Annadana

Soil and Seed Savers Network

"Seed Saving Tips "



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Importance of seed saving

We are on the verge of losing, in only one generation, much of the agricultural diversity which took mankind 10,000 years to create. As late as 1900's, food for the planet's hungry was provided by as many as 1,500 different plants, each further represented by thousands of different cultivated varieties.

Currently over 90% of the world's nutrition is provided by 30 different plants and only four (wheat, rice, corn and soybeans) provide 75% of the calories now consumed by human beings. Where once diverse strains strengthened each local ecosystem, currently, a handful of "green revolution", super-hybrid varieties are "mono-cropping" farms and gardens world over.

The modern world is facing the prospect of feeding hungry billions with a genetically uniform agriculture with little or no diversity to sustain it.

For approximately 10,000 years, individual gardeners and farmers created and sustained our rich genetic heritage. Now gardeners and farmers need to play an important role in saving this heritage, by learning to save their own seeds from varieties that perform best in their own mini-ecosystems. This will ensure biodiversity in the same way that diversity was promoted and protected instinctively throughout the history of agriculture and horticulture.

Why, save your own seed?

Until recently, every farmer saved their own seeds. And every farmer, home gardener was therefore, a plant breeder. They simply saved the seed of the plants that did best for them, and which they liked most. Although simple, this was efficient and effective.

But in the past 40 years, almost all these adaptable local strains have been lost, affecting our bio-diversity. Farming is just an industrial process. The rights of farmers have vanished, long overshadowed by the promotion of private companies and transnational's who sell hybrids, and genetically modified organisms. These seeds require massive doses of fertilisers and chemicals as they have no or little adaptability to different soils and climate. And worse still, they cannot be saved as the private sector has made sure that these seeds will not breed true to type for the next generation, insuring them a captive market: The farmers have to buy back the seed every season, each year.

Which seeds can be saved?

Seeds should be saved to sow new crops during the next season, but not all plants are suitable for seed saving.

Commercial F1 hybrid varieties cannot be used for seed saving because the F1 hybrid seeds are produced by crossing two distinct parent lines or two distinct inbreed varieties. As the farmer does not have the parent lines, but just the offspring, seeds saved from hybrids are either sterile or degenerative. The plants of the next generation may show so wide a variation in characters, uniformity and maturity, that they are often non functional to the farmers.

That aspect of F1 is bred consciously into the variety by the private breeders like the trans nationals and profit driven private companies with the prospect of incapacitating farmers by preventing them from saving their own seed. Farmers are obliged to buy back seeds from these companies leaving them in severe debts.

A professional plant breeder, recently declared his commercial intent that even as they can improve open pollinated varieties in the same way as with hybrids and improve them for yield, diseases, drought resistance etc... they stand to loose all commercial benefits. The farmer who buy's a variety each time, may not buy it back again, as farmers can then save their own seeds. Hybridisation is essentially a commercial process to ensure the private breeders ample profits.

Varieties suitable for seed saving include local varieties, heirloom varieties, ancient varieties, traditional varieties; these farmer's varieties have been grown for generations and are Open Pollinated. OP are not from two different inbreed parent lines, but from a population of a group of plants displaying the same characteristics (a variety). The genetic characteristic's is present in any of the population offspring and seeds can then be saved from season to season and generation to generation.

Seed saving involves selecting suitable plants to save seeds, harvesting seeds at the right time and storing them properly. Most of all, it is essential to understand some basics on how plants pollinate and cross. The seed saving techniques of many common vegetables are introduced in this manual.

"Seed Saving Tips "

ANNADANA's objective, since 8 years has been to exercise change by '*Sowing Seeds of Consciousness'.* And we continue with this endeavour.

We are happy to introduce an informative booklet called "Seed Saving Tips". This provides user friendly information on how to isolate, conserve, select, multiply and process vegetable seeds of traditional, heirloom, non-genetically modified, non-hybrid, **and open-pollinated** organic heritage vegetables.

Seed-saving is an easy process. A dash of effort and care will germinate the magic seeds of life. You can help maintain biodiversity from the very first origin in the food chain which are "the seeds". Thereby, help preserve and conserve 10,000 years of evolution, work for today and the future generations.

Note: These seed savings tips are not fit for professional breeders as terms and techniques are simplified for the understanding of marginal farmers and home- gardeners.

Simplified explanation of some technical terms

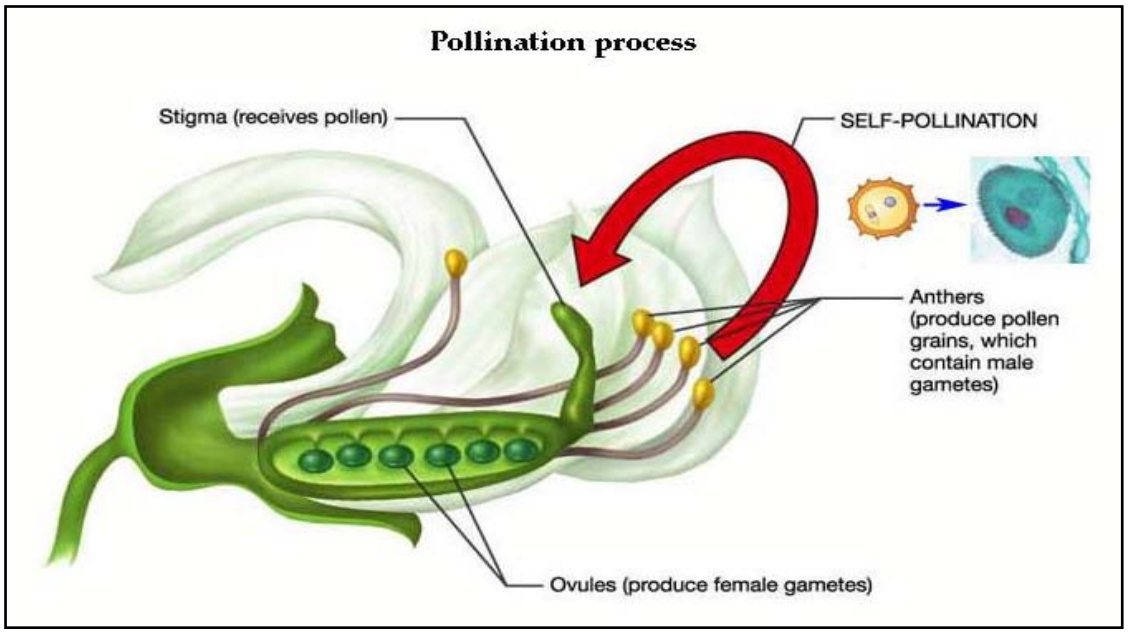
Our **"Seed Saving Tips"** provides a basic understanding and usage of certain terms that will be encountered throughout our Seed saving journey.

Seeds are a plant reproductive structure, containing a fertilized embryo in an arrested state of development, surrounded by a hard outer covering.
Seeds vary greatly in color, shape, size, and texture (shown, right).

Simply: Seeds are living, hibernating embryos. They have a life span and survive the longest if they are kept in a dry, cool environment.

Pollination

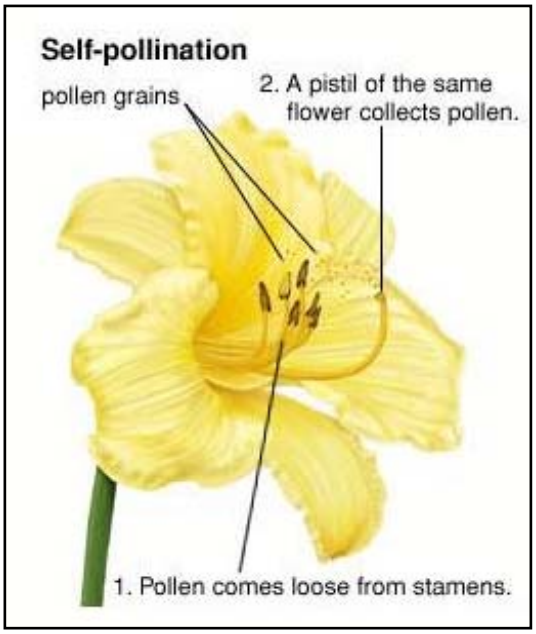
Plants reproduce and develop seeds through a process called pollination. It is a process in which pollen grains are transferred from the male part (anther) to the female part (stigma) hence, termed as **pollination** (as shown below).



Plants can be classified into 2 main reproductive categories.
They are: **Self-pollination and Cross-pollination.**

1. Self-pollination (selfers)

Self-pollination is a transfer of pollen grains from the male part (stamen) to the female part (pistil) within the same flower or on the same plant (shown, right).



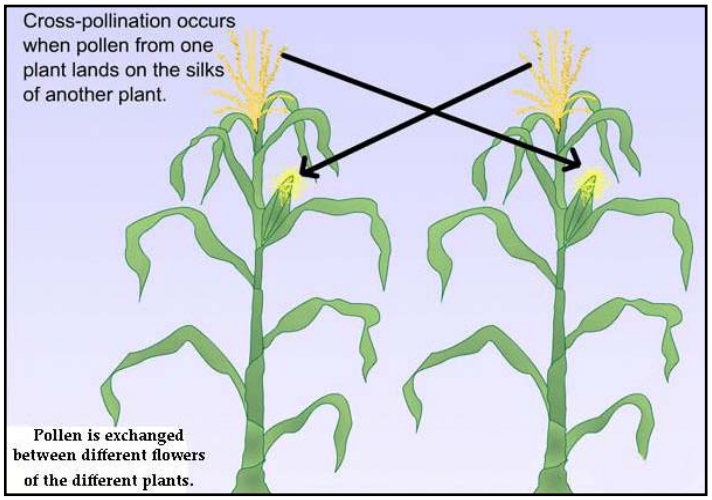
1. These plants usually require small minimum population sizes and number of plants are needed to ensure genetic diversity. Also these plants require shorter isolation distances between varieties (distance needed between 2 varieties ensures there is no cross - pollination).
2. Examples are beans, tomatoes, capsicum, brinjal, lentil, rice, wheat amidst others. Pollination occurs

without the need for other flowers, insects, birds or wind, as it takes place within the flower prior opening. Isolation distance to prevent cross - pollination is not necessary unless insects invade the flowers. For your information to a certain extent most of the plants cross-pollinate.

2. Cross-pollination (crossers)

Cross-pollination is a transfer of pollen from the male part of one plant to the female part of another plant (as shown below).

This process is usually accomplished naturally by wind and insects. It takes place when pollen is exchanged between different flowers in the same or on different plants.



1. When breeding cross-pollinating plants, one must be cautious to prevent crossing varieties. This can be accomplished through various methods of isolation.
2. Examples of cross-pollinated plants are basil, corn, cucumber, squash, water melon, bitter gourd, bottle gourd, onion, beets, radish, cabbage, cauliflower and broccoli.

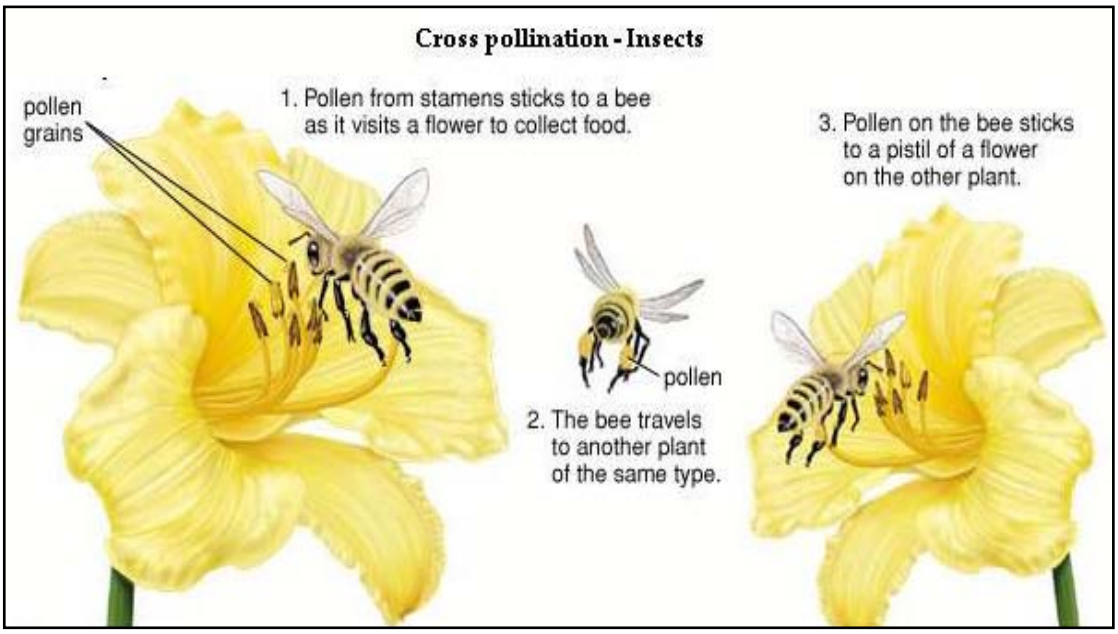
Methods of Cross-pollination:

(i). Wind pollination: Many species of flowers are wind pollinated. The pollen is transported by the wind. These species require the largest isolation distance as pollen can travel for kilometres depending on the strength of the wind and the presence or absence of natural barriers like trees or tall crops. Varieties that are wind pollinated should be planted in dense blocks to ensure total pollination.

Characteristic features of wind pollinated flowering plants include

- They produce huge amounts of non sticky pollen
- They have many flowers packed into a inflorescence
- They have large long female parts (pistil- stigma)
- They have large, well exposed male parts(stamen- anther)

(ii). Insect pollination: These plants have flowers that encourage insects to travel from flower to flower. A great many flowers are pollinated by insects (as shown above).



Many types of insects have very different ways of pollinating flowers like bees (the most common insect pollinator), butterflies, moths, beetles and wasps.

Insect pollinated species require up to a kilometre of separation from 2 varieties to ensure no crossing happens between varieties. Many insect pollinated flowers have bright colours and nectar - the reward the insect receives for visiting the flower. Pollen is deposited on the insect from the male part (anther) when the insect visits the flower to collect or drink the nectar, and then the pollen is deposited on the female part (stigma) of the next flower that the insect visits.

Flowers that are visited by nocturnal insects are attracted to less showy flowers but are often strongly scented. Other flowers are brown in colour and smell like carrion and attract flies, which pollinate them. Some flowers may get robbed of their nectar by insects which do not pollinate them. Some plants have therefore developed complex structures to prevent all but specific insect's species from reaching the nectar and getting pollen deposited on them, and then they transfer to the female part of the next flower they visit.

Plants that self pollinate are referred to as **Selfers,** whereas plants which cross pollinate are referred to as **out-crossing or Crossers.** However, most plant species are not strictly Selfers or Crossers but a combination of the two.

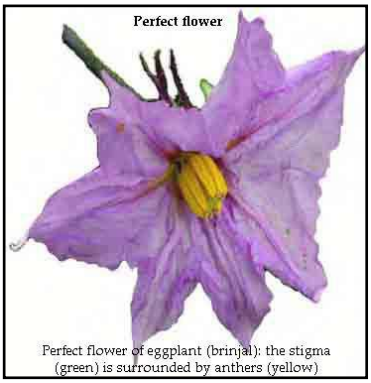
Selfers	Crossers
Few flowers	Many flowers
Small flowers	Large flowers
Mono-coloured	Bright colours
Absence or little nectar	Nectar present
Unscented flowers	Scented flowers
Male and Female part close to each other	Male and Female part far from each other
Fewer pollen grains	Numerous pollen grains

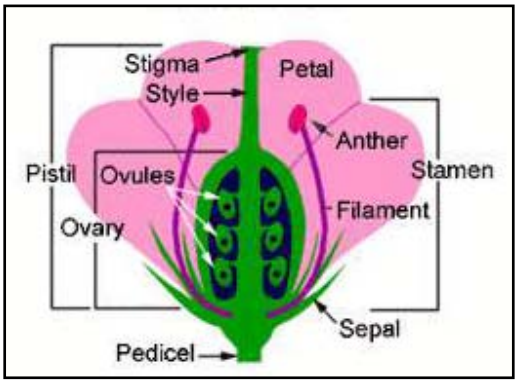
Perfect Flower - Female Flower - Male Flower - Unisexual flower

When both the essential organs of a flower (the male and the female part) are present in one flower, it is said to be bisexual, hermaphrodite or perfect.
If a flower lacks any of the essential organs, namely stamen or pistil, it said to be unisexual.

Perfect flower

Plants species which produce flowers with the male part (stamen) and the female part (pistil) in the same flower are called perfect flowers (shown, left).





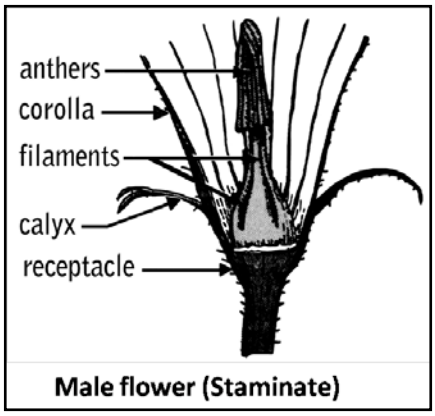
In perfect flowers, self-pollination occurs. Brinjal, capsicum, tomato, lady finger have the stigma so close to the anthers that the slightest wind movement can cause the pollen to drop onto the stigma within the same flower. In peas and beans, self-pollination occurs even before the flower opens.

Some types of perfect flowers still require cross-pollination. An external pollinator such as an insect is necessary. Onion, carrot, cabbage, and radish, for example, belong to this type.

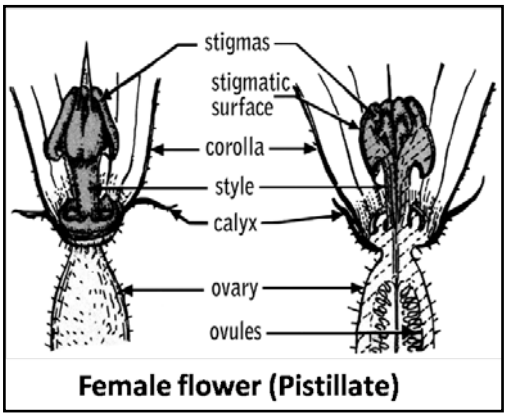
Unisexual flower

Plants species which produce flowers which are either male or female are called "Unisexual flower". The male flower is also called "Staminate" The female flower is also called "Pistilate". They require wind or insects such as bees to transmit pollen from the anthers of the male flowers to the stigma of the female flowers. Maize, for example, is cross-pollinated by wind, while cucurbits are cross - pollinated by bees.


Imperfect flowers of squash:
female flower with exposed stigma (left) and male flower with exposed anthers (right)



Male flower (Staminate)



Female flower (Pistillate)

Flower part- Essential organs

Stamen is the male reproductive organs in flowers that produce pollen in which sperm or male cell originate. They consist of the filament, anther and pollen. A **filament** is the tube that supports the **anther** where pollen is produced. **Pollen** is the equivalent of sperm in plants. Pollen grains fertilize plant ovules.

Pistils are the female reproductive organs in flowers that produce ovules within which an egg-cell originates. They consist of stigma, style, ovary and ovule (as shown in figure). The **stigma** is the opening in the pistil through which the pollen passes its way to the ovary. The **style** contains the pollen tube between the stigma and the ovary through which the pollen is carried.

The **ovary** contains ovules. When fertilized, ovules develop into mature seeds. The **ovule** contains an egg-cell.

How to keep Seeds and Varieties Pure?

Keep in mind that natural cross-pollination can always happen to some extent under a field situation, even in self-pollinating plants. It often occurs when pollen grains stick onto the bodies of insects visiting flowers, and then carry the pollen grains to the next flower they visit.

To prevent varieties from crossing, seed producers must use some means of isolation (cages, distance isolation, time isolation, or hand pollination) during periods, when pollination can occur. Genetic diversity within a variety is maintained by including a minimum number of selected parents into the breeding population. This number will vary according to crop species.

Ways to protect and ensure varietal purity:

1. Properly identify and label plants.
2. Plant on clean land, which has not been used to grow the same crop in recent past
3. Isolate plants from cross-pollination.
4. Maintain varietal genetic diversity by planting for the breeding population at least 200 plants for cross-pollinated crops and 50-100 plants from self-pollinated crops.
5. Rogue, off-types.

Isolation technique to prevent cross – pollination

1. Isolation strips: A plot planted with a tall crop or a nectar rich crop acts as a natural barrier or attractant. This barrier plot separates plots planted for seed production, preventing crossing and mechanical mixtures. This strip theoretically catches windblown pollen and distracts insects from visiting the seed plots on either side of it.

2. Isolation distance: Pure seeds can be produced by leaving enough distance between two or more varieties to prevent cross-pollination by insect or wind-blown pollen. Isolation distance can vary from 50m to 1000m or more depending on the plant species and its pollination habit.

One general rule of thumb: **Selfers** should be isolated by at least 50 meters and an isolation strip. Wind pollinated **crossers** should be separated by at least 1 kilometre; insect pollinated crossers should be separated by at least 1 kilometre and other barriers like tall crops or attractant crops (nectar rich crop like flowers…)

3. Artificial Barriers: This is constructed with PVC or Steel tunnel rows covered by fabric like mosquito nets or Kada cloth. Brown paper, fine meshed bags can also be used. Non-porous bags are not recommended because they rot. This method is most efficient for Selfers, which have perfect flowers and do not require wind or insect intervention for pollination. As for crossers this method is **not recommended** for it requires that either plants are hand-pollinated or pollinators must be introduced into the caged environment. This is not simple at all and requires a particular skill and not recommended for home gardeners or simple farmers.

i. Bagging**:** This method is best suited for home gardeners or small scale farmers, whose land is not more than 1 or 2 acres, and require small amount of seeds for sowing their next crop. Select the plant; cover the unopened flowers with a paper bag (as shown in the figure) or a mosquito net bubble. This is applicable for perfect flower crops with a high rate of self-pollination, such as chilly, eggplant, tomato.

ii. Caging**:** This method is best suited for farmers having land size from 2 to 10 acres to conserve seeds as per their quantity requirement. The advantage of this method is to isolate an entire plant, in order to produce more seed. Cages can be used for vegetables that flower over a long time and prevent insects from transmitting pollen from two nearby varieties of the same crop (as shown above). Cages can be made by erecting sticks from the ground, and then covered by mosquito net. The cage will exclude all insects, and prevent 2 varieties from crossing.

iii. Tunnelling: This method is best suited for big farmers, institutes, NGO's requiring to produce large quantity of pure seeds. - Erect steel or PVC tunnelled frames with mosquito nets so that it individually covers the raised beds with plants prior flowering. It isolates plants from visitor insects that can cause cross pollination. Varietal purity for seed production is hence maintained.

4. Time Isolation: You can plant different varieties of the same species in the same year as long as the time of flowering does not overlap. Sow different varieties at intervals of 45 to 60 days depending on the species. For annuals, this could mean starting one variety early in the season and then starting another several weeks later.

5. Hand-pollinating: Basically, it is the process of transferring pollen from the anther of the male flower to the stigma of the female flower and then covering or closing back the pollinated flower to prevent it from being pollinated by other unwanted pollen.

1. Select unopened male flower (shown, left) or artificially tape the male flower (shown, right).

2. Select unopened female flower - an ovary, small fruit like structure, the flower below indicates a female flower (shown, left) – or select an artificially closed (taped) female flower (shown, right).

3. Cut the male flower and remove the sepals to expose the pollen (shown center) bearing part (anther).

4. Gently open the female flower, and then brush it with the male flower. Touch and rub the anthers from the male flower onto the pistil of the female flower (shown, left and right)

5. After, the hand- pollination is complete; the sepal of the female flower should be closed and sealed with tape (shown, left and right)


6. Tag the pollinated flower with a red ribbon to identify later for pure fruit.

Note: Use 3 male flowers for 1 female flower; Rub 3 male flowers into 1 female flower. This is to ensure genetic diversity and prevents genetic depression.

SEED SAVING TECHNIQUES

1. Amaranth

Scientific name: *Amaranthus spp*
Family: Amaranthaceae

Production

Amaranth (*Amaranthus spp*.) is an important food crop especially for subsistence farmers in India, Africa and Asia. It is a fast-growing crop that easily grows on a wide range of soils and climates. Seed crops are often produced using transplants. Seedlings with desirable leaf and stem characteristics are transplanted about three weeks after sowing.

Pollination

Amaranth is a self pollinating, allogamous plant. It has perfect flower. Amaranthus hence does not need wind or insects for pollination, but accepts intercrossing with other varieties of amaranths (allogamy)

Isolation The pollen is tiny and very light and Amaranth is mainly cross pollinated through wind and sometime by insects - between 5 and 30% - the remaining of the flowers is self pollinated. A minimum isolation distance of 1000m between varieties is recommended. This distance can be vastly reduced if natural barriers as in tall crops like maize, sorghum are planted.

Selection

Plants may be rouged as young plants, remove types with undesirable or off-type colour, size or leaf shape. Plants should be rouged again just before flowering. Once flowering begins, plants with off-type flowers should be again quickly removed.

Harvesting

A lightening or yellowing of the foliage colour is an indication that the plant and seed are reaching maturity. Harvesting the seed can be processed by shaking the panicle into a large paper or cloth bag. Alternatively you can cut the whole plant and hang it upside down in a dry, aerated but shady place. Later, beat the panicle in order to release the seeds.

Processing

Seeds are easily threshed by hand or in a bowl. The threshed seeds are cleaned by winnowing or in a very fine sieve.

Seed viability

The seeds of the amaranth plants have an average viability of 10 years.

2. Beans

Scientific name: *Phaseolus vulgaris*
Family: Fabaceae

Production

For best results, bean should be grown during a season where temperatures begin warm but then gradually decrease. Under these conditions, seeds will germinate well in the warm soil and will set pods as temperatures decrease. Dry weather is preferred while pods mature.

Pollination

Phaseolus vulgaris are autogamous plant and produce perfect flower (shown, right). Automatic pollination occurs before the flower opens because the male part is pushed upon the female part of the flower. Cross pollination by insects is possible but rare.

Isolation

It is essential to select a few sturdy plants for the production of seeds. Although, for producing pure seed, ideally different varieties should be separated by a few meters or by scented plants in order to distract pollen gathering insects. Another isolation technique is to cover the entire plant or a few individual flowers with a mosquito nets to avoid cross pollination by insects. Finally, time isolation can be practiced by planting different varieties at 45 days interval to avoid flowering at the same time. For a home gardener, precaution is not necessary as *Phaseolus vulgaris* is an autogamous plant (and mainly does not cross).

Selection

Harvest seeds that grow on healthy, vigorous plants as shown in the figure. Avoid harvesting seeds from off-type plants as well as plants affected by diseases. Mark the plant select with a ribbon, so that you can recognise the selected plants at the end of the season.

Harvesting

Pods are harvested when they have turned yellow (as shown in the figure). You can wait until the seeds start to rattle in the pods. The inner seeds will be firm, well developed, and begin to loosen inside the pods. Do not wait too long as the dry pods will burst open.

Processing

Dry the pods in the sun and then place in a shelter for 1 – 2 weeks for curing. Pods are threshed by hand (shown, right). Seeds are further cleaned and dried after threshing. In order to ensure that the seeds are fully dry, you can bite on a seed and if it barely leaves a mark then it is dry.

Seed viability

The seeds of the beans plant have an average viability of 3 years.

3. Brinjal

Scientific name: *Solanum melongena*
Family: Solanaceae

Production

Brinjal is otherwise called as Eggplant. It is a warm season crop. It requires a long and warm growing season for successful seed production. It is more susceptible to lower temperatures than tomato and capsicum. A day temperature of 25 – 32 °C and a night temperature of 21 – 27 °C is ideal for seed production.

Pollination

Brinjal produce perfect flowers (as shown in the figure). Eggplant is thus a self – pollinating plant but which may be cross-pollinated by insects. The extent of natural crossing depends upon the insect activity.

Isolation

To obtain seeds of pure varieties, it is well advised to grow different varieties in isolation (under an insect screen), (as shown below) or to

grow one variety at a time. To avoid cross-pollination, isolate each variety by 500 to 1000 m or with another tall, flowering crop. Another way is to isolate a few flowers from each variety to exclude insects. Tie a mosquito net bubble around the flowers before they open (in a way that no insect can force its way) and remove as soon as the fruits are set. Mark the pure fruits with a red ribbon. If you want to produce large amount of seeds, then grow a few plants of each variety in a separate tunnel steel or PVC framed covered by mosquito net. If there is only one variety of eggplant being grown, isolation is not needed.

Selection

Select the most vigorous and healthy plants, mark and select fruits on the second branch, and leave them until they are fully mature. Keep one or two fruits from one plant and several fruits from different plants of the same variety to maintain crop genetic diversity.

Harvesting

Brinjal seeds are only viable, when harvested from fully ripe fruits: the skin of the fruit turns brownish-yellow as shown in the figure.

Processing

Brinjal seeds can be extracted either by a dry method or by a wet method. The dry method consists to knock the ripe fruits in order to dislodge the seeds from their place in the fruit. The fruit is then opened up and the seeds picked out. Another dry method is to leave the fruits to dry in the sun and then to remove the seeds.

The wet method consists in cutting the fruit into small cubes or slices (as shown below) and

dislodges them with a little water. Then, place them in a fine sieve to be washed prior putting them on a screen to dry under room temperature (as shown, right). Use a fan to aid the drying if conditions are humid. It can take up to 7- 10 days to achieve perfectly dry seeds.

Seed viability

The seeds of the brinjal plant have an average viability of 6 years.

4. Capsicum & Chilies

Scientific name: *Capsicum annum, Capsicum chinense & C. frutescens*
Family: Solanaceae

Production

It grows best in a cool dry season with temperatures in the range of 21 – 33 °C. For seed production night temperature is especially critical; generally, plants will not set fruits if night temperatures go above 30°C. Ideally, select a season when night temperature remains below 30°C at flowering stage. Avoid fields, where the previous crop was a solanaceae (tomato, capsicum, eggplant, potato). This prevents the build-up of diseases and insects in particular the *fusarium wilt.*

Pollination

Peppers produce perfect, mostly self-pollinating flowers (shown, right). Thus insects or wind are not required for pollination. Pepper is allogamous and can be cross-pollinated by insects.

Isolation

The use of steel or PVC framed tunnels with mosquito nets can be employed to avoid any cross pollination by insects between varieties to obtain pure seeds and pure variety (as shown above).

If we grow different varieties, which are recommended for marketing purpose, the farmers have the choice of applying different strategies depending of his scale:

- Grow few plants of each variety in isolation under a mosquito net, this is cost effective.
- Or isolate few individual flowers from each variety under a mosquito net bubble as shown in the figure.

– Or practice time isolation, by sowing 2 different varieties at 60 days interval.
- Or try distance isolation by cultivating different varieties while maintaining 500 to 1000 m distance between the varieties.

Selection

The earliest maturing and more attractive plants (yield, stand, resistance, deep roots) should be marked and inspected during growth. Select healthy, attractive fruits for seed saving (shown, right). Seeds from off-type plants or fruits should not be saved.

Harvesting

Green capsicum is immature and unfit for seed processing. It will reach maturity while turning green to red colour (shown, right). Some capsicums however are colored yellow, orange or nearly black when they are fully mature.

Processing

Pepper seeds should be extracted from fresh mature fruits, fit for consumption (shown, right) Seeds are removed by hand (shown, second right) placed in a fine sieve and shade dried for 6 - 8 days under room temperature (shown, below). Once they have dried completely, store them. They should emit a small sharp sound when mixed. When harvesting the hot or very hot varieties it is best advised to wear thick rubber gloves or coconut oil on both hands to protect against burning sensation provoked by capsaicin (the burning substance in the chilly). It is important to carry out all operations in open air because the *capsaicin* will cause considerable irritation to the eyes, nose and mouth. Later, wash your hands and any utensils used for this under running water.

Seed viability

The seeds of the Capsicum and chilly plant have an average viability of 4 years. Capsicum seeds have a normal germination rate of about 60-70%. Capsicum seeds are preserved best in a cool temperature below 18-20 C (or in the refrigerator).

Capsicum maturity / harvest index

The seeds of capsicums and chillies are removed when the fruit is totally mature and has reached a full color according to the variety. The mature color of capsicums and chillies may be yellow, red, purple, white, orange, black or chocolate.

5. Corn

Scientific name: *Zea mays*
Family: Poaceae / Graminae

Production

Corn grows almost through-out the year, the optimum temperature required for corn growth is from 10 – 30 °C. Sow the corn in 3 rows minimum instead of sowing in 1 row to optimise pollination. Spacing to be taken at 20 – 30cm between plants and between rows.

Pollination

Corn produces separate male and female flowers on the same plant. Male flowers appear as tassels on the top of corn stalks and produce the pollen (shown, right). Female flowers are pollinated via the silk emerging

from each ear (shown, left). Female corn flowers are pollinated predominately by the wind which carries the pollen from the male flower. Some insects and bees can be attracted by the pollen of maize. The pollen is light and can travel great distances.

Isolation

Corn is fertilized by the wind and so, to maintain varietal purity the farmers has few options:

- Distance isolation, by cultivating different varieties while maintaining 1000 m or 1 km distance and other tall plants acting as pollen barriers, between 2 varieties.
- Time isolation, by sowing 2 different varieties at 50- 60 days interval. It is essential to ensure that the male flowers of the first variety have finished shedding pollen before the silk of the female flowers of the second variety start to emerge.

Selection

The selected plants for seed saving should be short, mature, healthy and produce few ears. Grow at least 200 plants and save seeds from the best 100.

Harvesting

The cobs can be left to dry on the plant. If bad weather, insect or bird attacks prevail, cobs can be harvested and dried in a well- ventilated place.

Processing

The cobs are never stripped of seed until they are perfectly dry. Once they have dried completely, seeds may be removed by hand, shade dried under room temperature (shown, right) and

then stored. The seeds of sweet corn can be recognized for the seeds contract during the drying process. A sweet corn cob will therefore present gaps between all the seeds while non- sweet corn varieties will have no gaps between the seeds.

Seed viability

The seeds of the corn plant have an average viability of 5 years.

6. Cucumber

Scientific name: *Cucumis sativus*
Family: Cucurbitaceae

Production

The Cucurbitaceae family includes cucumbers, melons, squashes, pumpkins, and gourds. They all are warm season crops. Many cucurbits are susceptible to foliar diseases that attack plants during periods of high humidity and rainfall. Therefore, regions having hot temperatures and low humidity are ideal conditions for cucurbit seed production.

Pollination

Cucumber is a monoecious plant with separate male and female flowers on the same plant. Cucumber is cross-pollinated by insects which visit the flowers looking for nectar and carry the pollen away. Cross-pollination is predominant. Female flowers can be identified by locating the ovary - a small looking cucumber (as shown, right) at the base of the flower. The male

flowers can be recognised because they are found above the foliage on long - main stem (as shown, left). The flowers are insect-pollinated, and so, easily cross-pollinate between varieties.

Isolation

To ensure varietal purity:

- Hand pollination technique is possible but not recommended as the cucumber flower is very small and difficult to handle for a beginner in seed saving.
- Separate cucumber varieties by at least a distance of 1000 meters as insects are the vectors of pollen and cross pollinate
- Or grow one variety at a time
- Or use time isolation by sowing 2 different varieties at 50 days interval.

Selection

Select early flowering, healthy and vigorous plants. Remove any deformed fruits.

Harvesting

It is essential to leave the fruits to mature fully on the plants before harvesting for extracting the seed. These fruits are no longer edible. They will swell up and then soften, turning into brownish color (as shown above).

Processing

Cut the fruit lengthwise and extract the seeds from the central cavity with a spoon (as shown, right). Allow the seeds to ferment in their juice and add little water,

leave for 3 days, then wash them and dry on (as shown left) a screen for 6 to 10 days prior storage.

Seed viability

The seeds of the cucumber plant have an average viability of 10 years.

7. Ladies Finger

Scientific name: *Abelmoschus esculentus*
Family: Malvaceae

Production

Ladies finger is commonly called as Bhendi or Okra. It can be grown on a wide range of soils which have good drainage. Temperatures between 27 – 30°C promote rapid and healthy seedling development and seed production too. Seeds will not germinate below soil temperatures of 17°C.

Pollination

Bhendi produces one flower every 2 to 3 days. The flower is perfect, hermaphrodite, self compatible and self- pollination takes place. Although the yellow petal (as shown, right) attracts a lot of insects and cross pollination is frequent up to 69 % (allogamy).

Isolation

If you wish to grow different varieties, the farmers have the choice of applying different strategies depending on the scale:

- To grow each variety, select a few plants in isolation under a mosquito net.
- Or isolate, the evening before they open, a few individual flowers from each variety under a mosquito net bubble – Do not forget to mark the flowers that have been self- fertilized under isolation.

- Or practice time isolation, by sowing 2 different varieties at 50 days interval
- Or distance isolation by cultivating different varieties while maintaining 500 to 1000 m distance between the varieties.

Selection

Plants for seed production can be selected prior flowering, taking into consideration the vigour and habit of the plants (as shown, right). Once fruiting begins, you can verify that the pods conform the characters. Plants with off-type pods should be removed. Plants with viral symptoms should be removed immediately.

Harvesting

The okra pods mature in a sequence from the base of the plant toward the top (as shown, right). Once the fruit is ripe, it opens up five longitudinal fissures which reveal five rows of seeds. The pods have tendency to split along the suture when fully dried. Exposed seeds may be damaged by rain or may drop to the ground; therefore, the pods must be harvested as soon as they have become fully mature (brown colour)prior scattering.

Processing

Pods are easily hand threshed and separated (shown, right)

Seed viability

The seeds of the bhendi plant have an average viability of 3 years.

8. Lettuces

Scientific name: *Lactuca sativa*
Family: Asteraceae

Production

Lettuce is commonly called as salad. It can be grown easily as a vegetable crop in a cool or in moderate temperature. As a seed crop, it is a cool climate plant, especially for headed varieties. Leaf lettuce can accept more warm temperatures (26°C or higher) to bolt and set seeds.

Pollination

Lettuce produces perfect, self-pollinating flowers (as shown, right). Lettuce is considered as autogamous and does not cross - pollinate easily.

Isolation

Nevertheless lettuce flowers have a very small amount of natural cross-pollination which can occur from 1 to 6% maximum, when two varieties are grown side by side. It is advisable to keep different varieties separate by a few meters (5 meters) or grow a tall crop such as maize between different varieties; to reduce out -crossing.

Farmers can grow many varieties at a time provided that the varieties are separated by a few meters by a tall crop. Lettuce rarely cross- pollinates.

Selection

The selection and removal of plants not conformed to type is based upon observation at 3 stages of growth:

- at the first stage, between 4 to 6 leaves.
- at the second stage, at the formation of head of heart
- at the third stage, at the emergence of the seed bearing stem from the plant.

Mark the selected plants with a red or yellow ribbon or tag and remove off type. Early bolting plants are not usually kept for seeds as they produce poor quality seeds.

Harvesting

When two-thirds of the flowers of the stalk are turning fluffy white (shown, right), about 2–3 weeks after flowering, the seeds can be harvested from standing single plants. Shake their heads into a canvas bag. This can be done every 2–3 days.

- or you can plug the whole plant and transfer into a canvas bag (as shown below) and hang it upside down in a protected, dry and ventilated place for several days. The seed will continue to ripen and scatter. The plants can then be shaken into a hard receptacle (50 litres domestic dustbin), allowing the seeds to detach.

Processing

Winnowing is then necessary to separate the seed from large amount of fine debris. Use a sieve or a fan to blow the chaffs.

Seed viability

Lettuce seed loses its viability quicker than most vegetable crops. Under ideal cool and dry conditions, seeds may maintain their viability for up to 5 years.

9. Squash

Scientific name: *Cucurbita spp*
Family: Cucurbitaceae

Production

Squashes are divided in 3 main species:

Cucurbita maxima. This species has both bush and runner type. They are characterized by large leaves which have rounded leaf lobes, no white stripes and a long stem. The leaves are covered with numerous hairs, and not prickly. The peduncle of the fruit is always rounded and devoid of ribs and angles (as shown above). The seeds are marked with a groove at the edge. They are oval and often curved.

Cucurbita moschata. The varieties of this species are all runner type. The leaves present fairly marked angles and is criss crossed by white stripes. The leaves are covered with numerous hairs, and do not get prickly. The peduncle presents 5 angle or ribs (as shown above).

Cucurbita pepo. The varieties of this species present both runner and bush types. The leaves and stems are prickly. The leaves characterized by angular lobes and white stripes. The peduncle of the fruit has very pronounced 5 – 8 divisions ribs- angles (as shown in the figure).

Pollination

Squash and pumpkin are monoecious plant with separate male and female flowers on the same plant. They are cross-pollinated by insects who visit the flowers looking for nectar and carry the pollen away. Cross-pollination is predominant. Female flowers can be easily recognized by locating the small ovary which looks like a small future fruit at the base of the flower (as shown above), and already has a well defined shape.

The male flowers are easily recognized because they are found above the foliage on long / main stem (as shown, left). The flowers are insect-pollinated, and they easily cross within varieties. However, seed savers can grow more than one variety at a time in a single location by using hand pollinating techniques.

Isolation

Squashes and Pumpkin from different species (as mentioned above) can be grown next to each other without crossing. There is no inter-species crossing but crossing happen only between varieties of the same species (ex: in between 2 butter gourd or in between 2 pumpkins). A gardener can grow one variety of squash, one variety of pumpkin, one of zucchini one of cucumber and one of water melon without risking cross pollination.

- To ensure the varietal purity of different varieties of the same species (2 butter gourds, 2 pumpkins), separate different varieties by at least a distance of 1000 meters as bees are the main pollinators and travel long distances.
- However experienced, home, seed savers grow more than one variety in a single garden by using hand pollinating techniques.

Hand pollination techniques

Most cucurbit plants produce separate male and female flowers on the same plant. Female flowers can be identified by locating the ovary (a small looking cucumber) at the base of the flower.

Hand pollination: It consists of tying up the male and female flowers that are ready to open the following day (tie 3 male flowers for one female flower).

In the evening tie the end of the flower by using adhesive tape. The next morning the male flowers are gathered, the tape removed and the petals removed.

Pollination is executed by brushing the pollen of the male flower upon the stigmata of the female flower. You can observe that a layer of pollen has been transferred to the female flower. Finally the female flower should be delicately re- sealed with tape to exclude insect transporting other pollen.

Mark or tag, the pollinated female flower with a red ribbon for identification purpose, which is the pure fruit (as shown, left). This technique will produce pure seeds of different varieties grown at the same time. A gardener can also save pure seeds, by growing one variety per season. Squash and pumpkin flowers have a large size and are relatively easy to hand pollinate.

Selection

Select early flowering, healthy and vigorous plants. Remove any deformed fruits. Select for fruit conservation and taste.

Harvesting

Pumpkin must be fully mature (until the vine starts to dry) prior harvesting for seed production and extraction.

Processing

After harvest, it is recommended to wait 2 to 4 weeks before cutting open the fruits and harvesting the seed. The seeds, in fact continue to mature inside the fruit; quality and viability of the seeds are much improved.

When the fruits are opened, the seeds are extracted by hand (as shown in the figures)

and washed thus removing the pulp. They are then placed in shade on a tray in a dry, well ventilated place for 7-10 days. If necessary use a fan to hasten the process. If the seeds split upon bending, it means they are dried well.

Seed viability

The seeds of pumpkin plant have an average viability of 6 years.

10. Tomato

Scientific name: *Lycopersicon lycopersicum, Lycopersicon esculentum*
Family: Solanaceae

Production

Tomato grows best in the dry season under day temperatures of 21 – 30°C and night temperatures of 15 – 23 °C. Vines struggle to set fruit if temperatures exceed 35°C, and is not a favourable condition for seed production. Humidity levels higher than 60% at the time of fruit maturity will increase disease problems and reduce seed yields. Seed production during the rainy season leads to poor seed quality. Training and stalking of tomato plants will result in fewer diseases, higher yields and better seed quality.

Pollination

Tomatoes produce perfect flower, thus self-pollinating.

Anthers (male part) are fused together into a little cone that rarely opens until pollen has been shed and the stigma (female part) pollinated.

Isolation

If, we grow different varieties, for commercial purpose, to produce pure seeds, the farmers have the choice of applying different strategies depending on their scale:

- Isolate and bag a whole flower cluster, from each variety under a mosquito net bubble.

– Or practice time isolation, by sowing 2 different varieties at 60 days interval

- Grow each variety, keep few plants in isolation under a mosquito net cage, or in a

isolation house. Tunnels are not effective for tomatoes as the plants grow much taller than the tunnel height.

- Or try distance isolation by cultivating different varieties while maintaining 500m to 1000m distance between the varieties. This distance can be reduced if a tall crop or insect attracting plants are grown in between. 200 meters should be kept as a minimum distance.

Selection

Look for early maturing and attractive plants, stand of the plant, indeterminate or determinate type, profuse rooting, resistance to wilt, tolerance for humidity, for fruit characteristics like no- splitting, sweetness, size, colour… Selected plants should be marked and inspected during the growing season for resistance to diseases.

Harvesting

Allow tomatoes to completely ripen on the plant before harvesting them for seed production (shown, right). Seeds from not fully ripe fruits will be made viable if extracted after allowing the fruits to fully ripen, but this is not advisable. Totally unripe or green tomatoes do not produce viable seeds.

Processing

Cut each tomato into half (as shown, below). Gently squeeze out or scoop out the jelly-like substance that contains the seeds (as shown,

left). Place the jelly and seeds into a small container or bottle for fermentation (as shown, right). Add a little water as this aids the process of fermentation. Leave this mixture for 2 to 4 days until a moldy layer forms on the top of the container (as shown, left). The period of fermentation varies depending on the ambient temperature. Do not leave the seeds fermenting for too long, because once free of their protective coat, they will gleefully start to germinate.

Then clean the seeds by placing them in a fine sieve and pass them under running water (as shown, right). The debris and the immature **seeds will be washed away leaving only the good seed. Then place** them on a drying tray, in a well ventilated place to complete the drying process which takes 6 to 8 days (as shown above).

Do not dry them on a paper, as they will stick to each other, nor in an oven or under direct sunlight.

Seed viability

The seeds of the tomato plant have an average viability of 4-8 years, depending on the storing conditions.

11. Watermelon

Scientific name: *Citrillus lanatus*
Family: Cucubitaceae

Production

This crop has a long growing season under relatively warm temperature. The optimum temperature range for satisfactory growth is between 15 to 25 °C. It grows well in sandy loam soil rich in organic matter with a good drainage.

Pollination

Watermelons have male and female flower on the same plant, but separate. The watermelon is cross pollinated; insects are the vectors of these cross- pollination.

Female flowers can be identified by locating the ovary - a small looking watermelon (as shown, left) at the base of the flower.

The male flowers are easily recognised because they are found above the foliage on long / main stem (as shown, right). Cross- pollination is predominant between varieties.

Isolation

To ensure varietal purity:

- separate water melon varieties by at least a distance of 1000 meters as insects are the vector of pollen and cross pollination
- or grow one variety at a time
- or use time isolation by sowing 2 different varieties at 50 days interval.
- Hand pollination technique is possible but not recommended as the water melon flower is very small and difficult to handle for beginners in seed saving.

Selection

Select water melon for fruit size, sweetness, number of fruits per vine.

Harvesting

Watermelon seeds are mature and can be harvested, when the fruit is ripe, ready to eat.

Processing

The best means of extracting seeds is to eat the fruit and spit the seed out in a receptacle. Children love this, so invite them for a competition on seed spitting. The seeds are then washed under running water and placed on a tray to dry. When the seeds split easily, this indicates that they are dried well and can be stored.

Seed viability

The seeds of the water melon plant have an average viability of 4 years.

Other Tips to bear in mind

Labels and Records: It is very important to label properly all stages of the seed production in order to identify, separate, isolate different varieties and to follow the seed production process, from sowing, to transplanting, pollination, harvesting, extraction, drying and storage.
It is important to display on the label, the name of the species and varieties, the origin of the seed, the date of sowing and later on the date of harvesting.

Cleaning and Sorting

Seeds may contain many types of particles (the desired seed, weed seed, plant material, etc.). In addition to the many different types of particles, the desired seed may have broken; also unviable seeds may have mixed into the lot. By removing these undesirable seeds and particles, you can improve the germination percentage of your seeds.

Different parameters

1. Size (large vs. small, length, width, and thickness). The most popular way to separate particles of different sizes is by scalping (using a screen which allows the desired seed to fall through the screen holes while blocking the larger particles) or sifting (using a screen in which only the particles smaller than the seed are allowed to pass). Both of these separations can be made manually by using separating boxes.

2. Weight (heavy vs. light and differences in specific gravity and surface area). This separation is best done with a box fan or an air column. This works by dropping the seeds through a passing draft of air, allowing the light, often unviable seed to be blown out of the seed lot. This method also removes any light chaff that remains within the healthy seed lot.

3. Colour This separation is most often done by hand-picking.

Seed Extraction Method depending on the species characteristics

Dry Extraction

Dry extraction consists of letting the vegetable fruits to dry on the plant or in a protected area until the seed has reached maturity. Then the seeds are removed from the fruits by threshing, rubbing, scraping manually or

mechanically. Later on, winnowing, screening, drying and storing happens. Species suitable for dry extraction are: Amaranth, Beans, Corn, Bottle Gourd, Capsicum, Lettuce, Radishes, Carrots and Cabbage.

Wet extraction

Wet extraction consists of using some or little water to facilitate the process of extraction. Water can be used for dislodging seeds from their cavity and cleaning fruit pulp residues or fermenting the seeds. After wet extraction extra care should be taken for the drying process. Species suitable for wet extraction are: Tomatoes, Pumpkin, Cucumber, Water melon, Brinjal, and bitter gourd to name a few.

Drying

Drying is a process where removal of water moisture or moisture from the seed evaporates, to end in a solid state.

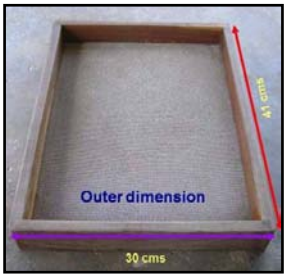
Natural air drying takes place when materials are dried using unheated forced air, instead taking advantage of the natural drying potential of the surrounding air. The process is slow and weather-dependent. So a wise strategy "fan off - fan on" must be devised considering the following conditions: Air temperature, relative humidity and moisture content of the materials being dried. Seeds are increasingly dried with this technique, and the total time (including fan off and on periods) may last from one week to several weeks.

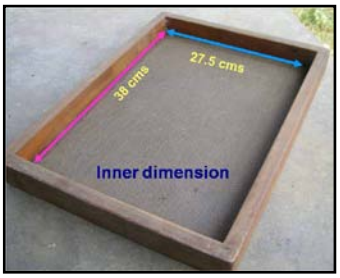
Drying is carried out as a requisite for safe storage, in order to slow down microbial growth. Seeds should be dried soon after harvest to avoid fungal and viral growth. Drying time is variable depending on the seed and the conditions in which the seed is being dried. One test for quality- If you can push your nail into the seed, it is probably not dry enough, to be stored.

A simple, inexpensive but efficient drier can be made out of a wooden planks and rippers together with thin steel mesh of different sizes.

A typical Drying Tray at Annadana

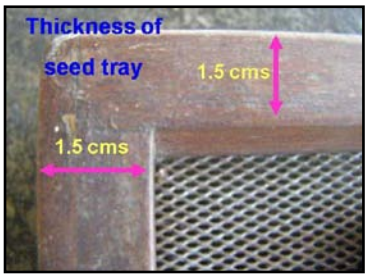
A seed drying tray has an outer dimension of 40 by 30 cm and inner dimension of 38 cm by 27.5 cm (as shown, right).

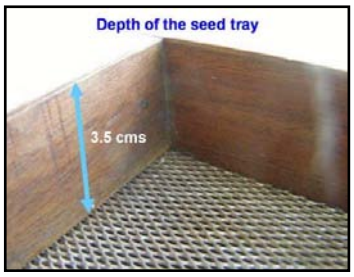




Thickness and depth of the tray

The thickness of the tray is about 1.5 cm and depth of the tray about 3.5 cm (as shown, right).





Safety bowl

When seeds are dried, great care must be taken against ants.

Make arrangements to protect the seed drier from ants. The safety bowl is made up porcelain or steel. The interior is designed to create a small "island" where the leg of the drying rests, and surrounded by water (as shown above, centre). This effectively prevents the ants from entering into the seed drier.

Humidity

Seeds absorb moisture from the storage environment. High humidity levels cause seeds to increase their respiration and use up their stored energy. Make sure the seeds are dry enough (seed moisture content about 8 to 15 %) prior storage. Then store them in an air-tight container, such as a screw-top jar.

Darkness

Exposure to sunlight will shorten the life of seeds. Use dark-coloured jars or non transparent containers to protect seeds from sunlight. If clear jars are used then place them in paper bags to shield out sunlight.

Temperature

For most vegetable seeds, a temperature below 18 - 20 °C is ideal. You can store the seeds in an air-tight container and place the container in the refrigerator. For short-term storage, keep the seeds in a cool and shade dry place. Most vegetable seeds can be safely stored for at least three to five years. Place seeds in cloth or mesh bags, plastic containers, or foil envelopes. The best containers are air-tight, such as a sealed glass jars, metal cans, or foil envelopes. Label each container carefully. Note the names of the line or variety, the year, and any such information you consider valuable.

Seed storage

Optimal storage for seeds needs to be airtight, maintain low humidity, and low temperature. Containers should ideally be moisture proof and sealable. However, low temperatures in storage are also highly recommended to avoid degradative reactions and, especially, the growth of insects and mites. A good maximum storage temperature is about 18°C.

At Annadana Seed Bank in Auroville, for quality and security purpose, we adopt storage of our seeds in a solar powered refrigerator.

At Annadana ecological centre in Kodaikanal, where the temperatures are cool most of the year, we plan to store our seeds in dark-coloured glass jars sealed with a screw type cork.

There exists many traditional ways of storing seeds, we have listed a few below. Ref: **Solomon Kiruba, Sathiadas Sam Manohar Das & Smaragdi Papadopoulou**

Research Department of Zoology, Scott Christian College, Nagercoil, Tamil Nadu, India.
Laboratory of Entomology, Technological Educational Institute of Thessaloniki, Greece.

Storage of seeds or food grains by the indigenous groups of the tropics and subtropics are mainly traditional. The traditional methods have been used for many years with little or no modification and are successful because of the application of scientific principles. The selection of a traditional storage system is often related to climate, but local natural resources and customs also influence the choice of the traditional and modern seed storage methods.

Thombai (Bamboo bin)

It is a storage structure made from *Bambusa arundinacea* (as shown, right) (Retzius) Bamboo splits, are closely intertwined in such a way that a bamboo skeletal structure is formed with a narrow opening at the top. This structure is placed over a foundation of boulders and covered on all sides by clay and allowed to dry. The interior of the structure is lime washed while the exterior is fortified with cow dung. When the structure is fully dried, the grains to be stored are put in the interior. Any additional material to be stored is saved in separate gunny bags or pots. An average thombai of 3m height and 1m radius can store upto 500kg seeds or grains. A large thombai can hold about 30 tonnes of grains. A small pothole alone is left at the top and this is closed by a large roof of *Cymbopogan* sp. Hackel (Ginger grass) which prevents rainwater from damaging the structure. The top of the thombai is in the form of spire and the roof is conical in structure similar to a pyramid.

Mankattai (Mud house)

This is a variant of thombai, and it is normally kept indoors. Here, there is no bamboo skeleton and the walls are made of mud bricks and plastered over with a primary layer of mud (as

shown, right). There is no spire, and the top is covered with wooden planks after storing the grains inside. The whole structure along with the mud or wooden planks is plastered over with clay and cow dung, allowed to dry and then it is lime-washed. The size of the mankattai is determined by the farmer based on his need. Mostly it is used to store seeds in proportion to the quantities produced. An average mankattai of 1.5m height and 1.5m width and 2m length that can store up to 500 kg seeds or grains.

Kulukkai (Earthen Pot)

This is another popular storage structure for storing lesser quantities of grains (below 200 Kg). The structure has a unique shape with a smaller base and a broader top with a constricted mouth for pouring in grains (as shown in the figure). The base of the structure is trenched in the soil, normally inside a protected house and there is a basal vent for removing the stored grains which is closed by coconut shell (*Cocos nusifera* L.). When grains are stored for longer periods, the door or vent is sealed with clay. The mouth at the top is covered by an earthen plate that exactly fits into the opening and the lip is sealed with mud. This earthen structure provides a storage time of about two years and it has proved to be very successful in storage of grains. It is a common practice to top up the Kulukkai with dried leaves of *Pongamia pinnata* (L.) Pierre and *Azadirachta indica* A. Jussieu.

Addukku-paanai (Earthen pot-pile)

A variant of the earthen pot is the earthen pot-pile. Usually three pots are stacked over another, the smallest being at the top, covered by an earthen lid fastened by thick cloth (as shown, right). The pots fit exactly over one another in such a way that, there are no gaps. The lips are sealed with clay and cow dung to further ensure perfect alignment. Addukkupaanai (Earthen pot-pile), capacity: bottom pot 30 Kg; middle pot 20 Kg; top pot 15 Kg.

Thallpai (Straw Case)

This is an unusual storage structure made up of paddy straw for storing seed grains. This storage maintains the seed grains viable for about two years. Paddy straw is specially prepared for making this structure. The straw is kept straight and dried properly. The dried straw is twisted to form ropes and the ropes are concentrically arranged over a large area (as shown, right). Loose straw is placed over this concentric arrangement and peelings from the bark of *Erythrina indica* L. and *Erythrina variegata* L. are placed along with loose straw. The bark peelings form the base and wall of this straw case. The grain to be stored in the straw case is first mixed with sifted fly ash and placed over the straw structure. When sufficient quantities have been placed, the straw ropes are folded over the grains and a rounded structure is obtained. This structure is usually suspended from the roof shafts.

Running a germination test after having completed your seed season

Germination rate is a way to measure how many of the seeds you have stored or that you want to share are still viable. It is usually expressed as a percentage. Germination testing is important to both the seed producer and the user.

Take a plastic tray with a hole at the bottom (as shown, left). The tray should be filled with soil, then count the number of seeds you wish to test on the tray (use a separate tray for each variety). Use a minimum of 25 seeds, up to 100. The higher number of seeds will give you a more accurate result. Use a minimum of 25 seeds if your supplies are low. Cover the seeds by little amount of soil (as shown above) and water slightly.

If moisture and warmth remain constant, most species of vegetable seeds will start to germinate within 3-6 days (as shown below). Check the seeds daily; remoisten if the tray is drying. A small rose can works well to supply the needed moisture while avoiding over watering that results in rot. After 15 days count the number of seeds that have germinated in the tray, be careful while counting. Avoid counting weed seeds germinating in the tray. Always try to germinate a random sample of the seeds you wish to plant. For long term storage, initial germination should be at least 75% for vegetables. Wild or traditional species often have a lower germination rate.

Seed germination can be capricious, read our seed sowing, germination guide. If, you are a self-reliant gardener, and into the habit of saving your own seed, your seed supply will never get low. And once you start experimenting with all our open-pollinated varieties, you will find that saving seeds from these age old jewels is a lot of fun. Our eight years experience guides you about cross-pollination, seed saving, and "having to" eat up a delicious watermelon, just to get the seeds.

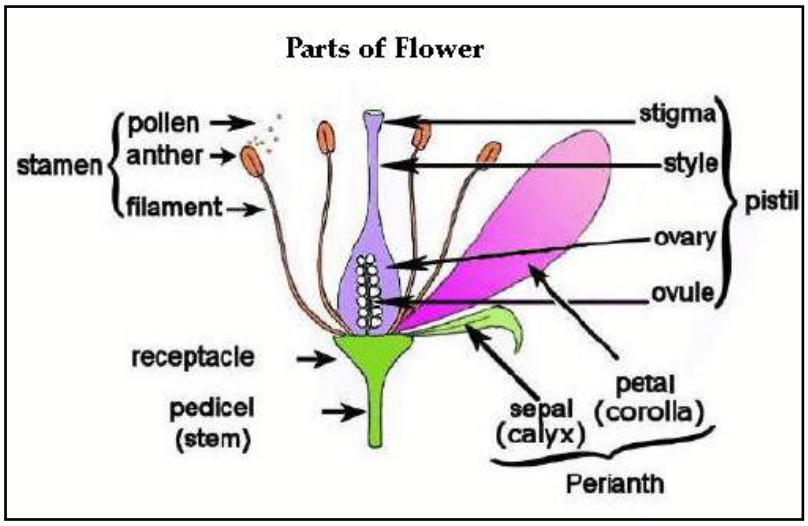
Technical Annexe

Some similar terms (simplified):

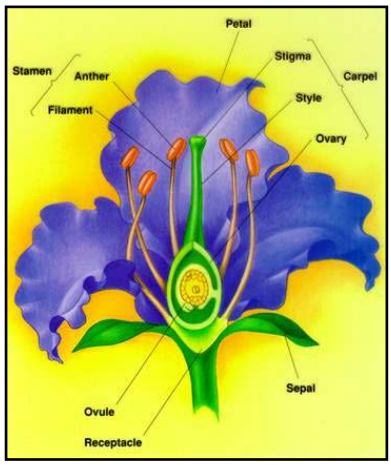
1. Male reproductive organ / Stamen / Pollen / Anther
2. Female reproductive organ / Pistil / Stigma / Ovule
3. **S**elf pollination / Selfers
4. Cross pollination / Out-crossers / Crossers
5. Bisexual / Hermaphrodite / Perfect flower
6. Unisexual / Imperfect flower/ Male and Female flower separate
7. Pure seeds / Breed True to type/ Pure variety
8. Autogamous / plant which will not cross/ Autogamy
9. Allogamous/ plant which will cross/ Allogamy

Flower

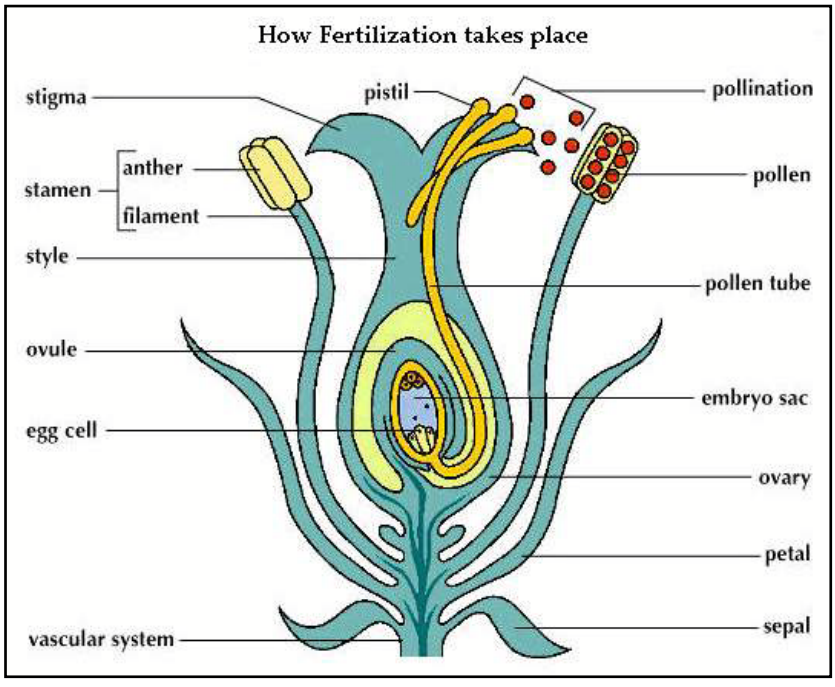
A flower is the reproductive structure of the plants. Flower is an adaptation for pollination and the process of pollination is necessary to bring the gametes (reproductive cells) together to produce an offspring.



Essentials organs or the flower **consist** of the male and female part, **stamen** and **pistil.**



Fertilization is the union of the (male) sperm nucleus from the pollen grain and the (female) egg nucleus found in the ovary.



If fertilization is successful, the ovule will develop into a seed (as shown in the figure, left) and the ovary will develop into a fruit.