

# **THE FAMILY SEED SAVING BOOK**

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**and**

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**Blue Mountains, Australia**

**First published 2002**

ISBN 0-9579683-1-2

C Rosemary Morrow and Susan Girard, 2002

Mountain Wildfire Press,

Lot 23, Explorer's Road, Katoomba, 2780 Australia

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## **OUR HOPES**

- That you understand the importance of seedsaving for yourselves, your children and your society and
- that you save seed and share it with others.

## **ACKNOWLEDGEMENTS**

There is a Vietnamese saying `no one can do anything on their own'. That has been established many times in our lives, and again in making this book. There has been the balanced and happy co-operation with Sue, the translation and interpretation by Phuong, and the ideas from Kosal Neary who learned from Jude and Michel Fanton of Seedsavers. Margot Turner and Tom Sizer read the draft and their comments improved it. Jude Fanton and Nancy Bubel gave permission for their tables to be used. Liz Connor did the final valuable `look good' edit. Copies can be bought from the author at the above address.

Cover design by Susan Girard

Printed on 80% recycled waste fibre - Renew

# Contents

|                                     | Page No |
|-------------------------------------|---------|
| Introduction                        | 5       |
| Background to seed saving           | 6-8     |
| Pollination and making seed         | 9       |
| Keeping the varieties pure          | 10      |
| Choosing the plants to save         | 11      |
| Choosing the plant material         | 12      |
| Collecting the seed                 | 14      |
| Cleaning, testing and drying seed   | 15-16   |
| Recording your collected seed       | 17      |
| Storing and keeping seed            | 18-19   |
| Germination tests                   | 22-24   |
| What happens at the seed bank       | 26-27   |
| Distributing seed for field testing | 28      |

# Tables

|     |                                    |       |
|-----|------------------------------------|-------|
| I   | Ease of saving seed                | 13    |
| II  | Storage time and no. seeds to gram | 20/21 |
| III | Days to emergence & temperature    | 25    |
| IV  | Seed sharing circle                | 29    |

# Illustrations

|   | Opposite page |
|---|---------------|
| 1. Importance of home seed saving           | 6             |
| 2. Technical problems of international seed | 7             |
| 3. Cost of company seed                     | 8             |
| 4. Cross pollination                        | 9             |
| 5. Keeping varieties pure                   | 10            |
| 6. Selecting for good traits                | 11            |
| 7. The seed growing cycle                   | 12            |
| 8. Steps in seed saving                     | 13            |
| 9. Collecting seed                          | 14            |
| 10. Cleaning and drying seed                | 15            |
| 11. Testing for living seed                 | 16            |
| 12. Recording collected seed                | 17            |
| 13. Checklist for good seed keeping         | 18            |
| 14. Storing seeds                           | 19            |
| 15. Stages of germination                   | 22            |
| 16. Germination tests                       | 23            |
| 17. Seed growers' records                   | 27            |
| 18. Seed distribution                       | 28            |

# INTRODUCTION

To save seed and have a seed bank is a new idea for many people. In many countries people have worked in agriculture and gardening for years yet they lack the techniques, skills and knowledge for keeping seed. People lose the seed, the tried and true varieties and their long time heritage.

In the future the seed will be saved and good quality maintained through local selection, seedsaving and seedbanks by the people trained in techniques of caring for their seed. They will need books for seed saving records and other equipment for storage. Seedsaving is easy to learn and to practice and it does not need much equipment. This book will show you how to do it.

This book was developed from a seedsaving course trialled in Viet Nam (2001) in two districts of Thanh Hoa Province with men and women district agricultural advisers. Corrections have been made according to the experiences of those courses and the participants' suggestions. This manuscript is presently being translated into Vietnamese and Khmer. Ease of translation was something we considered while writing this book.

# BACKGROUND TO SEEDSAVING

## Why saving seed is important

Many farm and garden crop varieties have not yet been systematically collected, described and discussed. Much seed is simply exchanged and passed among friends and not sold on the market. So the World Conference in 1991 suggested that NGOs set up schemes to gather, record and conserve plant genetic resources.

World plant seeds and genes have been lost through:

- Neglect
- War
- Disasters - fire, floods, earthquakes, tsunami, drought etc
- Plantations
- New farming methods
- Government or companies encouraging people to change to new species

Seed saving means collecting your own seeds:

- to grow the seed well,
- to protect the seed from going bad
- to keep it for a long time - if desired
- to save money usually spent on buying seed
- to have your own choice of varieties
- to save the traditional, heritage varieties
- to keep seed that is good for different conditions e.g. drought, flood, disease etc.

- to breed some new varieties
- to choose local growing areas and times to plant
- to share seed or swap with neighbours
- to select for local qualities e.g. high yielding, low compact plants
- to have very good quality seed
- to have seed at home for next season's planting.

In rural areas most people grow vegetables all the time and often many kinds. However while some people save seed, some cannot and some buy seed, often hybrid, in the market.

People who save seed don't buy it in the market; they save money and can grow vegetables all year, collecting the seed and keeping it well for growing next year. Saved seed can be kept at home, swapped with friends or it can be sent to a seedbank.

## **Problems of Buying International Seed**

Today most of the world's seed is owned, grown and controlled by very big oil companies like Shell or pharmaceutical companies like Monsanto's Pharmacia, and other such as Aventis and Syngenta..

These companies grow seed to sell and to make a profit for themselves. This means they produce seed that is not the same as local seed and often gives many problems to farmers:

- Seed as a Commodity. Some seeds, called hybrids, will not grow well unless the farmers buy **Seed + Fertilizer + Insecticide**. If they do not buy all these, then the plants will not grow well and farmers can lose the crop. And if the seed fails because of drought, cyclone or flood, then farmers go into debt because they had to borrow to buy all of the seed company's products.
- Terminator Genes. The big international seed companies want farmers to buy new seed from them **every year**. So they alter the plant seed genes so the crops will not grow viable seed. These seeds produce sterile seeds in the next generation. The next generation will not grow at all .
- Unsuitable Seeds. Companies sell seeds that are grown far from where farmers live. So, seed developed and grown in a dry area is now being grown in a wet area and does not give good harvests.
- Seed quality. This deteriorates when seed is too old, diseased, has low germination rates or it is not true to the original seed.
- Number of varieties. Seed companies like to have a small number of varieties, which are high yielding but have lost good genes for such qualities as disease resistance, tolerance of drought or flood, good flavour and nutrition.



# POLLINATION AND MAKING SEED

## What is pollination?

Pollination is what happens when pollen from the male part of the flower is transferred to the female part of the flower and so makes fertile seed.

### a. How Pollination Occurs:

Pollen is carried by wind, water, insects, birds and people. Chemicals and other factors can prevent pollination.

### b. Types of Pollination:

Self-pollination occurs when the male and female parts are close and in the same flower and are not self-infertile e.g. lettuce, tomato, okra. Pollen is taken from the male to the female flower parts through wind, water and movement. Beans and pea are pollinated before the flowers open.

- Cross-pollination occurs when male and female parts are: separate flowers on the same plant e.g. cucumber, corn, watermelon, eggplant, gourd; or separate flowers on different plants e.g. papaya, carrot, parsley, celery. The pollen is carried by wind, bees, flies, wasps etc.
- Hand pollination is when people help pollination. For example, with corn, a paper bag is placed over the male flower for one hour or more then it is taken off and placed over the female flower and left for two or three days, then removed. The male pollen in the paperbag has fertilised the female flower.

## KEEPING THE VARIETIES PURE

When you have some very good parent plants then you want to make sure that the seed is pure. This means that you want the seeds to grow well and have the same characteristics (which you choose) as its parents. Some plants are self-fertile and so are 'pure'.

Some plants mix the pollen of male and female flowers so the seed is a mixture of both and not pure. To make sure you will have seed that is pure from the pollination of male and flowers you can do the following:

1. Grow vegetables at different times so the pollen cannot mix up. For example, you can have different varieties at different times e.g. early and late season corn or cucumber.
2. Grow vegetables of the same variety but grow them some distance apart so they cannot cross-pollinate and also use integrated planting techniques, or windbreaks, to prevent the pollen being carried to another plant by insects or wind e.g. cucumber, eggplant or tomato.
3. Grow the same variety at the same time but cover the flowers (bagging) with paper bags to prevent the pollen from mixing with others.
4. Make baskets, cages or nets to cover the whole tree or bush to keep it from air and insect pollination from other flowers.

# CHOOSING THE PLANTS TO SAVE

## **In general, select plants for**

- Heirloom varieties handed down from one generation to another
- Local varieties grown as long as local people can remember
- Varieties taken off the market that cannot be bought any more
- Good recent arrivals

## **Selecting for special traits**

You can select for many different qualities of the plant and its fruit.

Observe the plants and their fruits very carefully while they are growing.

Then you decide why it is good. A plant may be very good if it:

- Survives in drought times
- Has many fruits or seeds - heavy yielding
- Has early maturing fruit (special traits) or late leaf and root crops
- Is good in a special soil e.g. clay or sandy or acid
- Tastes delicious, has good flavour
- Survives in a flood
- Bears well in hot or cold seasons
- Has large fruit or seeds
- Is nutritious

Usually you select for no more than three of these. When you select the best plant for the reasons you have chosen, tie a coloured ribbon around it to remind yourself not to eat or pick the flowers, fruits or roots.

# CHOOSING THE PLANT MATERIAL

## Three types of plant material

Until now we have been talking about saving seeds, but when we say "seed" we mean the plant material you use to grow another plant with the same good qualities. There are several plant parts which we can grow:

- Select a good stem for cuttings e.g. sauropus
- Select good fruit or root e.g. mango, ginger
- Select good seed e.g. beans, cabbages

A good-sized plant can also be divided to make new plants e.g. lemongrass

### 1. Good Stem Cuttings

- It is a good straight stem and strong
- It has no disease, insect attack or eggs on it
- It has at least one bud on the stem

### 2. Good Fruits and Roots

- It is a good sized fruit or root
- It is ripe or over-ripe
- It has no diseases, insect attack or eggs on it

### 3. Good Seeds

- It is a good sized seed
- It has no insect attack or eggs on it
- For small seeds in pods, collect a branch or whole plant with good seedpods

If you are not sure what fruits and vegetables to save then start with the simple ones. See Table 1 Ease of Saving.

## TABLE I - EASE OF SAVING

### FOR BEGINNERS

|               |               |             |             |
|---------------|---------------|-------------|-------------|
| Basil         | Beans         | Broad Beans | Chilacayote |
| Choko*        | Coriander     | Dill        | Fennel      |
| Garlic*       | Garlic Chives | Lemongrass* | Lettuce     |
| Marigold      | Nasturtium    | Okra        | Pea         |
| Sage          | Salad Burnet  | Shallot     | Snake Bean  |
| Sweet Potato* | Tomato        | Water Cress |             |

### FOR EXPERIENCED SAVERS

|                      |                   |                  |                 |
|----------------------|-------------------|------------------|-----------------|
| Amaranth             | Artichoke         | Asparagus        | Basella         |
| Bitter Gourd         | Borage            | Broccoli         | Calendula       |
| Cape Gooseberry      | Capsicum & Chilli | Carrot           | Celery          |
| Celtuce              | Chervil           | Chicory          | Chinese Cabbage |
| Chives               | Cowpea            | Dandelion        | Ginger*         |
| Gourd                | Gramma            | Hibiscus Spinach | Hyacinth Bean   |
| Jerusalem Artichoke* | Korila            | Leek             | Luffa           |
| Marjoram             | Mint              | Mitsuba          | Mizuna          |
| NZ Spinach           | Pansy/Violets     | Parsley          | Peanut          |
| Peruvian Parsnip*    | Poppy             | Potato*          | Pumpkin         |
| Qld Arrowroot*       | Rhubarb           | Rocket           | Rosella         |
| Rosemary             | Runner Bean       | Salsify          | Sorrel          |
| Soya Bean            | Spring Onion      | Squash           | Sunflower       |
| Taro*                | Thyme             | Tree Onion*      | Tumeric*        |
| Watermelon           | Wax Gourd         | Winged Bean      | Yam Bean        |

### FOR MORE ACCOMPLISHED SAVERS

|                 |               |                |             |
|-----------------|---------------|----------------|-------------|
| Beetroot        | Cabbage       | Cardoon        | Cauliflower |
| Celeriac        | Collard       | Corn Salad     | Cucumber    |
| Eggplant        | Endive        | Guada Bean     | Kale        |
| Kohlrabi        | Mustard       | Mustard Greens | Oca*        |
| Onion           | Orach         | Parsnip        | Radish      |
| Rockmelon       | Silverbeet    | Spinach        | Tarragon*   |
| Water Chestnut* | Water Spinach |                |             |

### FOR EXPERT SAVERS

|                  |      |        |
|------------------|------|--------|
| Brussels Sprouts | Corn | Turnip |
|------------------|------|--------|

\* These plants are grown from roots, tubers or whole fruits, or by division, rather than from seed and includes choko and water chestnuts. They cannot be stored.

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From Michel and Jude Fanton, *The Seed Savers' Handbook*, p. 51

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# COLLECTING THE SEED

## When and what seed to collect

- Collect the seed before 10.00 in the morning and after the dew has gone from the stem and fruit. Collect from a part of the plant that is sunny and healthy, without diseases, insect attacks or eggs on it.
- Collect all fruits and vegetables when well ripe. For chili and capsicum, collect the seed when the outside skin is soft.
- For herbs see that the seed is very ripe, pull the stem and root from the soil and hang the whole plant in cool dry place upside down. Cover with paper bag so seed is not scattered or lost and keep the stem dry.
- Collect seedpods of beans and cabbages when the outside skin is quite dry and full of seed.
- For vegetables with roots, make sure the fruit and seed is very ripe and collect the root and stem - as for herbs.

## Treating seed to control disease

### *Blackspot, blackleg and black rot*

1. For largish dry seeds such as spinach, cabbage place them in hot water at 50oC for 25 minutes then dry them as above.
2. For wet seeds such as tomatoes, cucumber, rockmelon ferment them by leaving them in a small amount of water at room temperature for two days and then rinse well until all the pulp has gone and dry the seeds on non sticky paper. See p. 16

## CLEANING, TESTING AND DRYING SEED

- Seeds must be thoroughly clean before they are stored for a long time.
- Seeds are heavier when they are alive - dead seeds or seeds which insects have eaten inside, are light and float in water. To test (large) seeds place them in a glass of water - the living seeds drop to the bottom and the dead seeds float to the top. If more float than sink select another lot of seeds if you can and test them.
- Seeds must be quite dry before they are stored or they can rot from fungus, attract pests, or get diseases from virus or bacteria. So it is important to dry the seed very well but not so dry as to kill it.

### Ways of cleaning, testing and drying seeds

1. Dry seedcoats e.g. Herbs, and vegetables with roots, amaranth, lettuce, cabbage, Chinese cabbage, carrot,
  - Pick the whole plant i.e. harvest the seed on whole plant
  - Hang it up in the shade - for one or two weeks in dry season, three to four weeks in the wet season - until seed and stem are quite dry
  - Take seed and clean it
  - Dry in the sun from 7.00 to 9.00 am then move and dry in shade
  - Do this every day until the seed is dry.
2. Dry fruits and vegetables e.g. Bitter gourd, luffa, pumpkin, beans, chili, eggplant etc.
  - Take the seeds out of the fruit and clean it - some need rubbing, crushing, winnowing, luffa and beans don't need to be cleaned
  - Place in glass of water and let settle
  - Select heavy seed from the bottom of the glass and dry as in 1.

3. Fruit with a high water content e.g. Cucumber family, and tomato.
- Cut the fruit, take out the seed, and put pulp in a glass of water for one day in the dry season and two days in the wet season.
  - Then stir all the pulp in the glass, let it settle
  - Discard floating seeds etc and keep the seeds from the bottom
  - Wash them in clean water and dry as in 1.

You may want to do a formal Viability (Living) Test, especially if you are planning to distribute your seeds.

Method: Take 100 fairly large seeds. (Very small seeds float anyway)  
Place them in a glass of water and stir gently.  
Wait 5 minutes to see which drop to the bottom  
Take out these living seeds and dry them again.  
Count these seeds.  
The number gives you the viability %

### **Drying seed properly**

Seed is properly dry when you cannot dent the seedcoat with your thumbnail or you do not leave a tooth impression when you bite it.

Ways you can dry it:

- Place the seed evenly on newspaper and place it out of the wind
  - on a windowsill and out of the sun is a good place
  - or on screens such as flywire and turn it regularly
- Place it in paperbags and hang them in a breezy spot
- In wet weather place it above a fire or heater but never >45oC

### **Sorting the dry seed**

- When the seed is dry shake it into open basket or sieve and let all the broken seed drop through.
- Store the biggest and cleanest seeds in a paperbag, write on the bag and record them immediately.



## RECORDING YOUR COLLECTED SEED

It is important to record the details about the seed you have collected because:

- you may forget why you saved it by the time you want to plant it
- you may want to give it to someone
- you may want to compare it with another variety

### How to record your collected seed at home

- Keep a notebook or old diary with the dates.
- Write down the following details on the date you picked the seed:
  - Name of vegetable
  - Special qualities of vegetable e.g. disease resistant, long yielding
  - Dates of collection
  - If there were special conditions at the time it was growing e.g. very dry
  - If you sent some to your seedbank send these details on the packet

*Address of sender*

*Name of seed and special type*

*Details of the seed - e.g. can grow in dry season*

*Date of collection*

- On the envelope you have placed the seed in, write the same details.
- Store in a cool dry place.

# STORING AND KEEPING SEED

You can do this at home or at the seedbank

## Materials for keeping seed

If seed is not stored well it can die, rot or germinate before you plant it.

Seed can be kept alive for quite a long time if it is stored properly.

Keep the good seed in a place with a temperature of 5-20oC and monitor (check on) it regularly.

## Containers used to store the seed

- water bottles and jars
- plastic box with lid
- paper bags - inside airtight clear glass bottles
- plastic bags
- cotton bags- inside airtight clear glass bottles

## Hygroscopic materials to keep the seed dry

- ash                                      oil from coconut,                      rice - hulled and nonhulled

## Insect repellent materials

- dried chili
- pepper
- dried leaf of marigold flower - also for pest control

The seed is stored in plastic or paper bags\* inside glass jars or bottles that are **airtight**. This is very important because with no air, any insects will die and fungi, virus and bacteria have trouble surviving.

## **Place for storing seed containers**

- You need a dark and cool place with temp 5-20oC
- Seed can be stored in a one metre deep hole in the ground, under the house or verandah - not outside
- All seed is good in a refrigerator for three to four years.
- If seed is stored for one year it is good to put it in a refrigerator for two or three days before sowing it.

## **Monitoring the stored seed**

- Check jars every two or three months and change the hygroscopic and ct repellent materials or again dry in sun and so on.
- If there are insects in the seed,
  - take the seed and put it in the refrigerator for two days and the insects will die
  - then take seed out and grow it.
- People without a refrigerator can take seed and put it in a jar or plastic bag, exclude air very carefully and the insects will die.

## **Life of stored seed**

Seeds, like all living things, will die eventually so it is no use keeping them too long in storage.

- Kept under good conditions seeds will give good germination
- Different seeds have a different life expectancy (see Table II)
- Seeds are much better preserved by continually growing them and...sharing them.

**TABLE II - STORAGE TIME AND NO. SEEDS TO THE GRAM**

| <b>Plant</b>                  | <b>Yrs of Viable Storage</b> | <b>Seeds Per Gram</b> | <b>Plant</b>      | <b>Yrs of Viable Storage</b> | <b>Seeds Per Gram</b> |
|-------------------------------|------------------------------|-----------------------|-------------------|------------------------------|-----------------------|
| <b>FOR BEGINNERS</b>          |                              |                       |                   |                              |                       |
| Basil                         | 5                            | 600                   | Beans             | 3                            | 5-10                  |
| Broad Beans                   | 4                            | 1                     | Chilacayote       | 5                            | 5-8                   |
| Coriander                     | 3                            | 90                    | Dill              | 3                            | 900                   |
| Fennel                        |                              |                       | Garlic Chives     | 1                            | 250                   |
| Lettuce                       | 5                            | 1000                  | Marigold          | 3                            | 300                   |
| Nasturtium                    | 3                            | 30                    | Okra              | 5                            | 15                    |
| Pea                           | 3                            | 5                     | Sage              | 3                            | 250                   |
| Salad Burnet                  | 3                            | 150                   | Snake Bean        | 3-8                          | 5                     |
| Tomato                        | 4                            | 400                   | Water Cress       | 5                            | 4000                  |
| <b>FOR EXPERIENCED SAVERS</b> |                              |                       |                   |                              |                       |
| Amaranth                      | 5                            | 800                   | Artichoke         | 5                            | 30                    |
| Asparagus                     | 3-5                          | 50                    | Basella           | 5                            | 50                    |
| Bitter Gourd                  | 5                            | 12                    | Borage            | 5                            | 65                    |
| Broccoli                      | 5                            | 270                   | Calendula         | 2                            | 100                   |
| Cape Gooseberry               | 3                            | 400                   | Capsicum & Chilli | 5                            | 150                   |
| Carrot                        | 3                            | 1000                  | Celery            | 4                            | 500                   |
| Celtuce                       | 5                            | 1000                  | Chervil           | 1                            | 450                   |
| Chicory                       | 8                            | 600                   | Chinese Cabbage   | 5                            | 350                   |
| Chives                        | 1                            | 600                   | Cowpea            | 5                            | 50                    |
| Dandelion                     | 2                            | 1000                  | Gourd             | 5                            | 30                    |
| Gamma                         | 3-8                          | 5                     | Hibiscua Spinach  | 3                            | 70                    |
| Hyacinth Bean                 | 4                            | 4                     | Korila            | 3                            | 30                    |
| Leek                          | 3                            | 400                   | Luffa             | 5                            | 20                    |
| Marjoram                      | 5                            | 12,000                | Mint              | 1                            | 40,000                |
| Mitsuba                       | 3                            | 500                   | Mizuna            | 2                            | 600                   |
| NZ Spinach                    | 6                            | 20                    | Pansy/Violets     | 7 days                       | 1-2000                |
| Parsley                       | 3                            | 200                   | Peanut            | 1                            | 12                    |
| Poppy                         | 2                            | 10,000                | Pumpkin           | 3-10                         | 4                     |
| Rhubarb                       | 1                            | 250                   | Rocket            | 2                            | 500                   |
| Rosella                       | 3                            | 70                    | Rosemary          | 1                            | 900                   |
| Runner Bean                   | 3                            | 1                     | Salsify           | 3-5                          | 100                   |
| Sorrel                        | 2                            | 1000                  | Soya Bean         | 3                            | 5-10                  |
| Spring Onion                  | 2                            | 250                   | Squash            | 3-10                         | 6-8                   |
| Sunflower                     | 3                            | 10-20                 | Thyme             | 5                            | 6000                  |
| Watermelon                    | 5                            | 6                     | Wax Gourd         | 3                            | 10                    |
| Winged Bean                   | 2                            | 18                    | Yam Bean          | 5                            | 5                     |

FOR MORE ACCOMPLISHED SAVERS

|                |      |       |             |      |     |
|----------------|------|-------|-------------|------|-----|
| Beetroot       | 5    | 50    | Cabbage     | 4    | 250 |
| Cardoon        | 4    | 25    | Cauliflower | 4    | 500 |
| Celeriac       | 5    | 2000  | Collard     | 4    | 200 |
| Corn Salad     | 4    | 700   | Cucumber    | 4-10 | 40  |
| Eggplant       | 5    | 200   | Endive      | 5    | 900 |
| Guada Bean     | 2    | 6     | Kale        | 4    | 250 |
| Kohlrabi       | 4    | 250   | Mustard     | 3-7  | 600 |
| Mustard Greens | 4    | 600   | Onion       | 2    | 250 |
| Orach          | 5    | 250   | Parsnip     | 1    | 200 |
| Radish         | 3-10 | 4     | Rockmelon   | 5    | 30  |
| Silverbeet     | 10   | 60-90 | Spinach     | 5    | 70  |
| Water Spinach  | 3    | 150   |             |      |     |

FOR EXPERT SAVERS

|                  |   |     |       |      |     |
|------------------|---|-----|-------|------|-----|
| Brussels Sprouts | 4 | 250 | Corn* | 2-10 | 3-8 |
| Turnip           | 5 | 300 |       |      |     |

\*Corn is easy to store but difficult to ensure the pure seed to get the true variety

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From Michel and Jude Fanton, *The Seed Savers' Handbook*, Appendix A, pp.165-7

# GERMINATION TESTS

A germination test is carried out to find out what percentage of seeds will grow. You can do a germination test on your own seed or on some given to you or on commercial seed.

At the seed bank germination tests are always done.

At home you generally do the germination test before you plant the seed.

## Preparation

- Use 100 seeds when you have a large number.
- Use all seeds when you have less than 100.
- You must take a good sample of the seeds.
- Don't take all the big ones or strong ones. You must have a mix of all the seed.

## Sampling method and preparing the seed

- Take 20 big or 30 small seeds from five places in their bag or packet.  
This is called sampling.
- For the large seeds, put them all in a glass of hot water at 53oC for 1-2 hours then dry gently on a sheet of paper.
- For the very small seed, use dry, don't soak in water e.g. carrot, celery, amaranth.

## Doing the germination<sup>1</sup> test

### 1. *For large seeds*

- Prepare a box or container for germination
- Place fine sandy soil for the bottom layer
- Then some sandy soil + ordinary soil + compost in middle layer
- Then ordinary soil mixed with compost for the top layer
- Place the seeds on the top in 10 x 10 rows and cover with sand
- Water lightly but well
- Make a label identifying the seed and put it in the box.

### 2. *For small seeds*

- Take a sheet of absorbent paper and clean the seed by rubbing it
- Fold the paper and then spray water on the paper
- Then take the seeds, count them 10 x 10 and place on the paper
- Fold the paper and spray more water
- Take the folded damp paper with its seeds and put it in a plastic bag with holes in it for breathing
- Write on plastic bag with permanent pen the seed code and date.

### 3. *Recording* - Write in a book:

- The number by code of the seed as on the bag or box
- The name of the vegetable
- The number of seeds and
- The date of starting the germination test.

## Monitoring the germinating seed

1. For the larger seed in the germination box:
  - water lightly with spray every day.
  - check once per week for four weeks and count and record how many seeds have germinated
2. For smaller seed in plastic bag
  - check every day and water daily
  - if necessary do this for one week

## Record sheet for germination results

|                                 |                   |
|---------------------------------|-------------------|
| Date Germination started .....  | Seed Box No. .... |
| Name of Person doing test ..... | Paper No. ....    |

| Code no.<br>of species | Name of<br>vegetable | No. Seeds<br>Tested | No. Germinating<br>per week | % Results | Comment |
|------------------------|----------------------|---------------------|-----------------------------|-----------|---------|
|                        |                      |                     | 1 2 3 4                     |           |         |
|                        |                      |                     |                             |           |         |

### Results of Monitoring

1. > 50% is good quality *may give to others*
  2. 30-50% is not very good quality *can give to others but give a lot*
  3. < 30% is poor quality *do not distribute to others.*
- NB.** Cucurbits don't have as high a germination % as high as others.

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<sup>1</sup> A Vigour Test is when the seed is planted in soil and compost and watered. The strength of the seedling is recorded. (Thanks for Jude Fanton – personal communication)



**TABLE III - DAYS TO EMERGENCE AT DIFFERENT TEMPERATURES**

| <b>Plant</b>   | <b>0</b> | <b>5</b> | <b>10</b> | <b>15</b> | <b>20</b> | <b>25</b> | <b>30</b> | <b>35</b> | <b>40oC</b> |
|----------------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|
| Asparagus      | x        | x        | 53        | 24        | 15        | 10        | 12        | 19        | 20          |
| Beans, Lima    | x        | x        | x         | 31        | 18        | 7         | 8         | x         | x           |
| Beans, Snap    | x        | x        | x         | 16        | 11        | 8         | 6         | 6         | x           |
| Beetroot       | x        | 42       | 17        | 10        | 6         | 5         | 4         | 5         | x           |
| Cabbage        | x        | x        | 15        | 9         | 6         | 5         | 4         | x         | x           |
| Capsicum/chili | x        | x        | x         | 25        | 13        | 8         | 8         | 9         | x           |
| Carrot         | x        | 51       | 17        | 10        | 7         | 6         | 6         | 8         | x           |
| Cauliflower    | x        | x        | 20        | 10        | 6         | 5         | 5         | x         | x           |
| Celery         | x        | 41       | 16        | 12        | 7         | x         | x         | x         | x           |
| Corn           | x        | x        | 22        | 12        | 7         | 4         | 4         | 3         | x           |
| Cucumber       | x        | x        | x         | 13        | 6         | 4         | 3         | 3         | x           |
| Eggplant       | x        | x        | x         | x         | 13        | 8         | 5         | x         | x           |
| Lettuce        | 49       | 15       | 7         | 4         | 3         | 2         | 3         | x         | x           |
| Okra           | x        | x        | x         | 27        | 17        | 13        | 7         | 6         | 7           |
| Onion          | 136      | 31       | 13        | 7         | 5         | 4         | 4         | 13        | x           |
| Parsley        | x        | x        | 29        | 17        | 14        | 13        | 12        | x         | x           |
| Parsnip        | 172      | 57       | 27        | 19        | 14        | 15        | 32        | x         | x           |
| Pea            | x        | 36       | 14        | 10        | 8         | 6         | 6         | x         | x           |
| Radish         | x        | 29       | 11        | 6         | 4         | 4         | 3         | x         | x           |
| Spinach        | 63       | 23       | 12        | 7         | 6         | 5         | 6         | x         | x           |
| Tomato         | x        | x        | 43        | 14        | 8         | 6         | 6         | 9         | x           |
| Turnip         | x        | x        | 5         | 3         | 2         | 1         | 1         | 1         | 3           |
| Watermelon     | x        | x        | x         | x         | 12        | 5         | 4         | 3         | x           |

x none of the seeds of this vegetable germinate at this temperature

Table from Nancy Bubel, *The New Seed starters Handbook*, p.33.

## WHAT HAPPENS AT THE SEED BANK

A seed bank is a small office and store, or someone's home with a small to medium garden. Usually the seed bank people really love and value seed.

### **The equipment it needs:**

- Record book or computer
- Some boxes to germinate seed, or plastic bags with holes in them
- Some envelopes to package the seed
- Cool, dry place to store the seed
- Some labels for labelling germinating seed and seed trials
- A little land to test a few seed types, or grow more seed

### **What the seed bank does:**

- It receives seed, does germination tests on all types of seed
- It describes the performance/conditions of growth and resistance to pests and diseases on the seed packet and in their records.
- It keeps very good clear records about each type of seed
- It stores some seed for short times e.g. until the next growing season
- It trials, through growing, some new or very different or difficult seeds

### **What the seed bank does not do:**

- Store very much seed - it sends it out to growers or farmers
- Charge for the seed
- Buy seed - volunteers send in seed to the bank
- Grow very much seed - special farmers and gardeners are seedgrowers
- Sell seed to multinational companies or others

### **How the seed bank keeps records:**

- Labelled seed is sent to the nearest seed bank
- At the seedbank the seed is recorded in a book or on computer:
  - *Code number for the seed variety* - all plants have a seedbank code
  - *Sender's name and address*
  - *Date of receiving the seed*
- The seed bank does a germination test (see earlier) and records date of germination test and percentage germination in book or on computer
- The seed is placed into small bags for distributing to special seed growers to grow larger amounts (see p. 28) or
- Some seed is grown at the seedbank to see how it performs.

**THE SEED BANK RECEIVES, TESTS, CIRCULATES SEED  
AND KEEPS INFORMATION ON IT.**

## DISTRIBUTING SEED TO GROWERS FOR MULTIPLYING AND FIELD TESTING

Seed can be grown by a special seed grower, or by the seed bank, to increase (multiply) the quantity of seed. Then there will be enough to distribute to all the people who want the fruits/vegetables from that seed.

Before distributing seed you must monitor the quality to make sure it is good and will grow. So you must do viability and germination tests. There can be a number of reasons why the seed quality is not good and why it won't grow. The seed could be - or the conditions for the seed could be - very dry, too wet, too old, too hot, or too cold. You have to find out why it won't grow.

When you receive seed back from the growers, do germination tests and then package it. When packaging the seed, put more or less seed in the packets according to the results of the % germination tests. If you distribute it, then you must keep records. Keep a book to show who has received seed.

### Records for distributing seeds to growers

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| Record Page for Distributing Seed |            |                   |         |          |             |               |      |
|-----------------------------------|------------|-------------------|---------|----------|-------------|---------------|------|
| No. Seeds Sent                    | Date Rec'd | Name of Vegetable | Sent by | Grown by | Place Grown | Germination % | Date |

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## TABLE IV - SEED SHARING CIRCLE

### *Village - Neighbourhood*

Has problems with seed  
Finds some good seed  
Wants local seed  
Has interested farmers and growers  
Needs more information about seed

### *District*

Seedsellers  
Seedbuyers  
Agriculture staff  
Market  
Information in/out  
about seeds  
Send seed in/receive seed  
from seedbank  
Are worried about company seed

### *People Growing the Seed*

Farmers  
Seedgrowers  
Information in/out  
about seed quality  
Yield information

### *Seedbank*

Collects the seeds  
Records the seed  
Stores and keeps the seed  
Germinates the seed and grows it  
Distributes seed  
Collects information about the seed

Biographical notes - in this happy collaboration,

Susan Girard is a suburban farmer with a highly productive and well-designed garden. She is a nurse born again as a permaculturist. She is also an artist who has refound her talents. Susan supports and is supported by her four children and permaculturist husband, Kevin.

Rosemary Morrow is an agriculturist turned permaculturist who has two permaculture books previously published. She also writes autobiographical pieces and her work is divided between work in the Blue Mountains in Australia and with the people of Viet Nam and Cambodia with stints in Albania and Indonesia.

#### Recommended References

- Bubel, Nancy, *The New Seed-Starters Handbook*, Rodale Press, Emmaus, Pennsylvania, 1988
- Fanton, Jude and Michel, *The Seed Savers Handbook*, The Seed Savers Network, Byron Bay, Australia, 1993

The Seed Family or The Heralds are a family living in Hope County serving as the primary antagonists in Far Cry 5 and Inside Eden's Gate. A family of Hope County and leaders of the cult Project at Eden's Gate. Joseph Seed is the patriarch of the family which he also calls the heralds. All the siblings have bunkers, which must be destroyed directly after killing them. This encyclopedia offers access to the diversity of ferns and seed plants, the most important groups of green land plants. Available information of general and systematic relevance is synthesized at the level of families. Evidence ...  
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