Intro to Organic Seed Saving

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Adapted from:
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COLLEGE OF TROPICAL AGRICULTURE AND HUMAN RESOURCES

The Importance of Seeds

These resources stand between us and catastrophic starvation on a scale we cannot imagine. In a very real sense, the future of the human race rides on these materials. The line between abundance and disaster is becoming thinner and thinner and the public is unaware and unconcerned.

By Alexander Klepnev

Jack Harlan,
Retired Professor of Plant Genetics
University of Illinois at Urbana

Why Save Seeds?

- Because its fun and fascinating
- Locally adapted materials
- Food security
- Potential to have unique, niche products
- Save money
- Can make money growing seed as part of enterprise
- Connect to the age old practice of farmers
- Preservation of cultural and culinary traditions
- Seed availability and sovereignty

Adapted Seed – An important tool for organic production

- Varieties selected for issues relevant to your farm:
  - heat-tolerance, pest and disease resistance, day-length neutral, tropical weather, days to harvest, resilience, changing climate, nutrient use efficiency, etc.
- Varieties can be developed for a certain season
- Hawaii is a small seed market, so they're not breeding for us.

Sierra, Heat-tolerant Lettuce


Seed
Basics

Seed vs. Vegetative Propagation

Seed = sexual propagation
Higher variation due to recombination of genes

Clones / Vegetative = asexual propagation
Lower variation, only from mutations

Seed crops

- Mostly annual or biennal
- Mostly orthodox - seeds which will survive drying and/or freezing during ex-situ conservation (vs. recalcitrant which will not)
- The result of the fertilization of ovaries by pollen to produce an embryo

Annuals and Biennial Crops

- Annual – completes life cycle in one year.

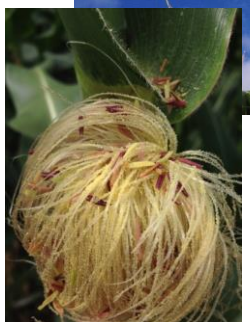
- Biennial – requires two years to complete life cycle, and will overwinter. Requires chill or *vernalization* to trigger flowering.
  - some biennials may act as annuals in Hawaii
  - Vernalization: A particular length of time at or below a certain temperature that each biennial crop requires for flowering in its second season
  - Examples: Colored carrots, radish, chard varieties, kale, maybe others

Considerations in Growing Seed

- "Trueness to type" – will the seed grow what you expect?
- Pollination: Outcrossing vs Selfing
- Isolation distances
- Population size minimums
- Maintenance vs. selection vs. breeding to create novel types

Types of Pollination

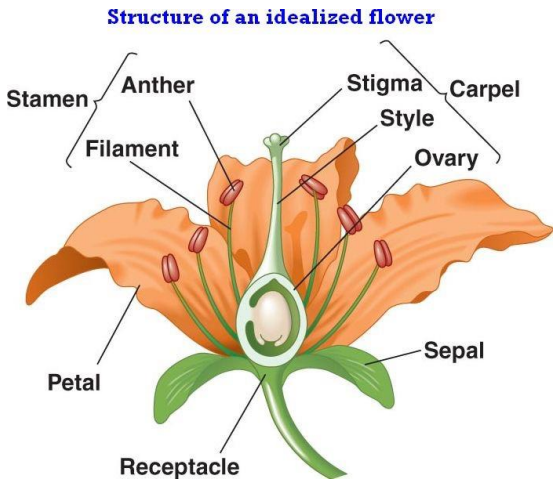
- Self pollination – peas, beans, lettuce
- Can self, can out-cross: tomato, pepper, squash
- Highly out-crossers – Brassicas, corn
- Obligate out-crossers – avocado, spinach
  - Either because temporal or spatial separation
  - OR because of genetic/biochemical blocks



Self Pollinators

- 'Selfers' cross-pollinate themselves; also called inbreeders.
- Examples include peas, lettuce, tomato, eggplant, pepper, and others.
- Most need some isolation to minimize crossing between varieties of the same species.

Hawaiian Chili Peppers



Outcrossers

- Outcrossers have evolved to cross with another of the same species or closely related species; also called outbreeders.
- Have a greater chance of cross contamination with closely related varieties.
  - Ex. *Brassica oleracea* (broccoli, cabbage, cauliflower, European kale, collards) can cross with each other and have to be isolated to prevent contamination.
- Cucurbits including squash, cucumber, watermelon, cantaloupe and others are pollinated by insects, especially bees.
  - Those of the same genus can cross.
- Corn is pollinated by wind, with male and female located on different parts of the plant.

Purple Peacock: Kale X Broccoli

Isolation:

Planting Distances to Prevent Cross Contamination

INBREEDERS			OUTBREEDERS		
Self-pollinated			*Insect -pollinated*		*Wind-pollinated*
5ft	10ft	20ft	500ft	1-2 miles	2+ miles
Peas	Lettuce	Tomato	Pepper Eggplant	Squash Brassicas Umbels	Amaranth Corn

Population Size - Minimum Plants Needed

Can range from 20-200 plants:

- Self-pollinated plants: 20-50 plants
- Cross-pollinated plants: up to 200

Population Size - Minimum Plants Needed

- **Need to save the best plants and cull ("rogue") the off-types and weaklings**, which is why on some crops you need a lot of plants.
- You can then eliminate over half if need be.
- These numbers refer to healthy plants.
- For crops such as tomato and lettuce, a single plant can be selected for the next generation, but there's always the risk this individual has defective characteristics.

Inbreeding Depression

- Occurs when the gene pool of a variety is narrowed by seed selection from a few plants.
- Yield, disease resistance, and vigor are adversely impacted.
- Each plant is an individual and different from its siblings. Important to capture the traits of as much of that gene pool as possible, and also be able to remove off-types.
- More common in cross pollinated compared to self-pollinated crops.

Open Pollinated (OP) Seed

- **Open pollinated** generally refers to seeds that will "breed true“, also referred to as ‘true-to-type’ or true breeding.
- When the plants of an open-pollinated variety self-pollinate, or are pollinated by the same variety, the resulting seeds will produce plants roughly identical to their parents (some variability).
- All ***heirlooms*** are OP’s.
- This is the most common seed saved.

Hybrid (F1) Seed

- **Hybrid or F1 hybrid seeds** refers to the selective breeding of a plant by cross-pollinating two different parent plants. In genetics, the term F1 is an abbreviation for Filial 1 – literally 'first children'.
- A cross between two OP's combines dominant traits of both parents to create a uniform plant.
- This is also a strategy to sell new seed each season and discourage seed saving.
- Seeds saved from hybrids (F2) will be variable as it combines traits from each parent in different proportions, ***but can also be used to create new OP's through generations of selection.***

'Black Cherry X Blue Tears'

Komohana x Indigo Kiwi F1

Open Pollinated vs Hybrids

Hybrids
- Uniform
- Expensive

Open-Pollinated
- Not as uniform – diverse, more resilient
- Less expensive

Both seed types are available for conventional and organic systems

Harvesting seed

- Wet crops vs Dry crops
- Fully mature
- Cleaning
- Drying
- Storing

Table 1. Examples of Orthodox Seeds That Are Easy to Grow and Save.

Crop	Pollination Biology	Processing
Beans	Self	Dry
Peas	Self	Dry
Tomato	Self	Wet
Eggplant	Self	Wet
Pepper (bell, chili)	Self	Dry
Carrots	Cross	Dry
Okra	Cross	Dry
Corn	Cross	Dry
Mustard	Self/Cross	Dry
Pak Choi	Self/Cross	Dry
Choi Sum	Self/Cross	Dry
Lettuce	Self	Dry
Cucumbers	Cross	Wet
Squash	Cross	Wet
Pumpkin	Cross	Wet

Saving Seed – CTAHR 2014

Seed Processing

- Knowing the crop is the first step in learning how to save its seed, minimizing contamination by the crossing of related species, and also when to harvest.
- Each crop is very specific in terms of processing its seed.

This is a very basic introduction to get you excited to learn more about seed production

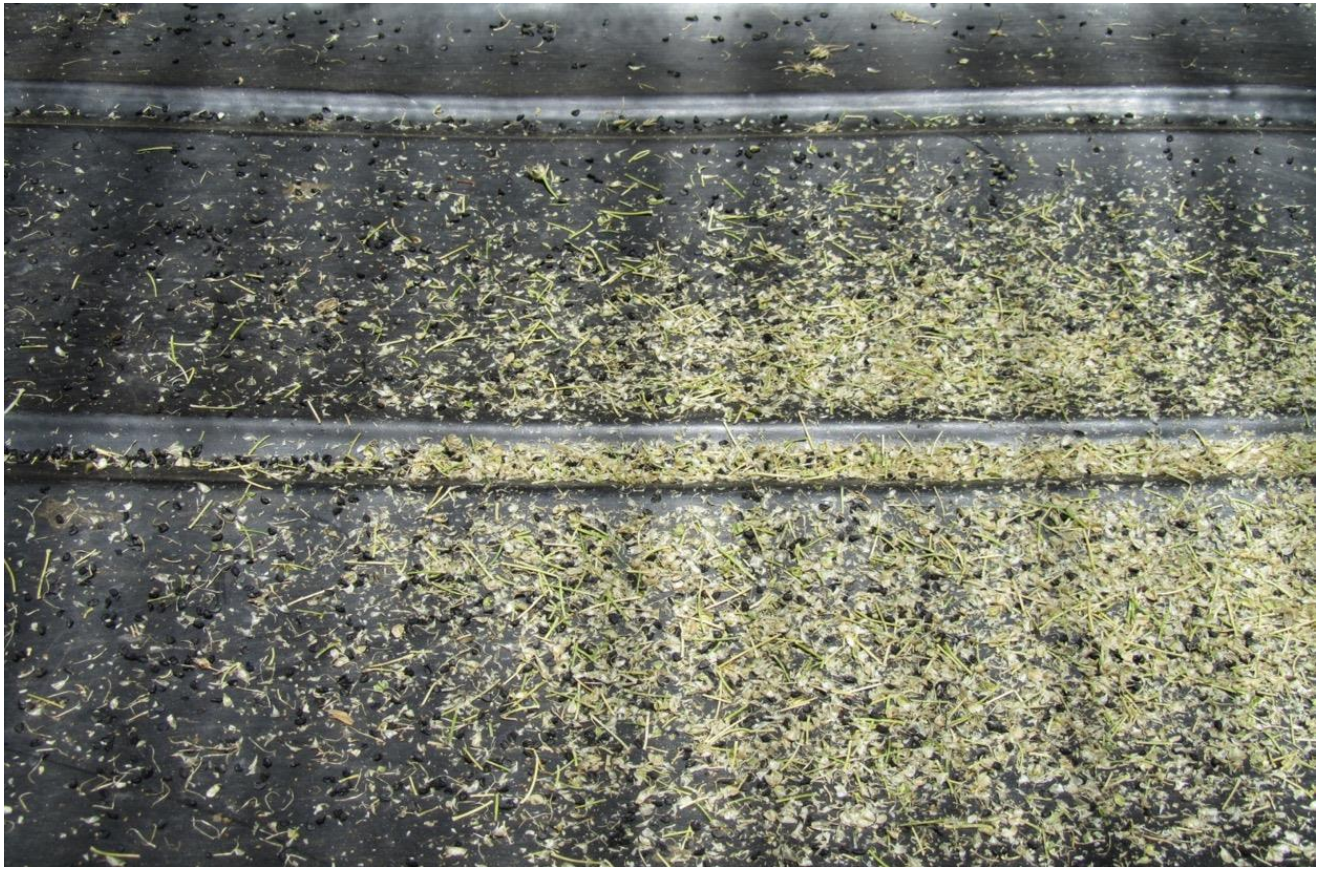
Green Onion Seed Production
UH CTAHR Volcano Research Station

Carpenter Bee Pollinating Koba Green Onion

Mature Seed Heads

Koba Green Onion Seed Separation

Seed Separated from Seed Heads



Before Last Stage of Seed Cleaning

Seed Separation

Methods used to separate seed from chaff:

- Size – use of screens, sieves, or colanders
- Weight – by winnowing
- Water – floaters and sinkers
- Threshing and beating – break open seed pod, flail
- Stepping, dancing, stomping

Seed Screens

Check with your local CTAHR Extension office if they have equipment available to borrow

Green Onion Seed Cleaning

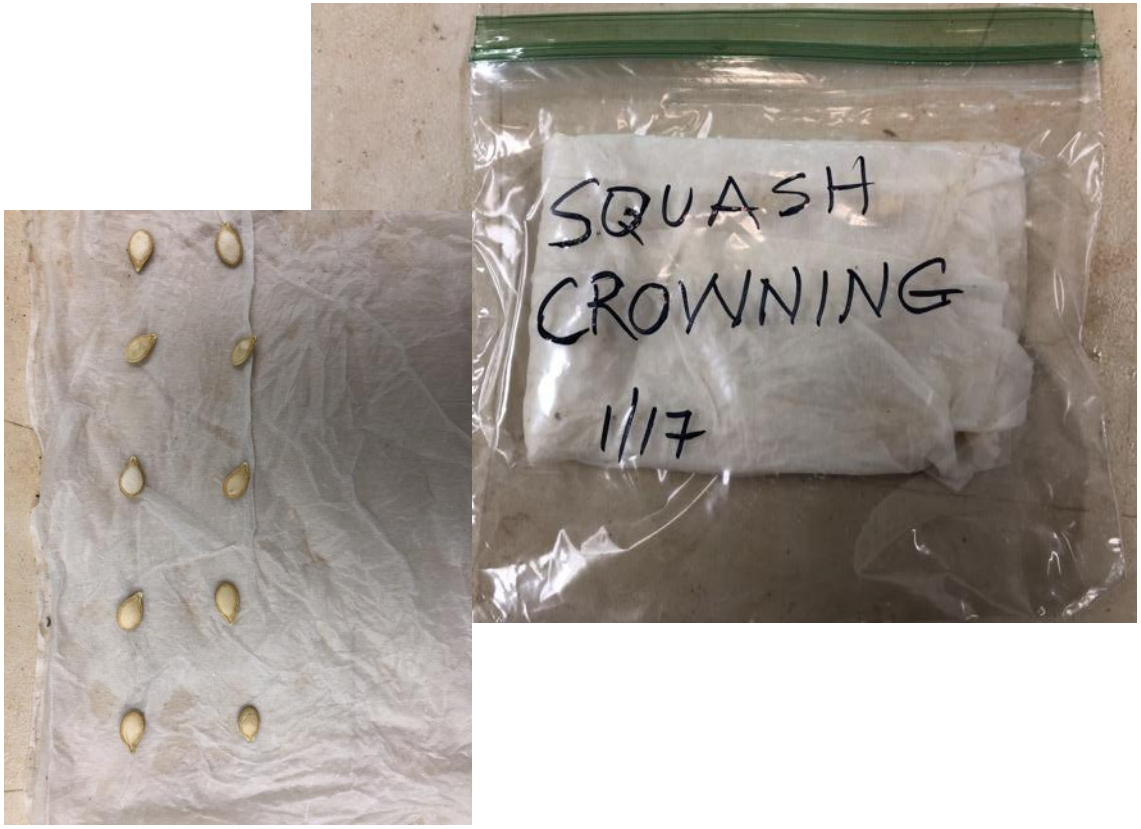
- Seed heads are harvested and dried, seeds will be released when dry but may need to mash seed heads or rub on screens to release all seeds.
- Separate chaff from seeds with screens or by winnowing.
- For last cleaning, put seeds in water. Seeds will sink and remaining chaff will float. Decant to separate chaff from seed.
- Dry seeds and package.

Germination Testing

- Every seed lot should be tested to determine germination percentage.
- Soak a paper towel in water and squeeze out excess. Layout a known amount of seed – 10, 25, 50, or 100 depending on the size of the lot.
- Put into a plastic bag. Mark bag with crop, variety, lot#, and date.
- Depending on crop, check every three days until seeds have germinated. Count the amount of seeds germinated. Determine percentage germinated. If 10 seeds tested, then multiply germinated seed by 10 to get percentage (%)

Germination % Standards

- Bean, Long 75
- Collards 80
- Corn 75
- Cucumber 80
- Eggplant 60
- Kale 75
- Lettuce 80
- Onion, Green 70
- Pepper 55
- Tomato 75
- Squash 75



Seed Storage : Rule of 100

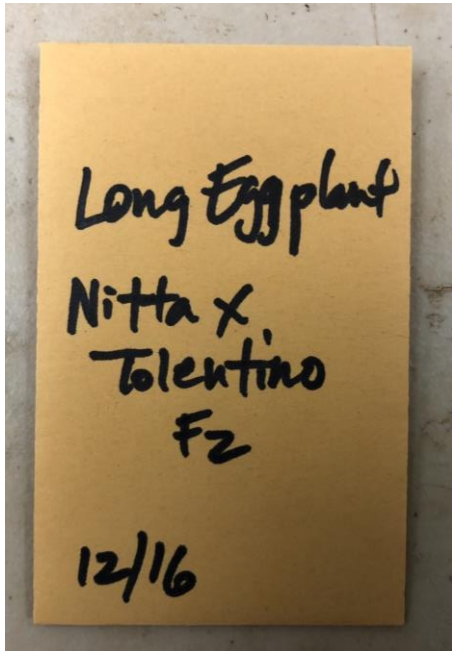
- The relative humidity of the atmosphere and the temperature in the storage area added together must not exceed 100.
- At 60% humidity, storage temperature should not exceed 40 degrees F.
- Seeds with high moisture content stored at low temperature will be damaged from water crystals. Moisture levels less than 10% are ideal.

Seed Storage

- Stored seeds are alive. Aim to keep metabolic rate as low as possible to preserve seed.
- *Storage conditions are more influential that the age of seeds in determining viability* – the ability of seeds to germinate.
- Store seeds at temperature range of 32-41 degrees F.
- Moisture is the killer of seeds, more damaging than heat.

Information on Seed Packet

- Name of Crop
- Name of variety
- Special characteristics
- Date harvested or processed
- Lot number
- Source
- Other info – OP, F2



Seed Lots

- Assign number to each crop harvest. It's better to separate different harvests instead of combining or 'massing' seed.

- In case you have a bad batch, you can easily track it and separate it from the good ones.

Controlling Pests in Seed

- Remove pests from seed when cleaning.
- Beans/Corn – use small amount of diatomaceous earth and shake around.
- Freeze for a short time. Seed should be well dried before freezing.
- Don't leave unprocessed seed around for long periods of time. Insects will inhabit the seeds.

Variety Trials

https://padlet.com/hamptonm4/hawaii-snow-peas-l0gc9gkjtexumdvl

cbusay 1mo
First snow pea

Well my first snow pea arrived last week on Nieve de Sevilla variety and all the varieties are flowering with the exception of the Manoa. The wind came back last week and is still blowing today, but not as intense as when I first planted. Nieve de Sevilla seems to be the strongest with Schweizer Riesen close behind. I am excited with all of the flowers blooming and hope to see more snow peas soon.

Anonymous 1mo

Today... Schweitzer Reisland and Nieve de Sevilla needing a little bit of help holding on in the blustery weather. Blossoms on SR, Oregon Sugar, Oregon Giant, and Ho Lan Dow. - yukie in Hilo

elmaxomax 1mo

I harvested some for dinner tonight!! These are alittle bit from each varieties! I have some that are really Nice and big but starting to brown so those ill be saving for seeds!

Anonymous 1mo
Looking good!

Andrea 1mo
Peas!

Leslie (Pepeekeo) 1mo
Week 5.5

Oregon Sugar Pod 5/8/23

Shweizer Riesen and Nieve de Sevilla are the most upright. Strong stems.
Ho Lan Dow, Manoa C, and Oregon Sugar Pod II are more bushy but also robust.
Manoa and Oregon Giant are noticeably less robust. Oregon Sugar Pod II and Schweizer Reisen are beginning to flower. Picture is of Oregon Sugar Pod

Schweizer Riesen harvest today, 45 days since planting. 4inch pods, sweet and crunchy. Lots of flowers on other varieties but no pods yet. -yukie ohashi in Hilo

Liz from Hilo 1mo
First flowers! May 7

sandra1175 1mo
Pea pods

All of the varieties have pods!

elmaxomax 1mo
First peas! Ho lan dow

First peas

elmaxomax 1mo

All my varieties of Peas are giving Peas. The winds been up this past to days so I been stringing the tall ones to my netting! A few of my Peas has some yellow leaves and dots on the bottom of plant those were planted with chicken manure. My compost and reg dirt peas are doing great!!

Anonymous 2mo

Field Testing/Variety Trials

- Every farmer should be conducting variety trials to identify cultivars adapted to their farm and seasons.
- Constant improvement in production and quality of product.
- Keep good records, take photos
- Use experimental design principles and minimize variables.
- Conduct in field where same crop is growing is ideal to compare new varieties with main variety.
  - Need to have standard in trial as reference.

Identifying Superior Varieties

Many criteria for selection:

Availability of seed
Tropical Resilience
Appearance/Color
Nutrition
Pest Tolerance
Compact plants
Ease of Harvesting
Time of Harvest
Cast Iron
Eating Quality
Yield
Storage/Self Life
Marketability
Performance
Scavenging Root System
Vigorous plants
Easy to Grow
Day Length Adaptability

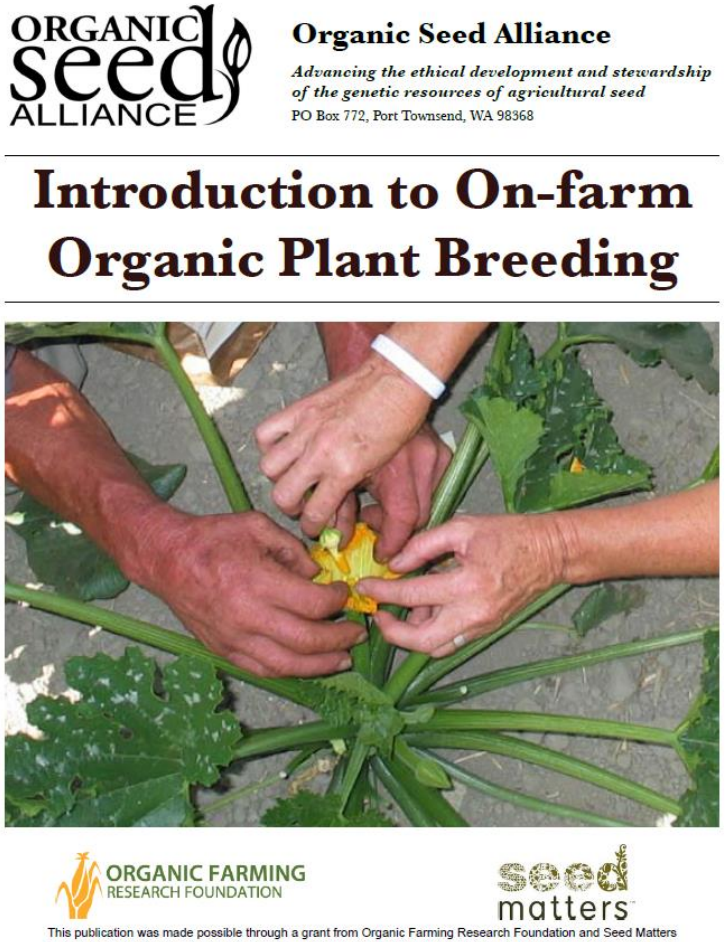
***Criteria Inspiration from New Organic Grower by Eliot Coleman*

What Do Results Mean?

- This variety will do well when planted and harvested during this period of year at this site in this management system.
- Do not over-extrapolate information: "The best variety in the world!!"
- There are many variables that can affect results and favor one variety over another: variable soil nutrition, tilth/compaction, wind, disease in certain fields, seed quality, seed vigor, weather variables, aspect, etc.

Awesome resources for further exploration of on-farm research and plant breeding

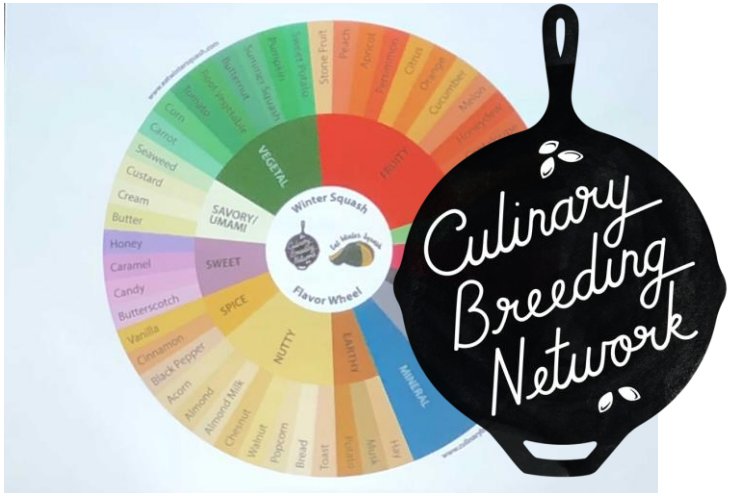
[SARE On-Farm Research Bulletin]



OSA On-Farm Plant Breeding [Webinar] [Introduction publication PDF]

Resources

- Seed Savers Exchange
- Organic Seed Alliance
- Hawaii Seed Growers Network
- Culinary Breeding Network
- CTAHR Seed Saving Hui



SEED SAVING
College of Tropical Agriculture and Human Resources

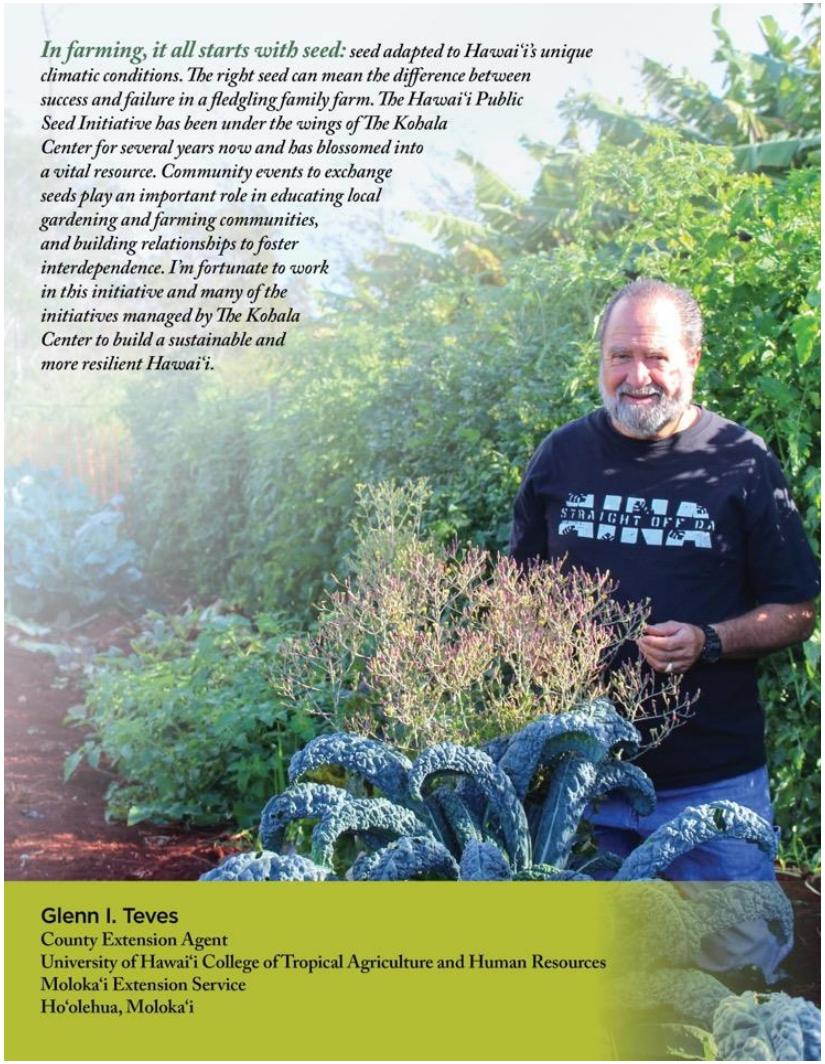
SEED SAVERS EXCHANGE®
PASSING ON OUR GARDEN HERITAGE™

- 2010 – Kohala Center conducts Baseline Assessment of Statewide Farmer/Gardener interest in seed saving.
- 2016 Hawaii Seed Growers Network formed. Website created and first seeds sold in late 2017.

https://www.hawaiiseedgrowersnetwork.com/

Hawai'i Seed
GROWERS NETWORK

Hawaiian Seed Stories



- Glenn Teves – Molokai Extension Agent
- Long time seedsman
- Memory keeper of Hawaiian breeding

Mahalo to Glenn, Jay Bost, and all our Hawaii Seed Growers!