

# Seed Saving 101- Vegetables

UME-MG Continuing Education

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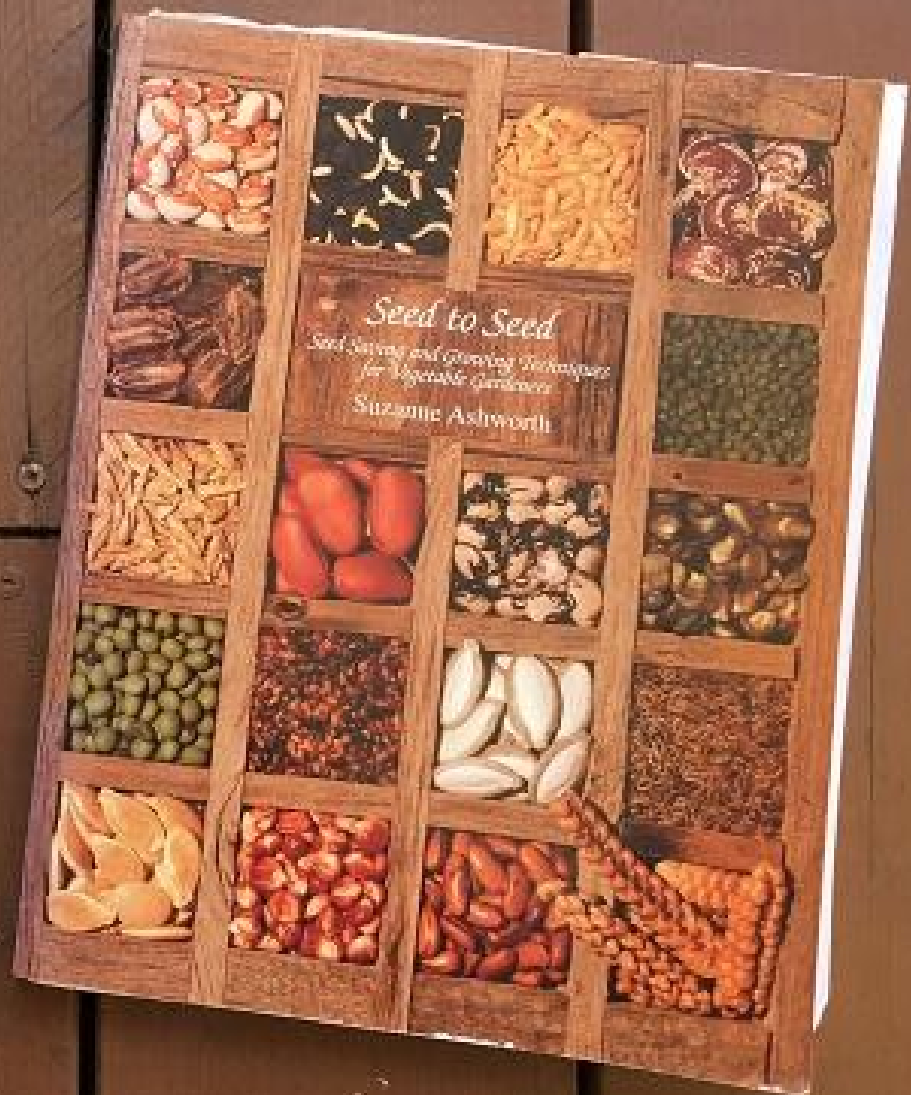
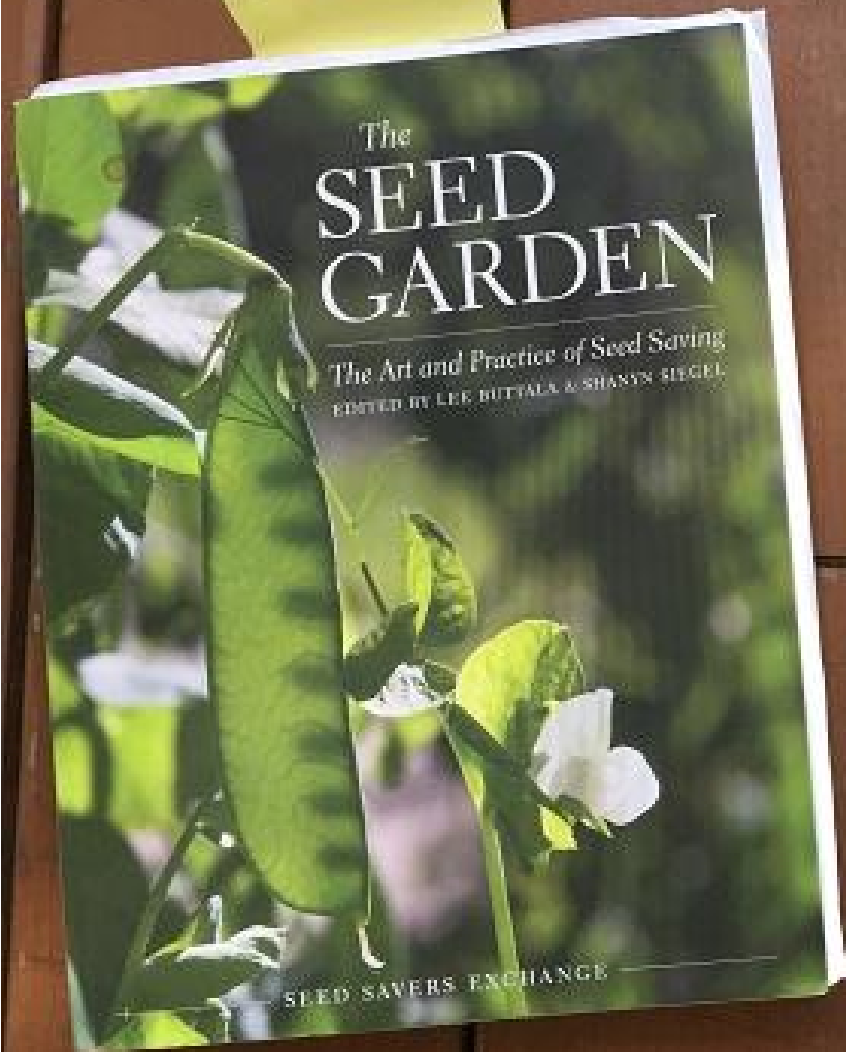
September 23, 2020

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- Seed-Saving Guides

Grow seed for the common good

Leading education, research and advocacy to advance organic seed



# Reasons to save vegetable seeds

- Fascinating and fun!
- Increase plant knowledge
- Save money
- Improve and preserve favorite cultivars
- Share seeds
  - Gardener-to-gardener; holiday gifts
  - Seed swaps and libraries
- Enhance Grow It Eat It programs







**Four phases of sexual reproduction:**

**Pollination**

**Fertilization of ovules**

**Fruit maturation**

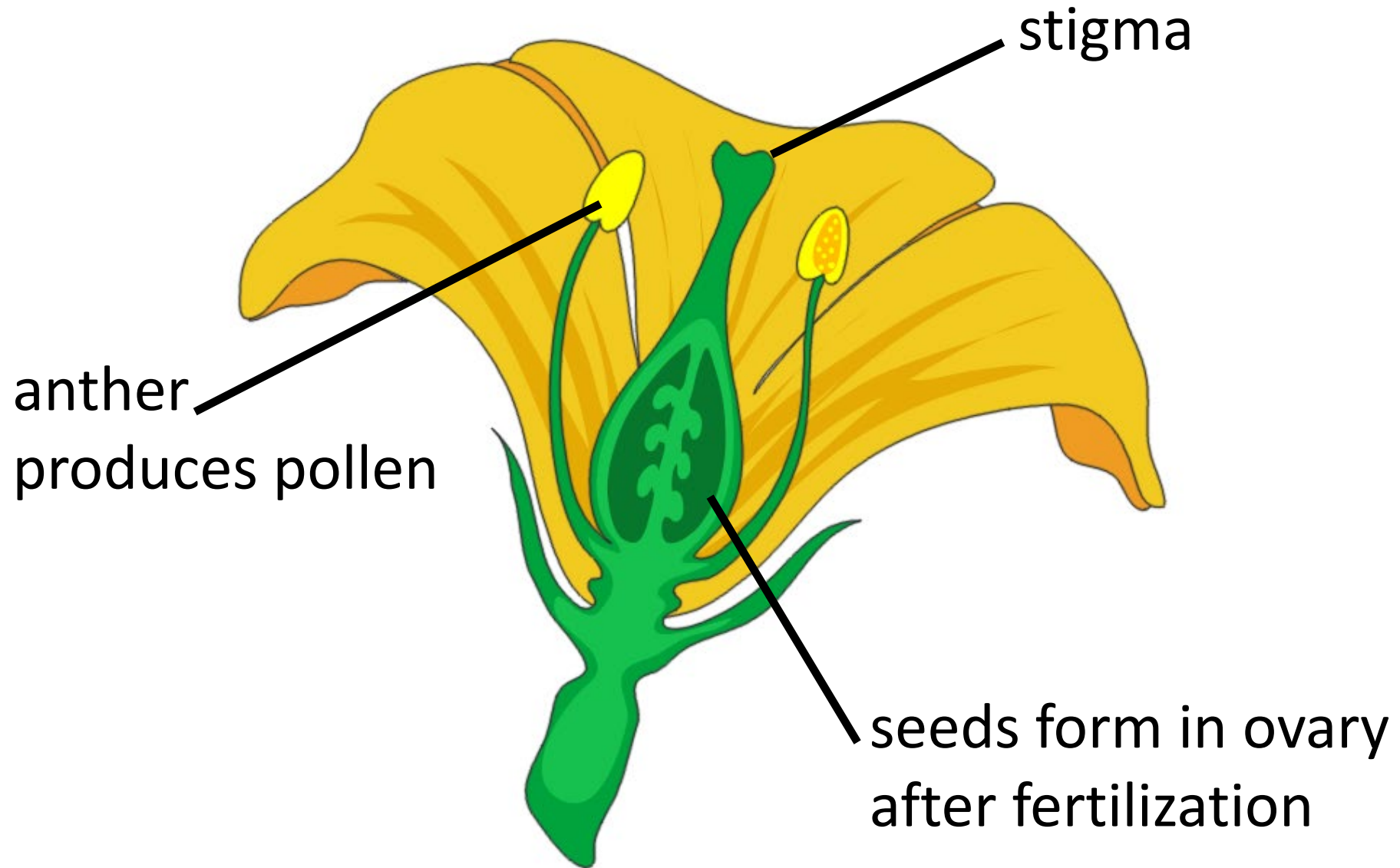
**Seed maturation**

**Flowers exist to produce seeds!**





Photo credit: Seed Savers Exchange; seedsavers.org



Pea & bean: self- pollinated



Photo credit: Seed Savers Exchange; [seedsavers.org](http://seedsavers.org)



Okra: self-pollinated and /insect pollinated



Photo credit: Seed Savers Exchange; seedsavers.org

Squash family: insect pollinated



Photo credit: Seed Savers Exchange; seedsavers.org





Corn: wind pollinated

Photo credit: Seed Savers Exchange; [seedsavers.org](http://seedsavers.org)



## Poll question 1

A monoecious species produces...

Correct answer is “b”



# Three levels of seed saving

## 1. Personal (for yourself, friends, and family)

possibly selecting for specific traits (earliest and largest fruits). Probably not able to follow population and isolation recommendations

## 2. Public sharing (for seed swaps, seed libraries, MG projects)

save seed from multiple plants and follow isolation recommendations

## 3. Cultivar maintenance (seed companies and serious seed savers)

requires seed from multiple fruits from all plants in the population to capture a range and balance of traits for genetic preservation

# Five elements of seed saving

- 1) crop selection
- 2) population size
- 3) isolation
- 4) selection/rouging
- 5) storage







# Crop selection

- Only save seed from open-pollinated cultivars. Seed collected from hybrid cultivars will not “come true”
- Learn the crop: family, genus, and species; annual or biennial; pollination, isolation, and population requirements
- Easiest to save seed from annuals that are mostly self-pollinating (genetically more uniform), such as bean, pea, tomato, and lettuce
- Harder to save seed from species that are mostly insect or wind pollinated, such as spinach, broccoli, and corn. They are genetically more variable and likely to cross-pollinate

# Isolation distance

## Population Size

- Isolation distance is the distance between the plants that seeds will be saved from and potential source of cross-pollination contamination
  - You can reduce distances based on topography and structures, pollinator forage, and bee populations
- Population size is the number of individual plants from which seeds will be saved to achieve a particular seed saving goal



# Three levels of seed saving- tomato

## 1. Personal (for yourself, friends, and family)

Population size- **1 plant for viable seed**

Isolation distance- 10 ft., except for potato-leaf cultivars (50 ft.)

## 2. Public sharing (for seed swaps, seed libraries, MG projects)

Population size- **5-10 plants for variety maintenance**

Isolation distance- 10 ft., except for potato-leaf cultivars (50 ft.)

## 3. Cultivar maintenance (seed companies and serious seed savers)

Population size- **20 plants for genetic preservation**

Isolation distance- 10 ft., except for potato-leaf cultivars (50 ft.)



# Strategies to prevent out-crossing (unwanted cross-pollination)

- Plant only one cultivar of a species
- Separate cultivars by time
- Cage or cover plants
- Bag flowers and hand-pollinate
- Learn what's growing in neighbor gardens



# Plant and fruit selection

- Rogue out off-type plants
- Don't save seed from badly stressed, diseased, or infested plants or from off-type fruits
- Save seed from best fruits (maternal selection)
- Seeds within a fruit ripen concurrently. Seeds between fruits ripen differentially





# Seed saving techniques

- Harvest fruits when seeds are mature; doesn't always match market (eating) maturity.
- Seeds almost always need further drying after extraction from dry or wet fruits. Moisture content should be 4-12%
- Wet/fleshy fruits- either use water to separate/wash seed (e.g., tomato) or scrape seeds from fruit cavity (e.g., pepper)
- Dry fruits- thresh by hand; walk on or flail dried fruits; hang seed heads upside down in paper bag or pillowcase



Photo credit: Seed Savers Exchange; seedsavers.org



## Vegetable seed storage:

- Keep them cool, dry, and in the dark
- Rule of thumb- air temperature + relative humidity  $\leq 100$
- Freezer good for long-term storage
- 2- 6 year life depending on species





# Scenario #1- Tomato

- Solanaceae family; *Solanum lycopersicum*
- Perennial treated as a tender annual
- Perfect, self-fertile flowers
- Very self-pollinating but varies by cultivar; also insect pollinated
- One fruit from one plant gives for viable seed



'Carmen' tomato- pistil is "inserted" – stigma is positioned below anther cone





'Pruden's Purple'- a potato-leaf heirloom with protruding (exserted) pistils



Photo credit: Seed Savers Exchange; seedsavers.org

Exserted pistil

Inserted pistil





Photo credit: seedsavers.org



Photo credit: seedsavers.org

### Wet processing and seed fermentation process:

- Cut fruits and scoop or squeeze out seeds and pulp into a container
- Place container outside in a protected location
- Fermentation occurs naturally in 2-4 days (breaks down germination inhibitor and helps prevent seed-borne diseases); seeds will sink to bottom
- Remove and discard fungal mat, rinse seeds well



Drying- 1-2 weeks indoors; spread seeds out

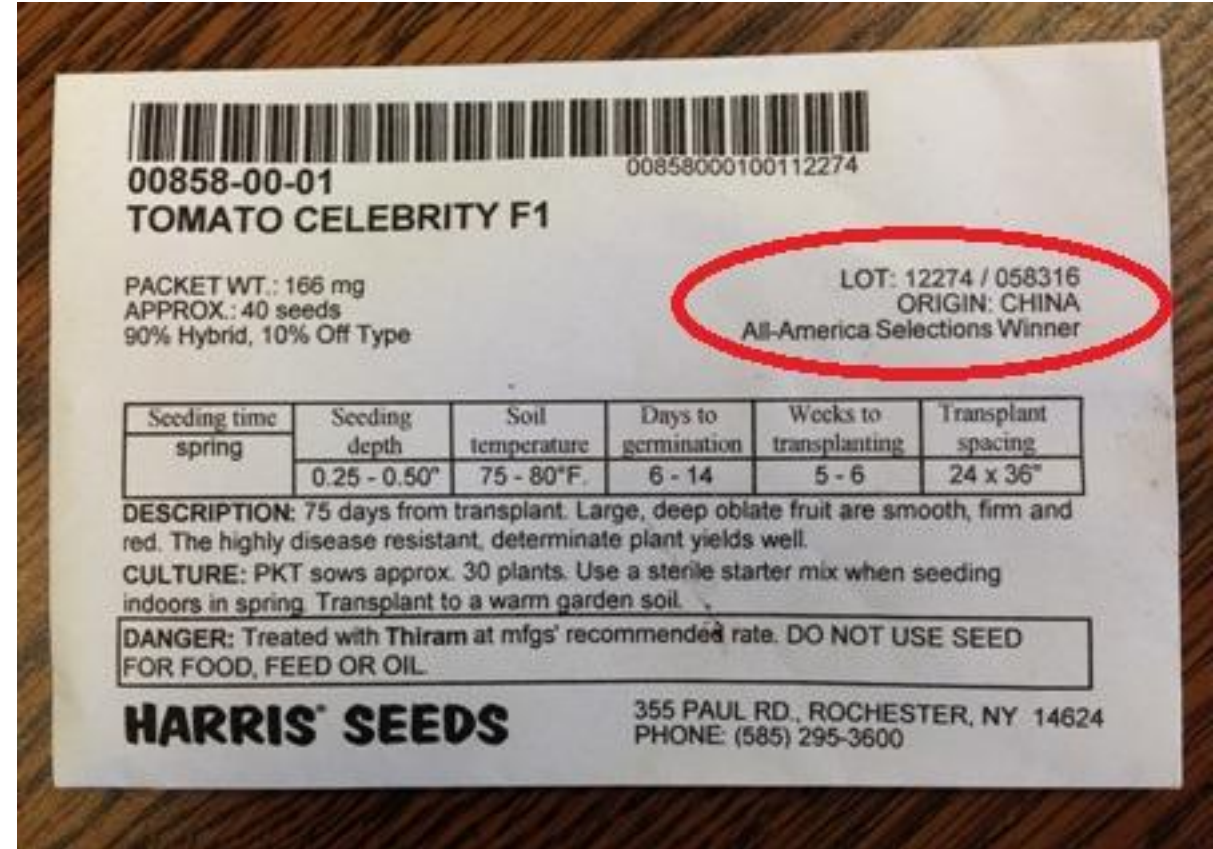


Photo credit: Seed Savers Exchange; seedsavers.org





Result from planting seeds of a store-bought grape tomato



Vegetable seed productions occurs world-wide



# Inter-species crossing in pepper



- Perfect, self-fertile flowers; also out-crosses via insect-pollination, especially chile peppers
- *Capsicum annum* (most garden peppers), *Capsicum frutescens* (e.g., Tabasco), and *Capsicum chinense* (e.g., Habanero) all cross-pollinate
- *Capsicum baccatum* (e.g., Aji' Amarillo) may cross with these three.
- *Capsicum pubescens* (e.g., Rocoto) will not cross with other *Capsicum* spp.

(In your garden, hot chiles do not make adjacent sweet peppers hot)

## Scenario #2- Summer squash

- Cucurbitaceae; *Cucurbita pepo*
- Annual
- Monoecious; separate male and female flowers on same plant; self-compatible
- Mostly outcrossing; insect-pollinated
- One fruit from one plant for viable seed





Photo: Gerald Holmes, Bugwood.org

Immature ovary (baby fruit) is always below female flower



Male flowers are on straight flower stems (pedicels)





Squash anther cone- three  
anthers fused together

Can be used as a paint brush to  
pollinate female flowers

# 'Costata Romanesco'

- Harvest fruits that are beyond “market maturity”- large with hardened rind and dry fruit stem
- Let fruits sit indoors for 30 days; seeds mature inside fruits







Remove, wash, and dry seed



To maintain wide range of cultivar traits: mix in seed from other sources if saving seeds from just a few fruits from 1-2 plants



## Poll Question 2

Can a zucchini plant (*Cucurbita pepo*) cross with a pumpkin plant (*Cucurbita pepo*)?

Correct answer is “d”



X



Photo credit: UNH Extension

## Scenario #3- Bean and Pea Family

- Fabaceae family
- Annuals
- Perfect, self-fertile flowers
- Very self-pollinating (varies by cultivar); cross-pollination via insects
- Dry fruits/dry seed processing
- One fruit from one plant for viable seed



# Pollination differences within bean family

- Common garden bean- very self-pollinating
- Cowpea- mostly self-pollinating
- Lima bean- self-pollinated and commonly insect pollinated
- Scarlet runner- mostly insect pollinated





Hairy vetch fruits threshed in box lid



Anise hyssop

Basil





Photo credit: Seed Savers Exchange; [seedsavers.org](http://seedsavers.org)





Photo credit: Seed Savers Exchange; [seedsavers.org](http://seedsavers.org)



# Winnowing



Photo credit: Seed Savers Exchange; [seedsavers.org](http://seedsavers.org)



Thanks for  
participating!

Questions?



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## UME-MG Continuing Education

### Seed Saving 101- Vegetables

September 23, 2020

#### Overview

Food gardening increases our self-sufficiency and community food security. Seed saving helps us deepen that self-reliance and gives us an important tool for crop improvement. The Intergovernmental Panel on Climate Change (IPCC) predicts a 17% reduction in world food production by 2100 when our planet may have 11 billion people. Seed systems (how we select, save, store, and share seeds) are at the heart of food security. To help meet the challenge of increasing population and climate change, we need adaptive crops that can tolerate prolonged drought, intermittent flooding, increasing heat, and general weather unpredictability. Selecting and breeding for resiliency is a key climate change adaptation strategy- one that all food growers can explore.

All vegetable crops that reproduce sexually sit somewhere on a continuum between “very self-pollinating” (easiest for seed saving) and “requires out-crossing” (most difficult for seed saving). Refer to the [Seed Savers Exchange: Crop-Specific Seed Saving Guide](#) for crop-specific information.

#### Three levels of seed saving

1. personal/friend sharing- possibly selecting for specific traits (e.g., earliest and largest fruits)
2. public sharing- need to save seed from multiple plants and follow isolation recommendations
3. cultivar maintenance- must capture a range and balance of traits. Need to be especially careful with rare and heirloom cultivars. Seed from multiple fruits from all plants in the population are collected. But you can also separately select for traits desirable for your needs (earliness, drought tolerance, etc.)

**Five elements of seed saving:** 1) selecting crops to save seed from, 2) population size, 3) isolation, 4) selection/roguing, 5) storage

**Five concerns:** 1) loss of genetic diversity with small population size, 2) contamination through cross-pollination, 3) unconscious bias in selecting plants/fruits, 4) seed deterioration in storage, 5) inbreeding depression

#### Crop selection

- Only save seed from open-pollinated cultivars. Seed collected from hybrid cultivars will not “come true”
- Easiest to save seed from annuals that are Very Self-Pollinating (genetically more uniform), such as bean, pea, tomato, and lettuce. Smaller plant population and shorter isolation distance required, and less risk of out-crossing
- More difficult to save seed from annuals and biennials (need vernalization to induce flowering) that are Very Outcrossing (genetically more variable) such as spinach and broccoli. Higher population and greater isolation distance required, more risk of out-crossing, and increased risk of inbreeding depressions.



## Population size

- Risk of cross-pollination increases in small plantings and at edges of planting
- If population is very small, loss of vigor and genetic diversity can be a problem. Mix in fresh seed of the named cultivar from seed companies or seed savers

## Isolation

- Isolation techniques prevent cross-pollination (good to know what neighbors are doing within ½ mile):
  - Space- many factors to consider: are there lots of pollinators of different species? How much pollinator forage is available? What about barriers like trees, buildings, hills?
  - Time- for example: plant one spring and one late summer lettuce crop; plant two corn varieties that silk and tassel at different times
  - Exclusion of pollinators with bagging/caging techniques. For crops that flower and set seed after harvest (e.g., lettuce), you can grow as many cultivars as you like but only save seed from one. If seeds are in the harvested part (e.g. cucumber) you can only grow one cultivar or use caging/bagging, including alternate day caging (one cultivar is uncaged per day to allow for insect pollination)

## Selection

- Save seed from best fruits (maternal selection)
- It's possible for pollen from a non-desirable plant contributes pollen so that fertilized ovules in true-to-type fruit is contaminated. Next year, be prepared to rogue out those plants. Always avoid off-type fruits
- Seeds within a fruit ripen concurrently. Seeds between fruits ripen differentially
- Don't save seed from off-type plants or badly stressed, diseased, or infested plants

## Storage

- Seeds will be viable for 2-6 years if stored in cool, dry, dark location
- Freezer or refrigerator can extend seed life but bring containers to room temperature before opening to avoid condensation (moisture) that seeds will absorb

## Seed saving techniques

- Physiological maturity or full seed maturity is not always the same as market (eating) maturity. With melon they match but with bean and summer squash it comes much later.
- Seeds almost always need further drying after extraction from dry or wet fruits. Moisture content should be 4-12%
- Wet/fleshy fruits- either use water to separate/wash seed (e.g., tomato) or scrape seeds from fruit cavity (e.g., pepper)
- Dry fruits- thresh by hand; walk on or flail dried fruits; hang seed heads upside down in paper bag or pillow case

## Resources

- Seed Saving PowerPoint presentation (MG24), UME, MGs, Montgomery Co.- <https://extension.umd.edu/mg/grow-it-eat-it-powerpoint-presentations>
- Books:
  - The Seed Garden, 2015- <https://www.seedsavers.org/the-seed-garden-the-art-practice-of-seed-saving>
  - Seed to Seed, 2002- <https://www.chelseagreen.com/product/seed-to-seed/>

- Good links:
  - Organic Seed Alliance- <https://www.seedalliance.org/>
  - Seed Savers Exchange (SSE)- <http://www.seedsavers.org/Education/>
    - SSE: Crop-Specific Seed Saving Guide- <http://www.southernexposure.com/growing-guides/saving-seeds-home-use.pdf>
  - Southern Exposure Seed Exchange:
    - How to Host a Seed Swap (<http://www.southernexposure.com/how-to-host-a-seed-swap-ezp-146.html>);
    - Seed Saving Guides- <http://www.southernexposure.com/growing-guides-library-ezp-41.html#seed-saving>
  - National Seed Swap Day- <http://seedswapday.blogspot.com/>
  - Hybrid Varieties and Saving Seeds- <http://aggie-horticulture.tamu.edu/archives/parsons/vegetables/seed.html>
  - Isolation distances- [http://msue.anr.msu.edu/news/distance\\_matters\\_when\\_saving\\_seed](http://msue.anr.msu.edu/news/distance_matters_when_saving_seed)
  - Seed saving information from other land-grant universities:
    - Maine- <http://umaine.edu/publications/2750e/>
    - Montana- <http://store.msuextension.org/publications/YardandGarden/MT199905AG.pdf>
    - Clemson- <http://www.clemson.edu/extension/hgic/plants/vegetables/gardening/hgic1255.html>

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Seed Savers Exchange: Crop-Specific Seed Saving Guide

Common Name	Scientific Name	Pollination	Life Cycle	Selfing or Outbreeding	Isolation Distance	Population Size	Seed Maturity	Notes
Arugula	<i>Eruca sativa</i>	insects	A	O	1600 ft	80	after	
Basil	<i>Ocimum basilicum</i>	insects	A	O	1600 ft	80	after	
Bean, common	<i>Phaseolus vulgaris</i>	self	A	VS	10 ft	10-20	market or after	
Bean, fava	<i>Vicia faba</i>	self, insects	A	SO	800 ft	40	after	
Bean, Lima	<i>Phaseolus lunatus</i>	self, insects	A	S	40 ft	40	market or after	
Bean, runner	<i>Phaseolus coccineus</i>	self, insects	A	SO	800 ft	40	market or after	
Bean, cowpea	<i>Vigna unguiculata</i>	self, insects	A	SO	160 ft	40	market	
Beet	<i>Beta vulgaris</i>	wind	B	O	3200 ft	80	after	crosses w/ Swiss chard
Broccoli	<i>Brassica oleracea</i>	insects	B	VO	1600 ft	80	after	crosses w/ other <i>B. oleracea</i>
Brussels Sprouts	<i>Brassica oleracea</i>	insects	B	VO	1600 ft	80	after	crosses w/ other <i>B. oleracea</i>
Cabbage	<i>Brassica oleracea</i>	insects	B	VO	1600 ft	80	after	crosses w/ other <i>B. oleracea</i>
Carrot	<i>Daucus carota</i>	insects	B	O	1600 ft	200	after	crosses w/ Queen Anne's Lace
Cauliflower	<i>Brassica oleracea</i>	insects	B	VO	1600 ft	80	after	crosses w/ other <i>B. oleracea</i>
Celery	<i>Apium graveolens</i>	insects	B	O	1600 ft	80	after	crosses w/ celeriac
Celeriac	<i>Apium graveolens</i>	insects	B	O	1600 ft	80	after	crosses w/ celery
Chard, Swiss	<i>Beta vulgaris</i>	wind	B	O	3200 ft	80	after	crosses w/ beets
Cilantro	<i>Coriandrum sativum</i>	insects	A	O	1600 ft	80	after (when coriander)	
Collards	<i>Brassica oleracea</i>	insects	B	VO	1600 ft	80	after	crosses w/ other <i>B. oleracea</i>
Corn	<i>Zea mays</i>	wind	A	O	1600 ft	200	market or after	
Cucumber	<i>Cucumis sativus</i>	insects	A	O	1600 ft	10-20	after	
Dill	<i>Anethum graveolens</i>	insects	A	O	1600 ft	80	after	
Eggplant	<i>Solanum melongena</i>	insects	A	O	1600 ft	80	after	
Kale, European	<i>Brassica oleracea</i>	insects	B	VO	1600 ft	80	after	crosses w/ other <i>B. oleracea</i>
Kale, Siberian	<i>Brassica napus</i>	insects	B	VO	1600 ft	80	after	crosses w/ rutabaga
Leek	<i>Allium ampeloprasum</i>	insects	B	O	1600 ft	80	after	short-lived seeds
Lettuce	<i>Lactuca sativa</i>	self	A	VS	10 ft	10-20	after	
Melon	<i>Cucumis melo</i>	insects	A	O	1600 ft	10-20	after	crosses w/ Armenian cuke



## Seed Savers Exchange: Crop-Specific Seed Saving Guide

<b>Mustard Greens</b>	<i>Brassica oleracea</i>	insects	A or B	VO	1600 ft	80	after	crosses w/ other <i>B. oleracea</i>
<b>Okra</b>	<i>Abelmoschus esculentum</i>	self, insects	A	SO	800 ft	40	after	
<b>Onion</b>	<i>Allium Cepa</i>	insects	B	O	1600 ft	200	after	short-lived seeds
<b>Parsley</b>	<i>Petroselinium crispum</i>	insects	B	O	1600 ft	80	after	
<b>Parsnip</b>	<i>Pastinaca sativa</i>	insects	B	O	1600 ft	80	after	short-lived seeds
<b>Pea</b>	<i>Pisum sativum</i>	self	A	VS	10 ft	10-20	market or after	
<b>Pepper, hot</b>	<i>Capsicum spp.</i>	self, insects	A	SO	800 ft	40	market	
<b>Pepper, sweet</b>	<i>Capsicum anuum</i>	self, insects	A	S	160 ft	10-20	market	
<b>Pumpkin</b>	<i>Cucurbita spp.</i>	insects	A	O	1600 ft	10-20	market	check species for potential crossing
<b>Radicchio</b>	<i>Cichorium intybus</i>	insects	B	VO	1600 ft	80	after	
<b>Radish</b>	<i>Raphanus sativus</i>	insects	A	VO	1600 ft	80	after	
<b>Rutabaga</b>	<i>Brassica napus</i>	insects	B	VO	1600 ft	80	after	crosses w/ Siberian kale
<b>Spinach</b>	<i>Spinacea oleracea</i>	wind	A	VO	3200 ft	80	after	
<b>Squash, summer</b>	<i>Cucurbita pepo</i>	insects	A	O	1600 ft	10-20	after	crosses w/ other <i>C. pepo</i>
<b>Squash, winter</b>	<i>Cucurbita pepo</i>	insects	A	O	1600 ft	10-20	market	crosses w/ other <i>C. pepo</i>
<b>Squash, winter</b>	<i>Cucurbita maxima</i>	insects	A	O	1600 ft	10-20	market	
<b>Squash, winter</b>	<i>Cucurbita moschata</i>	insects	A	O	1600 ft	10-20	market	
<b>Squash, winter</b>	<i>Cucurbita argyrosperma</i>	insects	A	O	1600 ft	10-20	market	
<b>Tomato, modern</b>	<i>Solanum lycopersicum</i>	self, insects	A	VS	10 ft	10-20	market	crosses w/ other <i>S. lycopersicum</i>
<b>Tomato, potato-leaf</b>	<i>Solanum lycopersicum</i>	self, insects	A	S	40 ft	10-20	market	crosses w/ other <i>S. lycopersicum</i>
<b>Tomato, currant</b>	<i>Solanum pimpinelifolium</i>	self, insects	A	SO	160 ft	40	market	
<b>Turnip</b>	<i>Brassica rapa</i>	insects	B	VO	1600 ft	80	after	crosses w/ many Asian greens
<b>Watermelon</b>	<i>Citrullus lanatus</i>	insects	A	O	1600 ft	10-20	market	

adapted from *A Seed Saving Guide for Gardeners and Farmers*, Organic Seed Alliance

**Life Cycle:** A = annual, B = biennial

**Selfing or Outbreeding:** VS = very self-pollinating, S = somewhat self-pollinating, SO = can be self-pollinating, but is often outbreeding, O = mostly outbreeding, VO = requires outbreeding

**Isolation Distance:** isolation distances are for home gardener use and will eliminate cross-pollination MOST of the time – however, more distance may be advisable if absolute purity is required

**Population Size:** keep in mind that the listed population sizes are for commercial production; home gardeners may have to grow fewer plants as garden space dictates, though particularly rare varieties should be grown close to recommended population sizes

**Maturity:** market = seeds are ready when fruit is ripe, after = seeds mature after fruit/plant is typically eaten (if listed as 'market or after,' market refers to a dry market stage (such as dry beans, flint/flour/pop corn, soup peas, etc).