

Seed Saving



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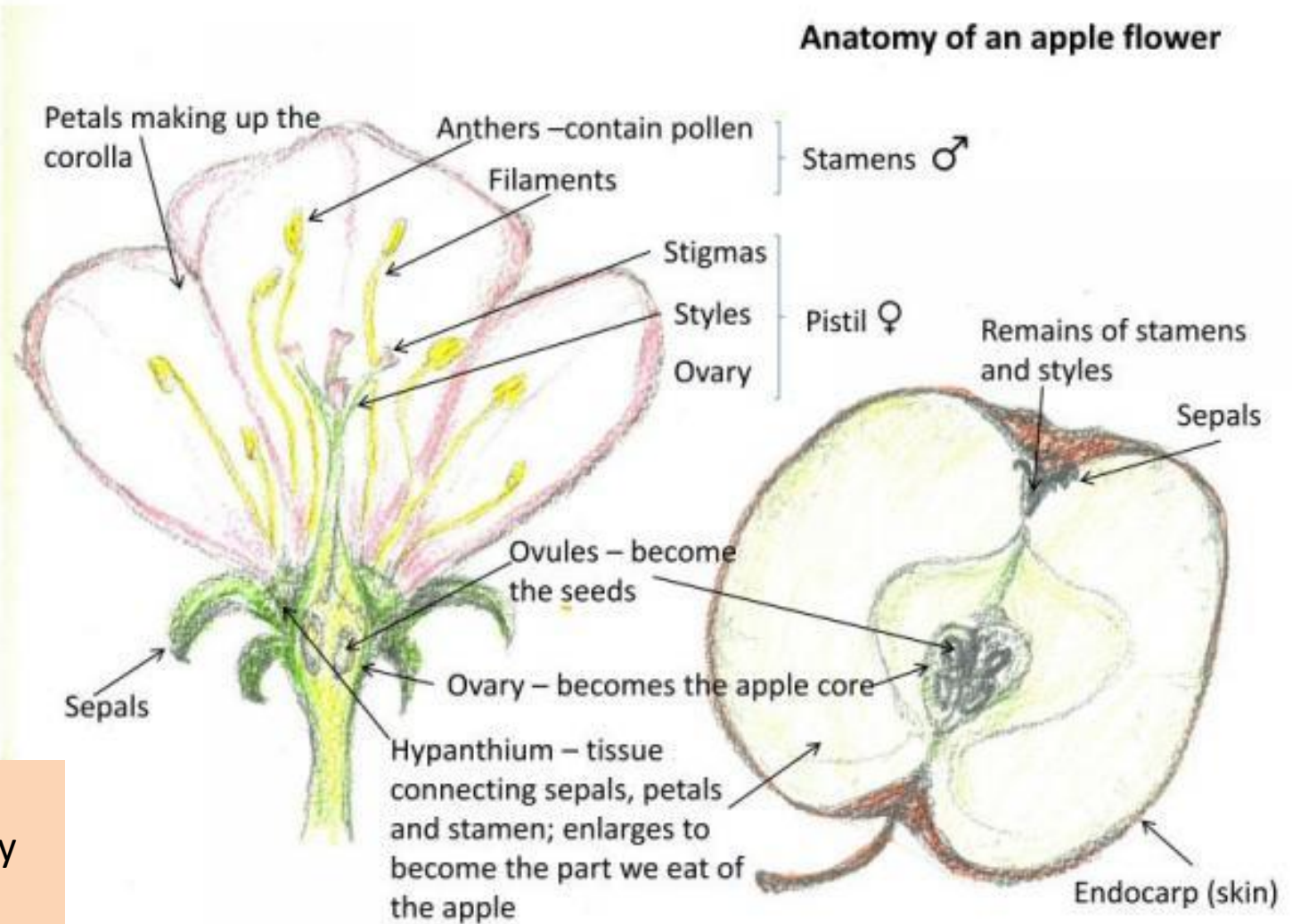
The Movement

- Saving seeds versus buying seeds (or seedlings)
- Heirloom versus hybrid
 - Which is really open-pollinated versus hybrid
 - And is thought of as wholesome, flavorful, aromatic, etc. versus plastic, manufactured, etc.
- Small farmer versus giant agribusiness and Monsanto
- Global biodiversity versus monoculture followed by the collapse of civilization when the next disease appears....

Outline

- Some terminology
- What to save
- Harvesting
- Preserving

Flowers into Fruit



Seeds are the only part that genetically combines both parents.

Terms – Open Pollinated vs Hybrid

Open pollinated



AA

x



aa

First generation hybrid (F1)



Aa

2nd generation hybrid (F2)



AA



Aa



Aa



aa

Terms – Open Pollinated vs Hybrid

- Open-pollinated (OP or blank)
 - The only option if you need it to breed true
- Hybrid (F1, F2, etc.)
 - May need to cull out about up to half the plants, which isn't practical if you're growing for fruit
 - Often have "hybrid vigor"



Terms – Heirloom

- Definition: A cultivar that originated at least 50 years ago
 - Or else at least 100 years ago
 - Or else before 1945
 - Or maybe it's 1951
 - Or maybe it was just handed down in a family
 - Or maybe it's just not a hybrid
- For sure:
 - Implication that it has more old-fashioned goodness and less commercial viability
 - Guaranteed it's open pollinated (not hybrid)

Heirlooms – more thoughts

- Unique plants?
- Harder to start / lower germination?
- Lower yield but more flavor?
- Lower disease resistance?
- More genetic diversity?

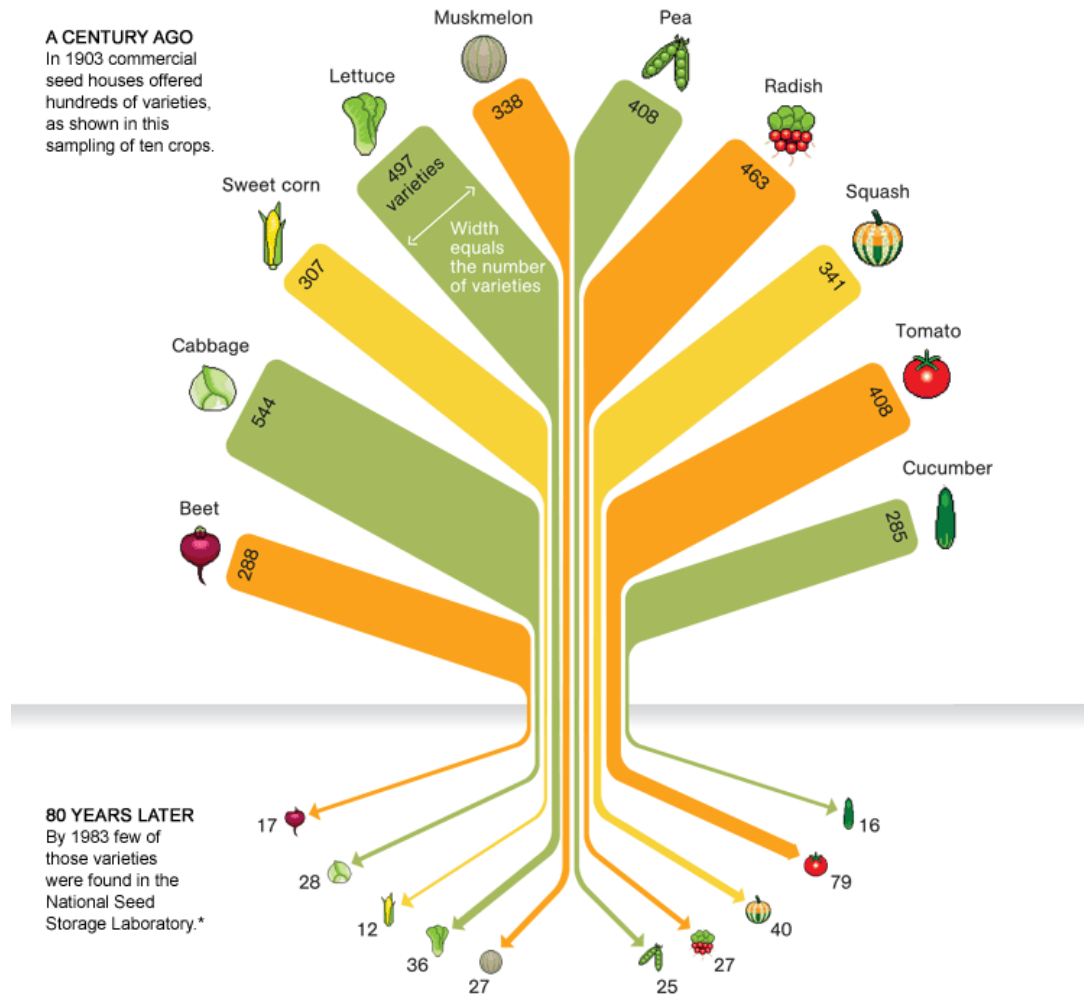


Christmas Lima Bean



**Good Mother
Stallard Bean**

Food Diversity Tree from National Geographic



* CHANGED ITS NAME IN 2001 TO THE NATIONAL CENTER FOR GENETIC RESOURCES PRESERVATION

JOHN TOMANIO, NGM STAFF. FOOD ICONS: QUICKHONEY
SOURCE: RURAL ADVANCEMENT FOUNDATION INTERNATIONAL

Svalbard Global Seed Vault



- Started in 1984
- Goal:
 - Preserve samples of all the world's seeds to be able to restore biodiversity in the event of a disaster
 - Serve as backup for the world's 1,750 seed banks
- Funded by Norway and the Global Crop Diversity Trust (GCDT), which is funded by various governments and organizations (e.g. Gates)
- More than 770,000 different samples saved there as of 5/23/2013

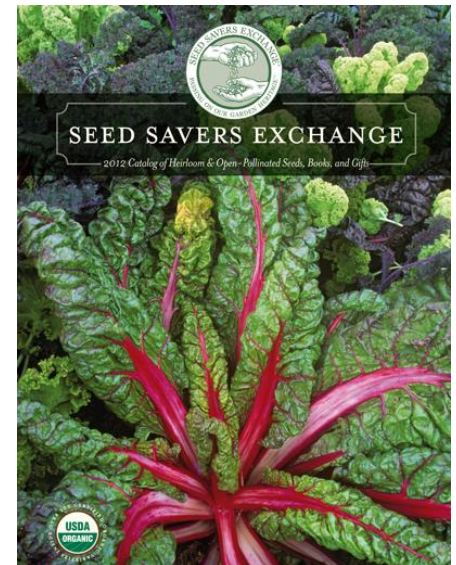


Seed Savers Exchange in Iowa

- Maintaining thousands of varieties of different plant types—from amaranth to watermelon—in one of the largest seed banks of its kind in North America.
- Regenerating seed in isolation gardens and storing them in ideal conditions.
- Documenting valuable cultural information on varieties and their histories.
- Distributing heirloom varieties to members and the public through the Seed Savers Exchange Yearbook and the Seed Savers Exchange Catalog
- Storing varieties in back-up locations at the USDA Seed Bank in Fort Collins, CO and at Svalbard Global Seed Vault in Norway. These off-site deposits remain the property of SSE.

Seed Savers Exchange

- Vegetables
 - Beans: 2,299 listings (Johnny's: 36)
 - Corn: 182 listings (Johnny's: 53)
 - Squash: 464 listings (Johnny's: 66)
 - Tomatoes: 9,153 listings (Johnny's: 134)
- Flowers
 - Sunflower: 72 listings (Johnny's: 41)



Seed Saving

Buy seeds because:

- You can grow new things every year
- You don't have to think about cross-pollination
- You don't have to think about storing the seeds

Save seeds because:

- Heirlooms can be interesting
- You know those worked here
- Some varieties can no longer be obtained
- It's free!



Getting started

- To get viable seeds, you need
 - A plant that can produce fertile seeds
 - That plant to be pollinated
 - Ripe fruit
- To get seeds that breed true, you need
 - Open pollinated plants
 - Sufficient separation
 - A large enough population

Seeds

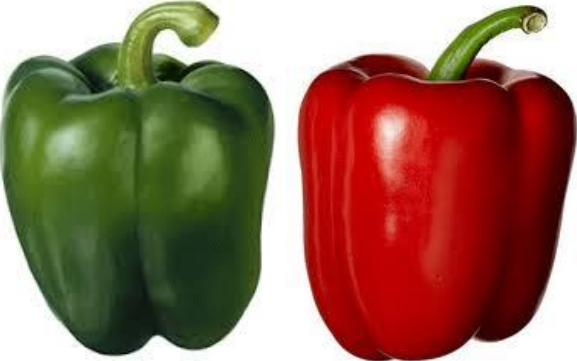
- Most garden plants can make seeds, but
- Some plants are seedless
 - Ferns, mosses, etc. reproduce with spores
 - Seedless cultivars
 - Watermelons, grapes, oranges, bananas
 - Many double flowers
- Some plants only (mostly) make sterile seeds
 - Some Japanese spirea, butterfly bush, burning bush, lantana, etc.

Fertile seeds

- Some flowers are self-pollinating
 - Dandelions, peanuts, peas, beans, violets
- Some flowers can be self-pollinating, but need help for complete pollination
 - Tomatoes, blueberries, shooting stars
- Some plants have male and female flowers on the same plant and can be self-pollinating
 - Squash, birch
- Some plants have “perfect” flowers (both male and female) but need 2 separate varieties for best pollination
 - Apples, blueberries
- Some plants are have male and female flowers on separate plants – need both, and only the female can make seeds
 - Hollies, Jack-in-the-Pulpit, gingkoes, pollenless sunflowers (female only)

And to make matters more complicated, some plants can generate fruit without being fertilized, but these fruits won't have seeds (some tomatoes, cucumbers, pineapples)

Ripe fruit...



To get seeds that breed true...

- Open pollinated plants
 - Not hybrids
 - Not clones
- Sufficient separation
- A large enough population to prevent “inbreeding depression”
 - Corn needs at least 200 plants of the same cultivar
 - Most plants can survive “a few” generations of inbreeding without negative effect

Separation from what?

- Family – Plantae
- Division – Magnoliophyta (flowering plants, also called Angiosperms)
- Class – Eudicots (also called Dicots)
- Order: e.g. Violales (includes squash), Primulales (includes primroses).
- Family: e.g. Cucurbitaceae (includes squash), Violaceae (includes violets).
- Genus: e.g. Cucurbita (includes squash), Cucumis (includes cucumbers, melons)
- Species: e.g.
 - *C. maxima* (some winter squash, some pumpkins),
 - *C. mixta* (some pumpkins),
 - *C. moschata* (some winter squash, some pumpkins),
 - *C. pepo* (summer squash, some winter squash, some pumpkins)

Plants in the same species will interbreed if they bloom at the same time
The fruit will taste like the 'mom', but the seeds will be a cross of both parents

Cucurbita pepo

- Acorn squash
- Delicata squash
- Dodi marrow
- Gem squash
- Heart of gold squash
- Kamo Kamo
- Pattypan squash
- Some gourds
- Some pumpkins
- Spaghetti squash
- Sweet dumpling squash
- Yellow crookneck squash
- Yellow summer squash
- Zucchini



Different species



“Big Max”
C. pepo



“Jack O Lantern”
C. maxima



“Musquee de Provence”
C. moschata



“Rouge d’Etamp”
C. mixta

What is “sufficient” separation?

Crops	Species	Family	Life Cycle	Primary Pollination Method	Recommended Isolation Distance for Seed Saving	Population Size (Number of plants)		
						Viable Seeds	Variety Maintenance	Genetic Preservation
bean	<i>Phaseolus vulgaris</i>	Fabaceae	annual	self or insect	10–20 feet	1	5–10	20+
carrot	<i>Daucus carota</i>	Apiaceae	biennial	insect	800 feet–1/2 mile	5	20–50	80+
cauliflower	<i>Brassica oleracea</i>	Brassicaceae	biennial	insect	800 feet–1/2 mile	5	20–50	80+
collards	<i>Brassica oleracea</i>	Brassicaceae	biennial	insect	800 feet–1/2 mile	5	20–50	80+
corn	<i>Zea mays</i>	Poaceae	annual	wind	800 feet–1/2 mile	10	50–120	200+
cucumber	<i>Cucumis sativus</i>	Cucurbitaceae	annual	insect	800 feet–1/2 mile	1	5–10	25+
eggplant	<i>Solanum melongena</i>	Solanaceae	annual	self or insect	300–1,600 feet	1	5–20	50+
kale	<i>Brassica oleracea</i>	Brassicaceae	biennial	insect	800 feet–1/2 mile	5	20–50	80+
lettuce	<i>Lactuca sativa</i>	Asteraceae	annual	self	10–20 feet	1	5–10	20+
melon	<i>Cucumis melo</i>	Cucurbitaceae	annual	insect	800 feet–1/2 mile	1	5–10	25+
pea	<i>Pisum sativum</i>	Fabaceae	annual	self	10–20 feet	1	5–10	20+
pepper	<i>Capsicum</i> spp.	Solanaceae	annual	self or insect	300–1,600 feet	1	5–20	50+
pumpkin	<i>Cucurbita</i> spp.	Cucurbitaceae	annual	insect	800 feet–1/2 mile	1	5–10	25+
radish	<i>Raphanus sativus</i>	Brassicaceae	annual	insect	800 feet–1/2 mile	5	20–50	80+
spinach	<i>Spinacia oleracea</i>	Amaranthaceae	annual	wind	800 feet–1 mile	10	20–50	80+
squash	<i>Cucurbita</i> spp.	Cucurbitaceae	annual	insect	800 feet–1/2 mile	1	5–10	25+
tomatillo	<i>Physalis philadelphica</i>	Solanaceae	annual	insect	800 feet–1/2 mile	5	20–50	80+
tomato	<i>Solanum lycopersicum</i>	Solanaceae	annual	self or insect	10–50 feet	1	5–10	20+
watermelon	<i>Citrullus lanatus</i>	Cucurbitaceae	annual	insect	800 feet–1/2 mile	1	5–10	25+

Biennials

- Biennials are plants that take 2 years to complete their life cycle
- To get seeds
 - Don't harvest the plant the first year
 - Overwinter the plant
 - May need to be dug up and replanted: Brussels sprouts, cabbage, carrots, kale, leeks, onions
 - May survive in the ground with ample mulch: beets, Swiss chard, turnips
 - Allow the plant to bolt the second year, flower and set seed

Harvesting seeds – dry seed heads

- Allow plants to bolt (arugula, beets, lettuce, etc.) and form seed stalks
- Protect seeds / seed pods from rain and birds while they dry
- If the plant makes seed pods
 - Collect the pods when they turn brown
 - Break open the pods and extract the seeds
- If the plant has open seed heads
 - Cut off the seed heads when most seeds look dry
 - Hang them inside till completely dry
 - Crumble the seeds off the stalk and discard the chaff
- Discard any seeds that are very small or don't look ripe

Arugula, Beans, Beets, Broccoli, Carrots, Corn, Gourds, Kale, Leeks, Lettuce, Okra, Onions, Peas, Radishes

Harvesting seeds – Fleshy fruits

- Leave the fruit on the plant till it starts getting soft, almost mushy
- Cut fruits in half lengthwise
- Scoop out the seeds
- Put through fermentation process (optional, good idea for tomatoes)
- Wash to remove the pulp
- Let air dry
- Discard any seeds that didn't fill out
 - Eggplants: viable seeds are usually brown and located near the bottom of the plant

Cucumbers, Eggplants, Melons, Peppers, Squash, Tomatoes, Watermelon

Fleshy fruits – Fermentation process

- Why?
 - Simplifies separating seed from pulp
 - Kills some seed-borne illnesses
 - Eliminates a germination inhibitor
- How?
 - Put the seeds with pulp into a container
 - Add a little water (1/4 – 1/2 cup of water for a tomato)
 - Cover with paper towel or cheesecloth to keep away fruit flies and contain some of the smell
 - Set aside for 3-5 days out of the sun. Ignore the smell
 - Squash should only ferment for 1-1/2 days or they may germinate
 - Skim off the scum that forms on the surface and proceed with the cleaning process



Fleshy fruits – Cleaning

- Method 1 (large seeds only)
 - Extract seeds individually by hand and rub gently under running water
 - Spread thinly on drying surface
- Method 2
 - Put seeds in large bowl or jar, add water and stir vigorously
 - Viable seeds will sink; pulp, skin and bad seeds will float – skim them off
 - Repeat the process till only seeds are left
 - Empty the seeds onto a sieve and wash under running water
 - Spread thinly on drying surface

Storing seeds

- Moisture, light and heat are the enemies of long-term seed storage
- When seeds are thoroughly dry
 - Package seeds in a labeled container. If you use a clear jar, put in some paper to block the light
 - Consider adding a packet of silica gel to absorb moisture
 - Store in the refrigerator or freezer (if the plant is zone 5 or above)
 - Bring to room temperature before removing from packaging to prevent condensation from forming on the seeds

Cold (& Moist) Stratification

- Why don't seeds sprout in fall?
 - Some do (winter annuals)
 - Need for cold period or moist period or both
- Solution – stratification
 - Inside
 - Put seeds in moist sand/peat in a plastic bag
 - Store in fridge for 1-3 months
 - Bring out in spring, plant and grow
 - Outside
 - Plant seeds outside in fall

**GREENHOUSE OBSERVATIONS OF GERMINATION REQUIREMENTS FOR VARIOUS
WILDFLOWERS COMMON TO THE EASTERN US.**

Better germination when surface sown, light and heat and cold strat	Better germination when surface sown, no cold strat required	Readily germinates with no Pre-treatment (@ least 70F)	Better Germination with 1-month Cold Stratification (39F)	Better Germination with 2 month cold-moist strat (39F)
big leaf aster	bluestem goldenrod	black-eyed susan	ashy sunflower	culver's root
boneset	boneset	blue vervain (FRESH SEED)	common milkweed	ohio spiderwort
cardinal flower	calico aster	butterfly milkweed	flat top white aster	purple giant hyssop
common sneezeweed	common sneezeweed	chicory	giant sunflower	spotted joe pyeweed
early goldenrod	culver's root	evening primrose	gray headed coneflower	
grass-leaved goldenrod	early goldenrod	giant sunflower	hairy beardtongue	
great blue lobelia	gray goldenrod	Indian Hemp	hoary vervain	
purple giant hyssop	hairy white oldfield aster	lance leaf coreopsis	Indian hemp	
Riddells goldenrod	New England Aster	New York ironweed	marsh blazing star	
rough leaf goldenrod	New York Aster	plains coreopsis	Ohio spiderwort	
showy goldenrod	perennial blue flax	purple bergamot	oxeye sunflower	
swamp milkweed	rough leaf goldenrod	purple coneflower	rough blazing star	
	showy goldenrod	spotted bee balm	tall white beardtongue	
	smooth blue aster	turtlehead	VA mountain mint	
	spotted joe pyeweed	white vervain (FRESH SEED)	zigzag spiderwort	
	zigzag aster	wild bergamot		
		WITH SCARIFICATION		
		false blue indigo		
		lespedeza		
		lupine		
		partridge pea		
		showy tick trefoil		
		wild indigo		
		wild senna		

**IF SPECIES IS IN ANOTHER COLUMN, IT DID EQUALLY WELL IN EITHER TREATMENT

**Per Literature, most wildflowers native to the eastern US, perform and germinate better with at least 1-month cold-moist stratification

**Seeds should be fresh as possible and a current germination test should have been performed within 6 months of receiving the seeds

Seed Viability

Vegetable Seed	Years
Asparagus	3
Bean	3
Beet	4
Broccoli	3-5
Brussels Sprouts	4
Cabbage	4-5
Carrots	3
Cauliflower	4-5
Celery	5
Corn	1-2
Cucumber	5
Eggplant	4-5
Kale	5
Kohlrabi	3-5
Leek	1
Lettuce	5-6
Muskmelon	5
Okra	2
Onion	1
Parsnip	1
Pea	3
Pepper	2-4
Pumpkin	4
Radish	5
Rutabaga	5
Spinach	3-5
Squash	4-5
Tomato	4
Turnip	5
Watermelon	5

Flower Seed	Years
Ageratum	4
Amaranthus	4-5
Anthemis	2
Anthirrhium	3-4
Calendula	5-6
Celosia	4
Cineraria	3-4
Clarkia	2-3
Cosmos	3-4
Digitalis	2
Eschscholzia	3
Gaillardia	2-3
Godetia	3
Helianthus	2-3
Heliotrope	1-2
Hollyhock	2-3
Impatiens	2
Larkspur	1-2
Linaria	3
Linum	1-2
Lobelia	4

Marigold	2-3
Nasturtium	5-7
Nicotiana	4-5
Nigella	2
Pansy	2
Petunia	2-3
Phlox	2
Salvia	1
Schizanthus	4-5
Sweet peas	2-3
Sweet William	2
Viola	1
Wallflower	4-5
Zinnia	5-6

Herb Seed	Years
Agrugula	3-4
Basil	5
Chives	1-2
Cilantro	5
Dill	5
Fennel	3-4
Marjoram	1
Oregano	1
Parsley	1-3
Sage	2

Tables from <http://www.clearcreekseeds.com/seed-viability-chart/>

Sources

- Seed Savers Exchange (.org)
 - Excellent source for information saving seed / good source of information on growing from seed
 - Excellent place to get tremendous variety of seeds
 - Excellent organization to support
- Cornell Vegetable Growing Guides / New England Vegetable Management Guide (.edu)
 - Excellent source for information on growing vegetables from seed
- Clear Creek Seeds (.com)
 - Source for how long seeds last in ideal storage

In general, trust .edu first, .org second, .com last.

Questions?