Methods of seed harvesting

- Non-mechanical methods
- Hand harvesting is an arduous task and seed yields are low. It can be the only feasible method of seed collection when a plant is rare, of limited local occurrence or in an inaccessible area.
- Seed heads can be individually cut off or seed stripped from the inflorescence (Inflorescence - a group of flowers borne on a stem) by running a hand from the base of the inflorescence upwards.
- In some cases (e.g. *T. triandra*), seed has been harvested by cutting the entire stem (culm a grass stem), and allowing the seed to mature in the head and be shed over time. In such cases culms can be transported to the revegetation site immediately following harvest.

Trough, beater and brush harvesting

- The light, chaffy nature of native grass seed lends itself to beater, and in particular, brush harvesting techniques. Trough and later beater harvesters were developed in Queensland to collect seed from Heteropogon contortus (black spear grass) and the exotic grass, Cenchrus ciliaris (buffel grass).
- In their simplest form, trough harvesters are simply a trough fixed on the front of the vehicle at an appropriate height. As the vehicle is driven through the crop ripe seeds fall into the trough while immature seeds remains on the plant to be harvested later.
- Troughs are not effective for species with light and fluffy dispersal units as they tend to blow out of the trough.

Conventional mechanical harvest techniques

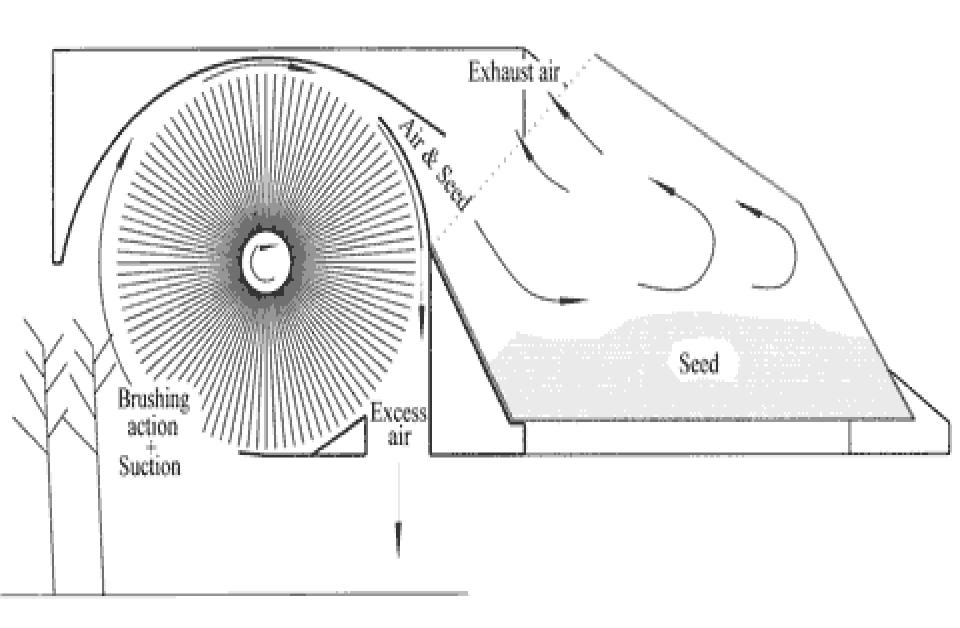
- It is the unique seeding characteristics of native grasses that make seed harvesting difficult using conventional direct harvesting methods. Exceptions include Astrebla and Elymus that have a high degree of seed retention and can therefore be harvested using conventional machinery.
- Some Austrodanthonia spp. also have a high degree of seed retention but are unsuited to direct heading because of the light fluffy nature of their seed. Windrowing followed by threshing the dry crop has been used with limited success to harvest seed from these species.

- The brush harvester has proven to be the most useful harvesting technique for a wide range of grass species.
- This is a non-destructive harvesting technique that allows for multiple harvests of a stand of grass. In this way it overcomes some of the difficulties by removing ripe seed only resulting in increased yields of viable seed.
- The original concept of the brush harvester comes from an American design, the Woodward Flail-Vac Seed Stripper that was developed in the



- The central concept of the brush harvester is a flailing brush which rotates upwards at its leading edge. This design has meant fewer stems are broken during harvest, as well as a cleaner product compared with conventional direct heading methods.
- A metal shroud over the brush creates a cross flow fan action that generates sufficient air velocity to gather seed heads into the flailing brush.
- The shroud also directs the flow of air and seed into a wedge-shaped seed hopper behind the brush. The triangular shape of the seed collection bin reverses the direction of airflow, depositing the seed into a dead air space on the floor of the bin while air escapes through the exit vent. These various components are illustrated in

Figure 1. Diagram representing the basic brush harvester concept, based on Beisel (1983)



Picture 2. The user friendly 'Trangie brush harvester' has an adjustable brush speed and harvest height as well as a seed bin that can be automatically emptied. (Photograph C. Waters)



Picture 3. The DLWC 'Grasshopper' is light weight (500–750 kg), has adjustable brushes and harvest height. The 'off-set' working position facilitates harvesting ripe seed that has not been disturbed by the towing vehicle. (Photograph C. Huxtable)



Picture 4. A hand held brush harvester designed to collect seed from small, inaccessible areas. (Photograph I. Cole)



Picture 5. A reel and brush harvester which gathers culms with inflorescences over the top of a rotating brush to deposit the seed in a seed hopper. Designed and built by J. Stafford, Vegetation Management Services, Main Rd, Lenswood. SA 5240 (Photograph R. Whalley)



Suction or vacuum harvesting

- The dispersal units of some native grasses (e.g. *M. stipoides*) are very easily removed from the inflorescences, even when they are in the early stages of development. Hand-held commercial outdoor vacuum cleaners can be used to harvest this type of seed and tend to remove only mature seed.
- Vacuum cleaners are only suitable for harvesting small areas because the intake is quite small (say 12 cm x 8 cm)

Picture 6. An electric garden vacuum cleaner can be used successfully to harvest small areas of *M. stipoides*. (Photograph C. Waters)



A final modification to this machine includes a combination of vacuum and brush.

The 'Rosevale Reaper' is a re-design of the original 'Scorpion' allowing for the harvester to be utility mounted and easily transported.



Which seeds can be saved ...

- Vegetable seeds can be saved to sow new crops in the future, but not all seeds are suitable for saving. Varieties suitable for seed saving include local varieties that have been grown in one region for a very long time, self-pollinating crops (for example, beansand peas), and open-pollinated varieties of some cross-pollinating crops (for example, pepper, cucumber and carrot).
- Commercial F1 hybrid varieties are popular among many vegetable growers today. However, the seed of hybrid fruits should not be saved, because the F1 hybrid seeds were produced by crossing two different parent varieties. Seed saved from hybrids will either be sterile or the plants of the next generation may show wide variation in characters, uniformity and maturity.

- Seed saving involves selecting suitable plants from which to save seeds, harvesting seeds at the right time, and storing them properly. The seed saving techniques of many common vegetables will be introduced in this manual.
- Before you start to save seeds, it is necessary to know a few things about the reproductive ability of plants. Many vegetable species produce flowers with the male part (anther) and the female part (stigma) in the same flower. These are called perfect Flowers.
- However, in maize and most varieties of the cucurbit family (cucumbers, melons, pumpkins, etc.), the anthers and the stigma are in the same plant but on different flowers. These are called imperfect flowers.



Perfect flower of eggplant: the stigma (green) is surrounded by anthers (yellow)



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

- Pollination occurs in plants when pollen from the anthers of the flower is deposited on the stigma. In some perfect flowers, self pollination occurs.
- Lettuce, tomato, and okra have the stigma so close to the anthers such that the slightest wind movement can cause the pollen to drop onto the stigma within the same flower. In peas and beans, self-pol- lination occurs even before the flower opens.
- Other types of perfect flowers require crosspollination. An external pollinator such as an insect is necessary. Onion, carrot, cabbage, and radish, for example, belong to this type.
- Plants with imperfect flowers 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.

How to keep seeds pure?

- Keep in mind that natural crosspollination 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

Isolation in 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. How far apart differs among vegetables; this will be described for each vegetable in the following chapters.

Bagging.

 When only a small amount of seed is needed, cover the unopened flowers with a paper bag.

 This is applicable for crop with a high but not 100% rate of self-pollination, such as pepper and eggplant. You can also bag the flowers of cucurbits; in this case, both male and female

d-pollination

flower sh is require

Caging

Cages can be used for vegetables that flower over a long time or to prevent insects from transmitting pollen from two nearby varieties of the same crop.

 You can use bamboo rods stuck in the ground to make an arched tunnel and covered with nylon mesh. Because the cage will exclude all insects, you may need to hand pollinate the plant to ensure seed set, or you can introduce bees into the cage if they are cross-pollinated

species.



The best way to store seeds

- After saving your seeds, it is important to keep them alive for future use. Newly harvested seeds should not be immediately stored in a plastic bag because the moisture content of the seed is still high and will lead to deterioration.
- Before keeping seeds in the storage, seeds should be dried. Keep in mind that seeds are alive—but they breathe very slowly. To keep seed alive for a long time, keep them under low temperature and low humidity during storage.

Humidity.

- Seeds will absorb moisture from the storage environment. High humidity levels cause seed to increase their respiration rate and use their stored energy.
- Make sure your seeds are dry enough (seed moisture content around 7–8%) before storage, and keep them in an air-tight container, such as a screw-top jar.

Darkness.

• Exposure to sunlight will shorten the life of seeds. Use dark-color jars or nontransparent containers to protect seed from sunlight. If using clear jars, place them in paper bags to shield out sunlight.

- Temperature. For most vegetable seeds, a temperature below 15 °C is ideal. You can keep 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 shady dry place Most vegetable seeds can be safely stored for at least three to five years.
- Place seeds in manila envelopes, cloth or mesh bags, plastic containers, or foil envelopes. The best containers are air-tight, such as a sealed glass jar, metal can, or foil envelope. Label each container carefully. Note the names of the line or variety, the year, and any other information you feel is valuable. Store seeds in a cool, dry place

oode stored in an agric containers to prevent them from absorbing





Cucumber Family

(cucumber, melon, squash, pumpkin and gourd)

"Production

- The cucumber family (Cucurbitaceae), commonly referred to as 'cucurbits', includes cucumbers, melons, squashes, pumpkins, and gourds.
- They are all warm season crops and very susceptible to frost. Many cucurbits are susceptible to foliar diseases that attack plants during periods of high humidity and rainfall. Therefore, regions having high temperatures and low humidity are ideal for the production of cucurbit seeds.

Isolation

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, melon, gourd, etc.) at the base of the flower. The flowers are insect-pollinated, and easily cross within species. However, seed savers can grow more than one variety at a time in a single location by using hand pollinating techniques.

Hand pollination.

- Cap or bag female and male flower buds on the same plant or nearby plant of the same variety. Then select male flowers when they bloom, turn cover their petals to expose their anthers, and gently roll the anthers over the stigma of the just bloomed female flowers; you can see a layer of pollen has been transferred on the stigma.
- After pollination, cap or bag the female flower again to exclude insects. Mark the pollinated female flower by wrapping a string to the pedicel.

Selection

 Select early flowering, vigorous plants. Hand-pollinate the female flowers located 10–20 nodes from the base of the plant. Removeany deformed fruits.

Harvesting

• The fruits should be left to fully ripen and turn color. The fruits of luffa and bottle gourd should be left on the plant until they dry. For cucumbers, fruits will turn brownish color. Bitter gourd fruits will turn orange. Some wax gourds will be covered with a pale-white powdery wax on the surface of the fruit. After harvest, the fruits can be kept in a shed for a couple of weeks to allow the seed to further ripen.

Processing

- For 'wet seeds' such as cucumber, wax gourd, bitter gourd and melons, cut the fruit lengthwise and scrape seeds out with a spoon. Allow seeds and the jellylike surrounding liquid to sit in a container at room temperature for 1–2 days.
- Fungus may start to form on top. Stir daily. The jelly will dissolve and good seeds will sink to bottom while remaining debris and immature seeds can be rinsed away. Spread seeds on a paper towel or screen until dry.
- For 'dry seeds' such as luffa and bottle gourd, keep the seeds in the fruit until they naturally separate from the flesh. This can be identified when you shake the fruit, the sound of seeds moving inside is heard. Cut off the bottom of the fruit and shake the seeds out, winnow to clean the remaining chaff, then place the seed on a screen for further drying before storage.



Wet seed extraction: mature cucumber (left), seed extraction (center), and fermenting seed (right)

Radish

Isolation

- Radish flowers are cross-pollinated by insects, primarily honeybees. Isolation distances of 1000 m or more are recommended.
- Related weeds, notably wild radish, wild turnip and wild mustard, must be removed to prevent crosspollination.

Selection

- In the root-to-seed method, foliar characteristics, root shape, size, skin and flesh colors, pungency, pithiness and bolting behavior are considered. Hairy or forked roots and early bolting plants are removed.
- Selection is more difficult in the seed-to-seed method because one cannot see the entire root. Nevertheless, growers using this method should aggressively rogue out undesirable plants taking

Harvesting

Threshing seeds from pods are difficult.
Allow the plants to mature fully; then bring them to the threshing floor for drying.

Processing

 Threshing is done by hand-beating with sticks. The seed is then dried further.





Radish roots (top) and ripening seed pods (bottom)

Pepper

- Isolation
- Peppers produce perfect, mostly self-pollinating flowers. Solitary bees will pollinate if other more desirable pollen is not available in the area. Most growers will get satisfactory results if different varieties are separated by 20 m or with another tall, wind breaking crop.
- Closing the flower bud with a cotton ball when the distance of isolation is not sufficient is an ideal method to prevent cross-pollination.
- Selection
- The earliest maturing and more attractive plants should be marked and inspected during growth.
 Select healthy, attractive fruits for seed saving.
 Seeds from off-type plants or fruits should not be saved.

Harvesting

Harvest mature, fully-ripe peppers for seed.
Most peppers turn red when fully mature.

Processing

- Pepper seeds may be extracted from fresh fruits or from fruits that have been dried in the sun for a few days.
- Seeds may be removed by hand or extracted by grinding the fruits and separating the seeds from fruits with a series of water rinses. Spread the seeds on a screen for drying under shade for 2–3 days but bring them inside every evening.





Sweet pepper cut for fresh seed extraction by hand

Chili pepper prepared for dry seed extraction

Okra

Isolation

 Okra flowers are often cross-pollinated by insects. An isolation distance of 500 m or more is recommended. An alternative method of keeping seed pure is to bag the flower buds and hand-pollinate once flowers have opened.

Selection

 Plants for seed multiplication can be selected before flowering, taking into consideration the vigor and habit of the plants. Once flowering begins, plants with off-type flowers should be removed. After the first pods are developed, remove plants with off-typ pods. Plants with viral symptoms should be removed as soon as symptoms appear.

Harvesting

- The okra pods mature in a sequence from the base of the plant toward the top. The pods have tendency to split along the suture when they are dried out.
- 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 color) and before shattering.

Processing

Pods are easily hand threshed.





Okra pod and flower

Pods maturing from the base of the plant

Lettuce

Isolation

 Lettuce produces perfect, self-pollinating flowers. But a small amount of natural crosspollination can occur from 1–6% when two varieties are grown side by side. A separation of 2–3 m or the establishment of a tall crop such as maize between different varieties is sufficient to reduce out crossing.

Selection

- Select the best plants at the edible stage when you normally harvest for consumption and mark them by putting a tag into the field near each selection. Early bolting plants are not usually kept for seeds because the seeds from the early bolting plants will also produce poor quality lettuce for consumption.
- Plants for seed production may need to be staked for support

Harvesting

 When two-thirds of the flowers of the stalk are turning fluffy white, about 2–3 weeks after flowering, the seed can be harvested from single plants by shaking their heads into a canvas bag. This can be done every 2–3 days, or you can put the whole plant on a mat under shading. The seed will continue to ripen and shatter.

Processing

 After completely dried with white pappis, seed heads are rubbed with hands to remove seeds. If necessary, separate seeds from chaff by winnowing

Storage

 Lettuce seed loses its viability quicker than most vegetable crops. Under ideal cool and dry conditions, seeds may maintain their viability for up to 3 years.





Staked plants

Shattering seeds

Carrot

Isolation

 Carrot plants produce perfect flowers that are pollinated by insects. Separate different varieties 800 m apart. Remove wild carrot weeds since they will pollinate with carrot.

Selection

 Rogue off-types taking into consideration the root color and shape, plant habit, and plant vigor. Plants that bolt and go to seed early should be removed. Save seed from many carrots to maintain crop vigor.

Harvesting

The seed turns brown 6 weeks after pollination.
Before the seed shatters,

cut and place umbels into paper bags to dry completely.

 Late-season rains will reduce seed quality. For small amounts, hand pick each umbel as it dries brown. Large amounts of seed can be harvested by cutting the entire stalk as umbels begin to dry.

Processing

 Allow seed to mature in a cool, dry location for an additional 2–3 weeks. Seeds can be removed by hand-beating or rubbing umbels between hands. Winnow to clean. Remove spines from dry seed by rubbing.





Cluster of carrot flowers (umbel)

Cluster of mature seeds