 5 years if stored properly.
- **Chives**: Insect pollinated. Capable of cross-pollination. ¼ mile isolation is suggested. Dry seed. Leave a few chive seeds to

flower in the spring and then harvest seeds when dried. It will last up to 2 years if stored properly.

- **Collards**: Insect pollinated. Capable of cross-pollination. 660 ft. isolation suggested. Dry seed. Leave a small number of leaves from the plant through fall or winter to allow seed formation. Harvest when seeds are dried in spring. It will last up to 4 years if stored properly.
- **Cilantro**: Insect pollinated. Capable of cross-pollination. Isolation is not imperative. Dry seed. Allow seeds to dry on the plant before harvesting. It will last five years or longer if stored properly.
- **Corn**: Wind pollinated. Capable of cross-pollination. 660 ft. isolation suggested. Dry seed. Time isolation is recommended. Allow seeds to dry on husks but harvest quickly afterward. Keep the seed population strong by harvesting seeds from at least 100 stalks. It will last up to 3 years if stored properly.
- **Cotton**: Insect and self-pollinated. Capable of cross-pollination. ¼ mile isolation is suggested. Dry seed. Hard to harvest, cotton seeds are exposed after pods pop to reveal them.
- **Cowpeas**: Self-pollinated. Rarely capable of cross-pollination. Isolation is not imperative. Dry seed. Allow pods to dry on plants before harvesting. Do not get wet after drying. It will last three years or longer if stored properly.
- **Cucumbers**: Insect pollinated. Capable of cross-pollination. ¼ mile isolation is suggested. Wet seed. Allow cucumbers to ripen on the vine until past eating quality. Then let ripen 20 days

longer after being removed before harvesting seeds. It will last up to 10 years if stored properly.

- **Dill**: Insect pollinated. Capable of cross-pollination. Isolation is not imperative. Dry seed. Allow seeds to dry on the plant before harvesting. It will last three years or longer if stored properly.
- **Eggplant**: Self-pollinated. Capable of cross-pollination. Isolation is not imperative. Wet seed. It should be left on the plant until it passes the eating stage. It will turn translucent and dry when harvesting ready. It will last five years or longer if stored properly.
- **Fava Beans**: Self-pollinated. Rarely capable of cross-pollination. Isolation is not imperative. Dry seeds. Allow pods to dry on the plant before harvesting. It will last three years or longer if stored properly.
- **Fennel**: Insect pollinated. Capable of cross-pollination. Isolation is not imperative. Dry seeds. Allow seeds to dry completely on the plant before harvesting. It will last three years or longer if stored properly.
- **Gourds**: Insect pollinated. Capable of cross-pollination. ¼ mile isolation is suggested. Wet Seeds. Allow gourds to ripen on the vine before harvesting. It will last five years or longer if stored properly.
- **Kale**: Insect pollinated. Capable of cross-pollination. 660 ft. isolation suggested. Dry seeds. Allow pods to fully dry on the plant before harvesting. It will last up to 4 years if stored properly.

- **Lamb's Quarters**: Wind pollinated. Green crosses with green, magenta crosses with magenta, but they do not cross-pollinate the same variety. Isolation is not imperative. Dry seed. Allow seeds to dry on the plant before harvesting. It will last five years or longer if stored properly.
- **Lettuce**: Self-pollinated. Cross-pollination under some circumstances. Isolation is not imperative. Dry seed. Flowers open in the morning for seed harvest and open for long periods. Allow seeds to dry on the plant before harvesting. It will last three years if stored properly.
- **Mustard**: Insect pollinated. Capable of cross-pollination, but only with the same variety of mustard plants. 660 ft. isolation suggested. Dry seed. Allow seeds to fully dry on the plant before harvesting. It will last four years or longer if stored properly.
- **Okra**: Insect pollinated. Capable of cross-pollination. 825 ft. isolation suggested. Dry seed. Allow seed pods to dry on the plant before harvesting. It will last up to 4 years if stored properly.
- **Onion**: Insect pollinated. Capable of cross-pollination. ½ mile isolation is suggested. Dry seed. Allow seeds to dry on plants before harvesting. Also capable of replanting through the bulb. It will last up to 2 years if stored properly.
- **Parsley**: Insect pollinated. Capable of cross-pollination. Isolation is not imperative. Dry seed. Biennial. Allow seeds to dry on the plant before harvesting. It will last up to 3 years if stored properly.

- **Pea (garden and snow)**: Self-pollinated. Not inclined toward cross-pollination. Isolation is not imperative. Dry seed. Allow seeds to dry in pods on the plant before harvesting. Do not let it get wet after drying has begun, or it is susceptible to mold. It will last up to 2 years if stored properly.
- **Peppers**: Self and insect pollinated. Capable of cross-pollination. 30 ft. isolation suggested. Dry seed. Allow seed pods to dry on the plant before harvesting. It will last up to 3 years if stored properly.
- **Pumpkin**: Insect pollinated. Capable of cross-pollination. ¼ mile isolation is suggested. Wet seed. Allow pumpkins to continue to ripen three weeks after picking before harvesting seeds. It will last five years or longer if stored properly.
- **Radish**: Insect pollinated. Capable of cross-pollination. 660 ft. isolation suggested. Dry seed. Allow seed pods to dry fully on the plant before harvesting. It will last up to 5 years if stored properly.
- **Sorghums**: Self-pollinated. Not inclined toward cross-pollination. 660 ft. isolation suggested. Dry seed. Allow seeds to dry fully on the plant before harvesting. It will last up to 4 years if stored properly.
- **Squash Family**: Insect pollinated. Capable of cross-pollination. ¼ mile isolation is suggested. Includes both dry and wet seeds. Allow dry seeds to dry on plants before harvesting fully. Allow wet seeds to mature in the plant until past the eating stage and store for 20 days after picking before harvesting. Storing time of seeds varies depending on the type of plant. Squash Family

includes watermelon, citron, muskmelon, cantaloupe, honeydew, cucumber, banana, buttercup, Hubbard, turban, pumpkins, cushaw, butternut, cheese, acorn, crookneck, scallop, spaghetti, zucchini, gourds, angled luffas, smooth luffas, and chayote.

- **Sunflower**: Insect pollinated. Capable of cross-pollination. ½ mile isolation is suggested. Dry seed. Allow seeds to fully dry on the plant before harvesting. Store and plant seeds in the kernel for protection of the seed. It will last five years or longer if stored properly.
- **Swiss chard**: Wind pollinated. Capable of cross-pollination. Isolation is not imperative. Dry seed. Allow seeds to fully dry on the plant before harvesting. It will last up to 5 years if stored properly.
- **Tomatillo**: Self-pollinated. Capable of cross-pollination. 30 ft. isolation suggested. Wet seeds. Allow plants to ripen on the vine before harvesting seeds fully. It will last up to 3 years if stored properly.
- **Tomatoes** Self-pollinated. Not inclined toward cross-pollination. 30 ft. isolation suggested. Wet seed. Allow the seed to mature on the plant at least until the eating stage, preferable longer, before harvesting. Fermentation suggested. It will last up to 4 years if stored properly.
- **Turnip**: Insect pollinated. Capable of cross-pollination. 660 ft. isolation suggested. Dry seed. Allow seeds to fully dry on the plant before harvesting. It will last up to 5 years if stored properly.

- **Watermelon**: Insect pollinated. Capable of cross-pollination. ¼ mile isolation is suggested. Wet seed. Pick plant after tendril closest to melon has completely shriveled dry and store three weeks longer before harvesting seeds. It will last five years or longer if stored properly.

How to Store Seeds

Seeds germinate when the temperature is right, and there is enough water and oxygen. To safely store seeds, ensure they don't get too hot and don't have access to the water and oxygen they need to germinate. You should also keep them away from direct sunlight.

If you take precautions to keep these three elements from reaching your seeds, you can store them for an extended period before replacing them. Some seeds can be stored for 10 to 20 years depending on the seed type, how well they were dried out, and the storage method used.

Dry Your Seeds First

If you collected the seeds yourself, they need to be dried until they only contain 4% to 8% moisture. The easiest way to properly dry seeds is to bring them up to 100° F and keep them there for 6 to 8 hours. If you're buying your seeds from a reputable source, they should already be dried, and you can skip this step.

The following techniques can be employed to dry seeds:

- Set a food dehydrator to 100°F and dry the seeds for 6 hours.
- Place the seeds in a gas oven and use the heat from the pilot light to dry them. Leave them in the oven for 6 hours.
- Use the interior light of an electric oven to heat the seeds to 100°F for 6 hours.
- Turn a conventional oven to its lowest setting and prop the door open enough to where the heat in the oven is 100°F. Dry the seeds for 6 hours.
- Spread the seeds out on a tray and dry them in the sun. It's tougher to achieve 100°F this way, so you'll have to watch the seeds closely and move them out of the sun when they're done.
- Once you think the seeds are dry, check them closely before storing them. Bend larger seeds in half. They should snap before you can touch one end to the other. Hit larger seeds with a hammer. They should shatter and turn to dust.

Preventing Light, Oxygen, and Water from Reaching the Seeds

Your seed storage method is only as good as the container the seeds are stored in. If the container allows air and oxygen in, your storage method is ineffective, and the shelf life of the seeds will be drastically reduced. This can be dangerous because seeds rarely show any signs of degradation. Seeds that have gone bad won't germinate when planted in the ground.

To keep air and water out of your seeds, store them in an airtight container. Seal the container and place it in a tub of water to see if it is truly airtight. Weigh it down, completely submerged, and leave it

for a couple of hours. When you pull the container out of the tub, if there is water inside, you know it isn't a good container to store your seeds in.

Never assume the packages seeds come in are airtight. You can leave them in the packets as an extra layer of protection, but the packets shouldn't be the only thing separating the seeds from the outside world. Some people store their seed packets in airtight Tupperware containers, while others opt for sealable freezer bags. Wrap the container in a paper bag to prevent light from reaching the seeds.

Another option is to vacuum pack the seeds. This will extend the life of the seeds because it removes much of the air and moisture inside the container and prevents new air and moisture from making their way inside. It's still a good idea to keep the vacuum pack of seeds wrapped in a paper bag to keep light out.

Here's a handy trick to further protect your seeds from moisture.

Place the seeds into an airtight container or bag and seal them. Place the sealed bag into another sealable container. Add dry milk, rice, or a desiccant pack or two to the outer container and seal the container. Moisture has to make it through multiple levels of security before getting inside.

Make sure you label the packages as you pack your seeds away. You don't want to unwrap a bunch of packages when looking for a certain type of seed, especially when you have a large collection. Be sure to include the date on the package, so you can easily tell when the seeds were packed away.

Keep Seeds Cool

Seeds kept at room temperature will slowly but surely get weaker and weaker until they're no longer viable. The seed's embryo consumes the energy units stored inside it while it waits for the water, sunlight, and oxygen that never comes.

When a seed is left at room temperature, the embryo slowly but steadily runs out of food.

When seeds are frozen, they enter a state of suspended animation in which they are alive enough to reactivate and germinate when returned to room temperature. Nonetheless, they will not deplete their stored energy reserves. Seeds can also be stored in a cold basement, root cellar, or refrigerator.

Saving Seeds from Your Garden

For many gardeners, the garden begins in January when the first seed catalog arrives in the mailbox. As the cold wind howls outside, we retreat to a comfortable chair and browse the catalog. We carefully observe the varieties of lettuce and tomatoes to wish we had the space to plant each flower skillfully displayed on its pages.

But have you ever wondered where your great-grandparents got their seeds for their gardens before seed catalogs and fancy gardening centers existed? They saved the seeds from their garden for the following year!

Saving seeds from your flowers or vegetables is a lovely way to fully experience the plant's life cycle. It is also much less expensive than purchasing seeds every spring, and the seeds of your plants will be well adapted to the unique growing conditions of your garden. Not only that, but it is also a fairly straightforward procedure.

Keep seeds only from vigorous and healthy plants. Some plant diseases can be repaired in the seeds, which will then be passed on to the next generation of plants. So do not save the seeds of a plant

that is sick or has struggled all season. Choose the seeds of plants with the characteristics you want, such as height, robustness, early or late ripening, flavor, or vigor.

It is not recommended to store seeds of hybrid plants. Hybrids result from crossing two genetically different mother plants, both severely inbred to concentrate desirable characteristics. The first generation, called hybrid F1, is superior to its parents. But subsequent generations of plants grown from saved seeds of an F1 plant tend to return to the characteristics of the original ancestor plants casually.

Plants that are not Hybrid are called free pollination. Many seed catalogs will identify which of their seeds are hybrid or pollinated in the open air. If you save your seed, always start with open-pollinated seeds. Some of them can be identified as seed inheritance. These inherited varieties have been handed down for generations, often saved within the same family for many years before becoming accessible to the general public.

Cross-pollination is another concern for the gardener who saves seeds. Cross-pollination often gives seeds with a different genetic composition than the mother plant. Pumpkins, pumpkins, and small pumpkins can cross each other, which gives seeds that will grow to produce rather picturesque fruits. Sweet corn intersects with field corn or popcorn, and your 6-inch marigolds intersect with your neighbor's 18-inch pompom marigolds. However, the crossing will only take place within one species. Cucumbers do not cross with pumpkin, and the cosmos do not intersect with thoughts.

To avoid cross-pollination, keep two varieties of the same species separated by as much space as possible. Some species, such as corn, are wind-pollinated, and pollen can travel great distances.

These plants must be pollinated by hand and isolated from other varieties of their species. This can be done with corn, for example, by attaching a small paper bag to the selected ears before the Silk emerges, and then once the Silk has appeared, it is hand-pollinated with pollen of the same plant or its healthy neighbors.

Try to save the vegetable seeds or flowers from your garden this year and make them grow next season. This infinite cycle can allow you to realize the endless joy of gardening through all seasons and all stages of a plant's life.

Saving Seeds from Your Herb Garden

Many gardeners like to save the seeds they collected in their herb gardens. This way, they have many seeds to plant next year. When the seeds are fully ripe and fragrant, it's time to collect them. Looking for mature seeds for harvesting is an enjoyable experience, and you'll have plenty of seeds to cut and save for planting during the next gardening season.

When the flowers of the plant are almost completely ripe, cut the stems of the plants at the base. Tie the ends of the rods with a strong elastic band or rope. Cover the flower beds with a paper bag attached to the plant with rope, then hang the package upside down in a dry, dark place like an attic.

In a couple of weeks, take the package of plants with covered flower buds. Shake the package well to free the seeds from the flower buds. The seeds will be turned towards the bottom of the attached brown paper bag. You can use the saved seeds for the next gardening season if you store them in paper packages or envelopes in an airtight container. Place the airtight container in a dark place

until the seeds are used. Be sure to label each package or envelope with the type of seeds you registered and the date you stored them to facilitate planting next year.

Some plants do not easily move away from seeds. It is therefore important to know if the plants you want in your garden easily start from the seeds. Ask your local nursery if the grass you want to grow starts easily from the seeds. Otherwise, you will have to buy seedlings. Some herbs that easily move away from the seeds are lavender, basil, coriander, and chives.

Plants grow better from self-pollinating seeds. Since many herbs pollinate, you should be able to collect a large selection of seeds from your garden. But do not collect seeds of plants pollinated by bees. The cross-pollination from bee pollination can give you unwanted surprises when your plants grow and grow.

Do not save seeds of hybrid plants. Seeds of hybrid plants do not reproduce the same plant as the mother plant. But if you have healthy or rare plants in your garden that you want to breed, saving seeds is a great way to get more plants without buying seeds. Saving from seeds is the only way to get rare or old plant varieties that cannot be found even in nurseries.

How to Preserve Tomato Seeds

Saving tomato seeds for the next season is a simple task. It can be made for the vegetable garden and your commercial harvest. If you want to save the seeds and get better results, follow a few simple but important rules. Here is some helpful information to help you develop a healthy tomato culture for the coming seasons.

To obtain seeds, we must first learn how to extract them from tomatoes. This lengthy but simple procedure is simple enough to practice at home. Try to find tomatoes from the healthiest plants, as they will be the best candidates to reproduce a healthy harvest for the following season. Allow the larger ones to ripen until their skin wrinkles, then pick them up. Choose fallen tomatoes because they will not produce good seeds.

Now, remove the seeds from the tomatoes you've chosen. Gently cut and extract tomato seeds with pulp and gel around them. Place them in a glass and cover them with a paper plate or cheese cloth to avoid dust for two or three days.

Fill the glass with water and let the seeds separate from the pulp, then filter the seeds by draining the water. Gently clean them and spread the seeds on a flat, dry surface. Let them dry for about a week. After about seven days, do their drought test, choose a seed and fold it. If it bends, it is still wet. In case of breakage, it is dry and ready for storage, or give it another day to dry. The weather will be dictated by your area's temperature and humidity levels.

It is now time to store the seeds. To save seeds, you must use clean, airtight containers or envelopes. Choose a clean, dry container. After cleaning the container, ensure no more moisture because if it remains dirty or wet, the seed will no longer be useful due to mold or fungus. After placing them in the container, label them with the name of the tomato variety and the duration of storage. When the seeds have been properly stored, select a safe location for the container, which must be dark and cold, as moisture and heat are the seeds' enemies. You can also store them in your refrigerator.

Book 3: Testing the Germination Rate

If you're concerned about the viability of seeds you've kept for a few years, test their germination rate regularly to ensure they're still viable. Even when stored in the best conditions, seeds can go bad, and you don't want to waste time and effort planting seeds that will only grow into a few (or none at all). When gardening for survival, the stakes are high, so it's critical to stack the deck as much in your favor.

Germination Tests

The process by which the embryo within the seed grows and develops into a seedling is known as germination. Growth resumes with the germination stage after the state of dormancy, in which the embryonic plant within the seed is prevented from growing. Only in favorable conditions inside and outside the seed will the seed germinate and resume growth to become a seedling.

So, what factors influence seed germination? It may appear impossible, but different processes occur within these tiny seeds.

If you're wondering about the viability of seeds you've had stored away for a few years, test the germination rate of the seeds occasionally to ensure they're still viable. Even when stored under the best conditions, seeds can go bad, and you don't want to waste a bunch of time and effort planting seeds of which very few (or none at all) will grow into viable plants. The stakes are high when gardening for survival, so it's essential to tilt the odds as much in your favor as possible.

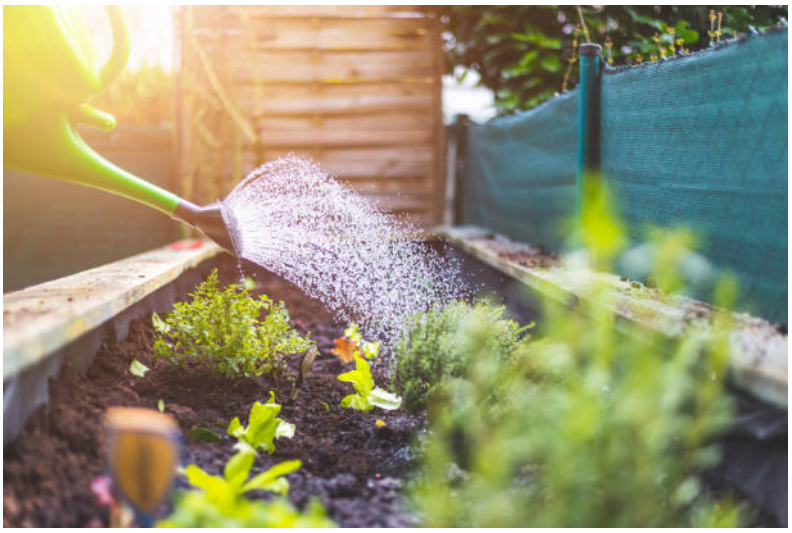
As seeds age, they don't all die at once. You'll gradually lose seeds, a few here and a couple there, until the germination rate has been reduced to practically nothing. Regardless of the storage method, the longer you wait to plant seeds, the more chances they'll have to die, and the fewer viable seeds you'll have.

Place 15 to 20 seeds between two damp paper towels to test germination. Place them somewhere with an ambient temperature of 65° F to 75° F and let them germinate. Check the seeds daily for germination. Some seeds, such as corn, wheat, and legumes, must be soaked in water before they will germinate. Some seeds may also

require stratification, which means they must be exposed to cold temperatures for some time before germinating.

If the germination rate is less than 70%, it is time to consider replacing your cache or planting it and collecting new seeds. Learning how to keep a survival garden from which you can collect both seeds and produce well before relying on your skills to survive is a good idea. Planting seeds to collect new seeds and rotate your stock is a great way to learn the ropes.

Test Your Plants' Drought Tolerance in Advance



It's a good idea to test your plant's water needs while learning the ropes. Water may be scarce in an emergency, and you will need to know precisely how much water your plants need. There's no use wasting valuable water on plants that aren't going to produce anything useful. Knowing how much water your crops need allows you to save the water you have instead of wasting it watering crops that aren't going to grow into healthy plants.

Divide your garden into sections to test your plants' tolerance to a lack of water. Make sure to space the sections far enough so that water from one section does not drain into another. Give a different amount of water to each section. Water one section of the garden with small amounts of water once a day. Water another section with the same amount every other day. Every third day, water another section with an equal amount. When your plants are not given enough water, they may not grow, or they may grow but produce nothing. Calculating the amount of water your plants stop producing

provides a baseline for determining whether you have enough water to grow your crops. If you dip below the baseline water amount, you can stop watering your crops and let them die. They won't produce anyway, and it's best to conserve your water for other uses.

Knowing the needs of your plants allows you to monitor how much water you're using in your garden so you don't waste water where it isn't needed. When water is scarce, every last drop counts. A wasted gallon here and there could mean the difference between having enough water to grow food successfully and not having enough water to survive.

When you test your plants and give them limited amounts of water, you may discover that some of your plants grow better than others in a single crop. These plants are predisposed to grow with less water. Harvesting seeds from these plants will provide seeds that grow better in drought conditions. Selectively growing and harvesting seeds from naturally drought-tolerant plants over several generations will eventually allow you to create a drought-resistant variety of plants ideal for survival farming.

Why Germination of Internal Seeds Can Give Misleading Results

Because parsnips do not transplant well, the results of indoor germination of these and many other plant species can be misleading. They have to be planted directly outside. So how can we assess their potential in the outdoors without wasting a lot of seeds?

Look at how these seeds grow in less-than-ideal circumstances. Spread your seed on moist kitchen paper, but keep it in a cool, dark spot with abrupt temperature changes for eight days, like at 28°C, just above the freezing point, or the same temperature as your garden.

You may determine the exact percentage of this seed's vitality by observing all the sprouting seedlings! The remaining seed can now be planted outside with confidence.

Grow your New Variety of Plants!

Another advantage of putting the seed through rigorous testing is that you will get very hardy plants if you pre-germinate the seeds in these conditions and plant only the surviving seedlings. Save the seed from them once they've grown. You can grow and stabilize your unique variety if they are pollinated outside (for example, not F1 or other hybrids) and kept from year to year. The one that is only suited to your microclimate.

Seed Viability and Germination Rate

Seeds have a limited lifespan, meaning they must be used within a particular time or lose their ability to germinate. The longer you store your seeds, the less viable they become. Seeds won't all go bad at the same time. Instead, they'll go bad gradually over time. The longer you keep a group of seeds, the less likely it becomes that the seeds in that group will germinate.

Beans, for example, can be stored properly for up to 5 years. When you first harvest the beans, viability is at its peak. Viability deteriorates over time. Less of your beans will be viable after the first year than when you first harvested them. This means you'll need to plant more beans to get the same number of plants. You'll have a higher percentage of beans that aren't viable by the end of the second or third year. All the beans you've stored will eventually lose viability, and there's no telling when this will happen. When this happens, your entire bean collection will be worthless. Nothing will grow if you plant them.

You may notice germination rates listed on the seed packets you buy from the store. This rate is usually given as a percentage. If the seed packet states that the seeds are tested at 75% germination, you can

expect less than 75% of the seeds in the packet to germinate under ideal conditions. This means, at most, 75 out of 100 seeds will germinate, and 25 won't do anything.

Seeds harvested directly from a plant and properly dried and stored are more viable and have a higher germination rate than commercially collected seeds sitting on a rack in a hot nursery for months. Your germination rate should be higher than that of store-bought seeds as long as your plants were properly pollinated and your seeds were collected at the appropriate time. The trick is to determine how to extract the most viable seeds from your crops.

When plants don't get adequately pollinated, you'll end up with many seeds that look like good seeds but don't have the necessary components to grow into plants. Essentially, they end up as empty shells that masquerade as seeds but won't grow when placed in the ground. This can be devastating in a survival situation, as you'll have collected several no-good seeds, and you won't know until you try to plant them the following year.

Testing your seeds a couple of times a year allows you to determine the seeds' viability in your cache. I suggest testing viability when you harvest your seeds to ensure they're good seeds capable of being grown into plants and then testing them every six months to ensure they're still viable. The initial test allows you to set a baseline for viability that can be used to determine how many of your seeds are going bad. The more seeds you test, the better your results will be. If you only test 10 seeds, you're more likely to have skewed results than if you test 100 seeds. You could easily get different results when testing multiple sets of 10 seeds. This variance becomes less likely the more seeds you test. I like to test 100 seeds

simultaneously to determine the germination rate. If you don't have a lot of seeds saved and 100 seeds will put a big dent in your supply, go ahead and test 10 at a time. It'll still give you a decent idea of where you stand.

If I have initial viability of 50%, I know that the best I can hope for overtime is somewhere in the range of a 50% germination rate. That rate will drop over time, so I will need to store a lot of this type of seed in my cache. If I have 500 seeds stored, only 250 of them are currently good. On the other hand, if I have 5,000 of these seeds, I still have 2,500 good seeds. If I test my seeds at the 1-year mark and find I now have a 25% germination rate, I know that half of my viable seeds have gone bad. I will have to plant them soon and harvest new seeds, or I risk losing this type of crop from my seed supply. This isn't a huge deal in a non-survival situation because I can buy more from the store. It's a much bigger deal in a survival situation because allowing all or most of a certain type of seed to go bad will mean I lose that crop for good.

You can increase the viability of your seeds and the amount of time they last by properly storing them in a cool, dry place. For most seeds, the best place to store them is in an airtight container in a drawer in your fridge. Avoid storing seeds in the freezer because freezing your seeds can destroy cell membranes and render them useless.

How to Test Germination

Here's a quick and easy way to test the germination rate of your seeds:

- Dampen a paper towel with water and place ten seeds in a row on it.
- Fold the paper towel over the seeds.
- Repeat this process until you've reached the number of seeds you want to test. If you're testing 100 seeds, you'll end up with ten paper towels with ten seeds. You may be able to place more than ten smaller seeds on a single paper towel. Give each seed a bit of room to grow.
- Place the paper towels in a Ziploc bag, seal it up and place the bag in a warm location in your house.
- Check after a couple of days. Make sure the paper towels are moist.
- Wait two weeks, checking every couple of days and moistening paper towels, if necessary.

- After two weeks have passed (or longer, if testing a seed type that takes longer to germinate), open up all of the paper towels.
- Count the number of seeds that germinated. To get your germination percentage, divide the number of seeds that germinated by the total number of seeds you attempted to germinate.
- If you time things right, you can plant the germinated seeds directly in your garden, so you won't have to waste them.

Testing the germination rate of your seeds regularly allows you to closely monitor them to ensure there are no unpleasant surprises when it comes time to plant your seeds. You're better off learning that half of your seeds won't germinate than waiting until none of your seeds are viable. Saving seeds could mean the difference between having enough food to eat and dying of starvation.

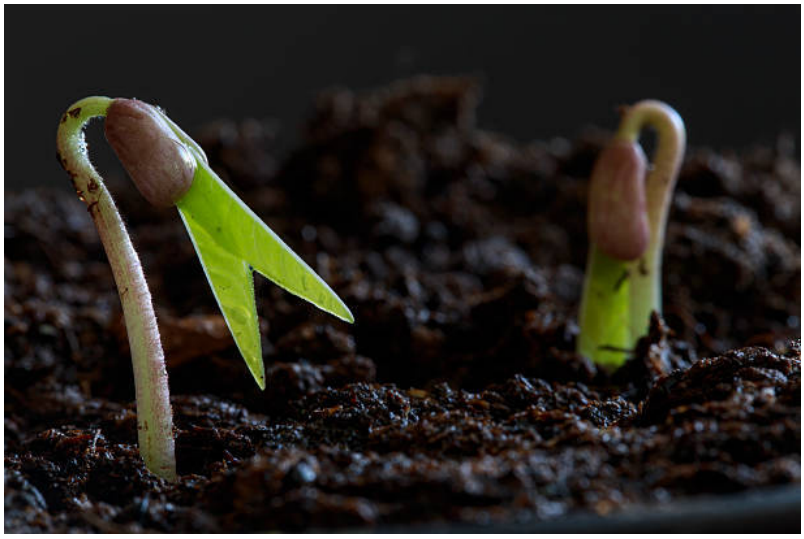
Organic Soil Amendments

Soil amendments are substances added to the soil, such as organic compost, natural fertilizers, and manure, to ensure the soil contains the nutrients plants require to grow. They can also be added over time to change the pH of your garden soil, making it more compatible with the crops you want to grow.

Don't rely on store-bought soil amendments because stores may be closed during a prolonged emergency. The chances of having soil amendments in stock at a reasonable price are slim, even if they are open.

Some soil amendments can be stored, but your supply will eventually run out. When this happens, you'd better be able to use the natural ingredients you have on hand.

Seed Dormancy



Seeds go into dormancy before entering the germination phase. Dormancy is a state in which the germination process is halted due to conditions within or outside the seeds. Seed dormancy is important because it allows for seed dispersal before germination. Dormancy also protects seeds and seedlings from harm or death during inclement weather or from passing herbivores. Aside from these benefits, dormancy prevents the seed from germinating in an unfavorable external environment, such as when the weather is too hot or cold. Dormancy can last months or even years in many seed species.

There are two significant types of seed dormancy: **endogenous** and **exogenous** dormancy.

Endogenous Dormancy

Endogenous dormancy is the effect of the conditions within the embryo, and this type of dormancy includes:

- **Physiological dormancy** – This is when there wouldn't be any seed germination until the required chemical changes occur; the factors that usually affect this type of dormancy are temperature, light, and drying.
- **Morphological dormancy** – This happens when the embryo of the seed is underdeveloped. This immature embryo undergoes dormancy to give the embryo the time to grow further and fully develop.
- **Combined dormancy** – This is also known as morpho-physiological dormancy. This type of dormancy is a combination of the preceding types of dormancy.

Exogenous Dormancy

Exogenous dormancy is the effect of the conditions outside the embryo; this would include:

- **Physical dormancy** – This happens when the seeds cannot absorb water or are prevented from exchanging gases.
- **Mechanical dormancy** – This is when the protective covering or the seed coat is too hard to allow growth and expansion during germination.
- **Chemical dormancy** – These may involve leaching out of chemical growth inhibitors by natural factors like rain or snow and other means like washing or soaking the seeds
  Maximizing garden space for planting seeds.

A Step-by-Step Model for Beginners

Are you aware that compost is a natural fertilizer that provides nutrient-rich soil? Composting eliminates the need for expensive and potentially toxic fertilizers. Composting is the most efficient and environmentally friendly way to create a stunning garden.

Composting is widely used in many countries because it has numerous environmental benefits.

Take a look at the advice and information provided in the following sections to find out what you need to make foolproof compost and why you should do it.

What is Compost?

Compost is the natural result of organic material/matter biodegradation by worms, invertebrates, and microorganisms (fungi, bacteria, and yeasts). It can be used in your houseplant, yard, plant beds, or as a potting and seed starting mix.

Why Should You Make Compost?

- It's a natural fertilizer (It helps save money on chemical fertilizers)
- It assists in retaining soil moisture
- It also enhances drainage with even water retention
- It's free; you can reuse garbage and save cash
- It preserves waste disposal expenses - with increasing restrictions and rising council taxes
- It assists the environment. Your waste doesn’t need to be transported to landfill sites. It's 100% environmentally beneficial, meaning it doesn't pollute in any way

- It makes fabulous, healthy soil while recycling nutrients and developing structure
- It improves worm liveliness which is priceless for gardens
- It breaks up clay soil

What Must You Ensure Goes into Your Composter?

Do you know you can separate the two types of garbage that should be composted into 'greens' and 'browns'? Greens decay quickly and provide fundamental moisture and nitrogen.' Browns take longer (or are more hesitant) to decay, provide carbon and fiber, and allow the formation of air pockets. If you want to achieve the best balance, aim for roughly two parts 'Green' to one part 'Brown' in mass, with only minor amounts of 'What not to add.'

Here is a list of what you must add to your compost bin:

Greens

- Garden refuse such as weeds and grass clippings
- Urine – optionally diluted with water
- Herbivore droppings such as those of rabbits and guinea pigs
- Rotted manure
- Food scraps include fruit, vegetable peelings, tea, and coffee grounds.

Browns

- Diseased plants
- Disposable nappies

- Meat and fish
- Coal and coke ash
- Dog droppings and cat litter
- Cooked food
- Grease
- Dairy products
- Bones
- Fallen leaves
- Hair is reluctant to decompose but is a good source of nitrogen
- Eggshells – these will not decompose in the bin but will add relevant minerals
- Sawdust
- Straw
- Cardboard and paper such as egg boxes and newspapers
- Twigs, bark, and branches
- Natural fibers such as 100% wool or cotton
- Other ingredients

What not to add

- Very thick branches
- Weeds with seeds or harmful weeds

How to Make Compost

A good scale of 'Browns' and 'Greens' indicates ideal compost. Design your kitchen storage amenities to ensure your precious leftovers are not lost.

Following the addition of all of your products, all subsequent changes are automatic. Because decay is a natural process, simply keep adding until the bin is full and settled. Ensure all your paper and cardboard are stripped or broken up to expedite the process. Your compost should take six to eighteen months to complete using this method. If you want to speed up the process, ensure you turn in the material weekly and that your bin is directly under the sun. Once you've determined that your compost is dark brown, crisp, thick, and moist, with a sweet, earthy aroma, it's safe to use.

The Compost Bin

Compost bins are designed to help the composting process by blending their green color into garden aesthetics and having a robust edifice with a lid to shield the contents from the elements and help insulate. The good news is that you won't need to use surface agents like powders or bio-liquids to keep a modernized and high-quality compost bin. Furthermore, compost bins come in various sizes, so don't just buy the largest; instead, choose one that fits the size of your garden/backyard. A large space also makes removing and adding compost materials simple.

Survival Gardening

Choosing a Location for Your Survival Garden

Now is a good time to decide on a location for your survival garden. You'll have to think about a few things the average gardener doesn't have to do because you'll be growing food when good, healthy food like fruits and vegetables will be scarce. This means you'll either have to hide your garden out of sight, or you'll have to be able to defend your garden from roving packs of hungry people looking for food.

Growing a garden in plain view in the city is asking for trouble. While you may know and trust your neighbors, you never know what a person will do if they're desperate and think raiding or taking control of your garden is their best chance of survival. You also have to consider the risk that strangers will stumble upon your little oasis in the middle of the town and decide to take it for themselves. You may be able to scare off a few people who stumble upon your garden, but

you likely won't be able to fight off a sustained and coordinated assault.

Choosing a remote location away from the prying eyes of the hungry masses will allow you to produce on a larger plot of land with less fear of being discovered. You may have to leave your home and travel to a less-populated area to survive. Better yet, get away from the city and go somewhere off the beaten path. You can always commute to work in the city, giving you time to start your survival garden. Rather than starting from scratch, you will be able to begin growing crops on land that you know you will be able to grow on in an emergency.

If you cannot leave the city, scout out locations you can head to in advance. The more planning you do ahead of time, the better off you'll be in an emergency. If you have friends or family who live in the country, you can ask them if you can set up a small garden plot on their land in an emergency. They may be more receptive to it if you offer to supply them with fruit and vegetables as well.

Ideally, you will want to set up shop on land that belongs to you or someone you know. You don't want to worry about angry landowners stumbling across your guerilla garden on their property. Good luck explaining why you're growing tomatoes on their property to an angry landowner who thinks he's stumbled across an illegal marijuana growing site. Even if you convince him that the plants are just tomatoes, you're more likely to get arrested for trespassing. Land in the country is relatively inexpensive. If you can't afford a tract on your own, consider going in on one with like-minded friends and family.

And remember, the further off the beaten path, the better. Buy property along a busy country road, and you might as well stay in the city and try to grow your produce there. Even if you can find a spot hidden out of sight in the city where you can set up shop, you probably don't have enough space to grow enough produce to feed your family. A family of 4 will require at least ½-acre of land on which to grow produce if they're to survive on fruit and vegetables alone. It's doubtful that you'll be able to find half an acre of open land in most cities, let alone half an acre of land hidden out of sight that can be farmed. Ideally, you'll have at least an acre of land on which you can grow. This will allow you to grow extra food, so you don't end up starving if a crop doesn't grow or if it dies.

When choosing your location, don't forget an essential item: water. You're going to need easy access to a source of water. Don't forget that city water may not work or be so contaminated it can't be used. I've seen survival literature recommend people make sure the location they choose is close to a faucet with running water they can use to water their crops. Sure, that's great if the water is working, but what happens if pressure is lost and there is no running water? You're better off setting up your garden near a consistent water source like a river, stream, pond, or lake.

You can also set up a system through which you can collect rainwater to use for irrigation purposes. Many of these systems can be set up to attach directly to your rainspouts and trap water normally running right off your roof into the gutter. A couple of 50-gallon containers aren't going to cut it. You need to have the ability to store thousands of gallons of water if you plan on depending on rainwater to water your plants. If you have a well on your property, it

can also be a good water source—make sure you aren't entirely reliant on electric pumps to draw the water.

Making a Seed Bank

A survival seed bank is a collection of seeds preserved in a protected container as a long-term emergency survival assistance. It's an excellent approach to preparing for an emergency that necessitates home food production for your family's survival. Whether you are a prepper or just want to have enough seeds on hand to plant your garden in the spring, storing your seeds correctly is an excellent idea to minimize germination rate reduction. Survival seed banks, or collections, are widely accessible from various businesses. Purchasing a survival seed bank is a good alternative if your time is limited and you want the peace of mind that comes with an immediate purchase. Various veggies, herbs, melons, and other seasonal fruits are often available.

Basics of a Survival Seed Bank

To save money, you may create your survival seed bank, tweak it, and keep those that thrive in your growing circumstances. The fundamental thing is to place various heritage seeds in an airtight container and keep them in a cold, dry location. However, a few things will help the procedure go much more easily.

Choose Your Seeds Wisely and Properly Store Them

Purchase heritage seed varieties from a reputable supplier, such as Mary's Heirloom Seeds. They only sell open-pollinated varieties that

can be stored from seed year after year (or the second year after planting for biennials) and produce the same variety. Hybrid varieties result from two or more species being bred for specific characteristics. Hybrid seeds harvested at the end of the season may yield an edible crop, though results may vary. Stick to heirlooms for your survival seed bank.

Oxygen absorbers aid in removing oxygen from the container for up to a year and maybe longer. It's a good idea to replace the oxygen absorbers with new ones when you open the container. Silica gel packets absorb moisture and keep them from accumulating in your storage container. When combined with refrigeration or freezing, these items help to extend the storage life of your survival seed bank.

If the container is removed from cold storage and opened immediately, condensation may form on the seeds. Moisture has the potential to cause germination, which is undesirable. So, allow the entire jar and contents to cool before removing the seeds you want to use.

Making Use of Your Survival Seed Bank

Even under ideal storage circumstances, the quality of seeds will decrease with time. The perfect answer is to keep seeds for shorter periods and utilize a portion of them each year. Gardening regularly provides nutritious food, significant savings, and excellent practice for disaster preparedness and long-term survival. We hope we never need these skills but having those helps with daily self-reliance. If

you use half of the seeds in your survival seed bank (keeping the other half for crop failure), replace them as needed. Keep your gardening skills sharp, and you'll get the best results when it matters.

Is An Emergency Seed Bank Necessary?

What if you don't have anywhere to plant a garden? If you don't have the space for a small garden right now, look for a community garden in your area, plant in pots, or learn about gardening techniques. Choose the Mylar bag option with a silica gel packet and an oxygen absorber if you're putting together a survival seed bank for your disaster preparation plans but won't be able to use it immediately. Create a new survival seed bank every three to five years to improve germination rates. You can also donate your old seeds to someone who will appreciate them.

Succession Planting

You may wonder where you will find enough space to plant all the crops mentioned in this book. You won't have enough space to grow everything at once unless you have a large plot of land. The good news is that it does not have to be grown all at once. You don't want to grow all of your crops simultaneously. If you plant everything at once in the spring, you'll only have food for a few months.

Succession planting, or the practice of planting a crop, harvesting it, and then planting another crop in its place, will allow you to have products available for the majority of the year. Because you get multiple types of products from one area every year, it can increase the number of products you get from your garden. Year-round production is possible in mild climates.

You will need to research the best succession crops to plant in your area. You'll need to know which crops can withstand frost. Because they can withstand cold temperatures, these crops can be planted early in the spring and late in the fall. Because they can often be planted as soon as the soil is workable, they are good plants to start

growing early. Follow them up with a spring or summer crop that can withstand warm weather. You can plant another frost-tolerant crop that will grow before the ground freezes at the end of the year. Crops can grow year-round if you have mild winters in your area.

It's a good idea to plant continuous harvest crops that produce for most of the growing season, along with some determinate crops that mature and are harvested simultaneously. Determinate crops are great for pickling, canning, and freezing because you can store the excess produce you harvest for the lean winter months.

Your climate will ultimately determine which crops you can grow. You'll be able to grow crops all year if you have mild summers and winters. If you have extreme winter and summer temperatures, you may find that you can only grow in the spring and fall and are limited to what you can grow in the summer and winter. Plan accordingly and ensure you can grow enough food during your growing seasons to produce all year.

The following plants are good plants to grow in the spring:

- Artichokes
- Asparagus
- Broccoli
- Carrots
- Cauliflower
- Garlic
- Spring onions
- Strawberries
- Green tomatoes

- Kale
- Peas
- Radishes
- Some bean varieties
- Some potatoes
- Spring lettuce

You may be able to follow spring crops up with the following summer crops:

- Peppers
- Bell peppers
- Carrots
- Corn
- Cucumbers
- Garlic
- Lettuce
- Onions
- Snap peas
- Summer squash
- Melons
- Tomatoes
- Cantaloupe
- Watermelon
- Green beans
- Some bean varieties

- Leafy greens

The following crops may be able to be planted as fall crops:

- Artichokes
- Arugula
- Beets
- Broccoli
- Carrots
- Cauliflower
- Celery
- Chile peppers
- Garlic
- Green beans
- Green onions
- Kale
- Lettuce
- Brussels sprouts
- Cabbage
- Onions
- Peas
- Peppers
- Potatoes
- Pumpkins
- Radishes
- Spinach

Depending on how cold your winters are, the following crops may be able to be grown in your area in the winter:

- Beets
- Endive
- Broccoli
- Brussels sprouts
- Cabbage
- Carrots
- Cauliflower
- Celery
- Kale
- Turnips
- Winter squash

Tips & Tricks for Beginners

Seed saving has been used favorably for many crops over the years – the species we call "heirlooms" are here now because of dedicated growers like you and me. We have devotedly saved seeds over the years. Seeds are commonly saved from seasonal and biennial plants. Seeds you save from your homestead production system are customary to your climate and growing medium and adapted to your area's pests.

Seeds from hybrid classes produce a mix of offspring, many of which may have several characteristics than the parent. Seed saving is simple; people have done it for thousands of years, breeding all the great vegetables we eat now.

Saving seeds requires you to grow plants to maturity; consequently, they get bigger and stay around longer than usual, so leave a bit more space around them. Saving and growing seeds, year on year, is taking part in the growth. Saving seeds from custom plants or plants indigenous to your region sustains diversity in the area. Saving garden seeds at the end of each growing season can be a

great cost-saving measure and a way to multiply last year's tasty harvest.

Are you aware plants are pollinated in three different ways, by wind, insects, or by what is known as self-pollination? Plants from the same varieties can cross with each other, producing mixes of the parent plant.

Plants with pods, like beans, are available when the pods are brown and dry. Plants pollinated by wind (such as spinach and corn) and those pollinated by insects (such as cucumber and squash) may produce a next generation that matches a parent, or it may cross with other varieties to turn up something unique. In recent decades, there has been a significant shift to buying seed annually from commercial seed suppliers (and hybridized) or cloned plants that do not give seed that remains

Before you save your seeds, ensure that you have thoroughly dried them. Home-saved seeds will retain vitality if thoroughly dried and preserved in airproof containers in the freezer for extended storage or in a cool, dry cellar for the next season. While some vegetable seeds can remain in storage for 10-15 years, grains may remain viable much longer under steady environmental states. When you have processed the seeds and are ready to package for the winter, it pays to buy desiccant packs for your storage boxes to keep your seeds dry.

Seeds should contain 3-5% moisture while in storage. Saving seeds in storage will safeguard the Earth's vegetation in the event of worldwide disasters, war, pandemic outbreaks, and other unforeseen disasters.

Seed saving can instantly become a hobby, and you'll be in a good group. Seed saving enlightens us about the wonder of nature, and by saving seeds, we complete the circle of growing crops. Moreover, seed saving is a wonderful way to introduce kids to gardening.

The Most Common Errors When Starting Seeds Indoors

When establishing flower and vegetable plants indoors, avoiding a few major seed-starting blunders can mean the difference between delicious success and catastrophic growth failure.

Growing plants from seed are one of the most enjoyable gardening experiences. It's impossible to get tired of watching something you planted blossom into a beautiful flower or vegetable plant. Many gardeners, however, have difficulty growing plants from seedlings. And more often than not, the issue stems from a few simple mistakes that can be easily corrected.

Planting Seeds Too Soon or Too Late

One of the most common mistakes in growing from seed is starting seeds inside at the wrong time. If you start seeds too soon, you'll have overgrown seedlings before planting them outside. However, if you wait too long, your plants may never have the chance to bloom or fruit before the season ends.

Seeds grown too late may not grow big enough to be planted outside until it is too late. So, what is the solution? It all boils down to understanding your location's typical last frost date. Simply subtract the weeks necessary for the seeds to be ready for transplantation. That is precisely when you should plant.

Using Stale/Old Seeds

Your garden and flowerbeds will offer you blossoms and food for months. So why attempt to save a few pennies by using seeds that may have passed their prime? A simple seed-starting garden error may be avoided by always utilizing fresh, high-quality seeds.

Seeds should never be stored for longer than a year. Fresh seeds have a higher germination rate and a greater possibility of producing healthy plants. Not only can old seeds germinate at a lesser rate, but they may also have less power and vitality as they expand. Generally, never preserve or save seeds for more than one growing season. Also, keep seeds from your plants in a cool, dry place while preserving them. A cold, dark basement is ideal — and storing it in the refrigerator is even better.

Making Use of Inadequate Soil

Amazing soil is required for seeds to grow into great plants! Unfortunately, many gardeners make the error of using inferior seed-starting soil in their seed trays. It immediately puts plants behind the proverbial eight ball.

Seeds need lightweight, nutrient-rich soil that drains effectively to germinate and develop properly. A seed spends the first 6 to 8 weeks of its life in those small soil cells, and that soil must be ideal for stimulating robust root development. Never use regular garden soil or topsoil to start seedlings. Instead, use a high-quality seed-starting mix with slow-release nutrients. A good example is Espoma Organic Seed Starting Soil. You can also make your high-performance potting soil at home. We've been doing it for years, and it not only saves money, but it is also a great way to feed your seed, starting with a variety of high-quality nutrients.

Seed starting in a Sunny Window is a Big Mistake

Contrary to common perception, starting vegetable or flower seedlings on a sunny windowsill is not a good idea. The immature seedlings respond swiftly to the sun's rays. However, even with continual rotating, they grow spindly and feeble. Seedlings in windows tend to be spindly as they strive to develop quickly to the light. Windowsills simply do not support the growth of flower or vegetable seedlings. The sun's rays are too far away to be seen through a window. Furthermore, immature seedlings expend too much energy growing towards it while failing to fill out.

It is thought to be preferable to grow seeds indoors under artificial lighting. However, there is no need to purchase expensive and specialized equipment. Ordinary fluorescent lamps placed an inch above developing seedlings promote gradual, consistent growth.

All of our seeds are grown in a typical retail environment. It keeps them straight and sturdy, with moderate and steady development. We raise all of our plants from seed using our DIY-built seed-starting platform and a few shop lights. It works wonderfully for growing healthy, bright transplants.

Failure to Harden Plants Before Planting Outside

Finally, one of the most common mistakes gardeners make when planting inside is failing to adequately prepare the plants for outdoor life. Indoor plants have had an easy life. Most will not survive if they

are just pulled out and put straight into the soil. Allowing seedlings to acclimate to outdoor life gradually is known as hardening off. Plants are hardened off to prepare them for life outside.

Begin by allowing plants to acclimate to changing temperatures and breezes for a few hours. Begin this technique a few weeks before the seedlings are to be planted. As the days become longer and warmer, let them out for extended periods to allow them to acclimate. Finally, if the weather permits, leave them out overnight. When the time comes, your plants will toughen up and be ready to be planted in their ideal outdoor setting.

Conclusion

Thank you for persevering until the end. Make sure your seeds are as dry as possible before storing them. However, avoid exposing them to direct sunlight or heat while drying. Spread the seeds on a paper plate or a clean cloth to dry. Paper towels aren't ideal because seeds tend to stick to them; however, you may attempt to plant the paper towel, seeds and all.

You can tell if a bean or pea is dry by stepping on it or hammering it. It should snap. Bitable seeds should also loudly click when you bite them between your teeth. Your seeds should be in airtight containers and in a cold, dark location with little temperature and humidity variation. In a refrigerator, a glass jar like a Mason jar works well. Ensure the containers are labeled, so you know what seeds are inside.

The enduring seed plant varieties are preserved through the satisfying pastime of seed preservation. You will appreciate watching healthy plants grow from your nurtured, gathered, and planted seeds, whether you save seeds from flowers or fruits.

It is crucial to keep the seed dry while it is being stored. Put your dry seeds in tightly capped pots, metal film jars, or empty vitamin bottles. Smaller quantities of various seed kinds can be kept in individual envelopes inside a jar to conserve space. A cool basement, closed-off spare room, or a garage that never freezes can be suitable places to store seeds. Simply store your seed jars in the refrigerator. The ideal range for temperature is 32 to 41 degrees Celsius.

Now that you've had a brief introduction, you're ready to try saving and storing seeds. Reading this book is only the start of a wonderful journey that will benefit you in numerous ways. Seeds can be grown and saved for monetary gain, health benefits, nutritious food, and a sense of accomplishment. But if you decide to grow your seeds, you'll be a part of something bigger. You will be a part of making history. Many wonderful things can be obtained from an heirloom seed farm or garden. It's time to take the first step and see what happens.

Best wishes for seed saving!

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