



College of Tropical Agriculture and Human Resources
University of Hawai'i at Mānoa

School Garden Basics Workshop For Educators



Let's Plant!

by O'ahu Master Gardeners in cooperation with Kōkua Hawai'i Foundation (KHF)

Today's Objectives

- Ground, Raised Beds or Containers
- Planting Seeds & Seedlings
- Weeding & Mulching
- Watering
- Harvesting
- Confidence in gardening!! **The most important Objective!!!!!!!!!!!!!!!!!!!!!!!!!!!!**



Goal

Kids working. Parents smiling.



Where to plant?

In Ground?

Container ?

Raised Beds?



In ground planting



Container Planting

Purchased container



Recycled container (food safe)



Raised Beds

Raised Bed above ground



Raised bed on the ground



Plant needs

➤ Plant needs:

Place

Light

Air

Nutrients

Thirsty

Soil

➤ **School Activity:** Relate students needs to plants needs?



In-ground planting

Principle gives okay to dig

No underground utilities

Motivated Students

Many Volunteers

Site Evaluation completed



Site Evaluation

- Soil type
- Levelness of ground
- **Always check for underground Utilities.** (sewer, elect. water, cable)
- **Sunlight** - Choose a site that receives at least 6 hours of direct sunlight each day.
- **Water** - Locate your garden near a water source. (H₂O is 8.34lbs per gallon)
- **Convenience**
- **Size**

Crop Selection

- The Growing Season
- Local weather
- Class likes and dislikes



In-Ground Planting.



1) Turn over soil



In-ground planting



2) Till soil to a manageable texture



In-ground planting



3) Prepare the planting beds



In-ground planting



4) Plant seed or seedling 5) Add irrigation 6) Add bird protection



In-ground planting



7) Observe and maintain the crop



In-ground planting



8) Harvest (Soybeans pictured)



Raised Bed Gardening

Poor Soil quality?

Soil depth?

Poor drainage?

Accessibility to sun light?

Ease to customize your soil.



Let's build a Raised Bed garden



1. Dig trenches in soil $\frac{1}{4}$ of border height





2. Assemble border material



3. Cover grass with cardboard inside and out





4. Fill the garden bed with amended soil mix.



Several beds @ Kahalu'u School



5) Grow your veggies!



Build a sheet mulch garden



1) Place the cardboard over grass and wet





2. Cover cardboard with a mulch

3. Water thoroughly





4. Add border and fill with amended soil





5. Make pathways with cardboard or stepping stones





SIX MONTHS LATER!



Raised Bed

Urban Garden Center, Oahu Hawaii



Small Budget?
Lack of space?
Small Garden Club?

Do Container Gardening!



Container Gardening

Can be as big or small as you want.

Most crops can be grown in containers

Tree roots or underground utility lines?

Easier to physically manage.

Less tools to farm the crops.

Easier on the water budget.

Less weeding.

Easier to grow or reduce your garden.



Container Gardening Urban Garden Center, Oahu Hawaii



Recycled Containers for Garden



Use Food Grade containers



Pineapple in a fish crate



Container Garden



Ko'olau Farms container garden



My container experiment



Raised Bed & Container Garden Combo



Some other Gardening Ideas



Hydroponics gardening



Easy Hydroponic Gardening

Manoa Lettuce

Week 2



What you need



Week 4



Vertical Wall garden



Roof Top Garden



Growing up Crawling Plants



Let's look at some garden plants grown here at U.G. Center



UH Manoa Lettuce



Peanuts



Won Bok



Oregon Sweet Peas



Soybeans



Leaf Parsley



Shiso



Sweet Potato



Let's look at the Crop Display Board for the seed varieties.

~

Univ. of Hawaii web site for ordering
seed: <http://www.ctahr.hawaii.edu/seed/>

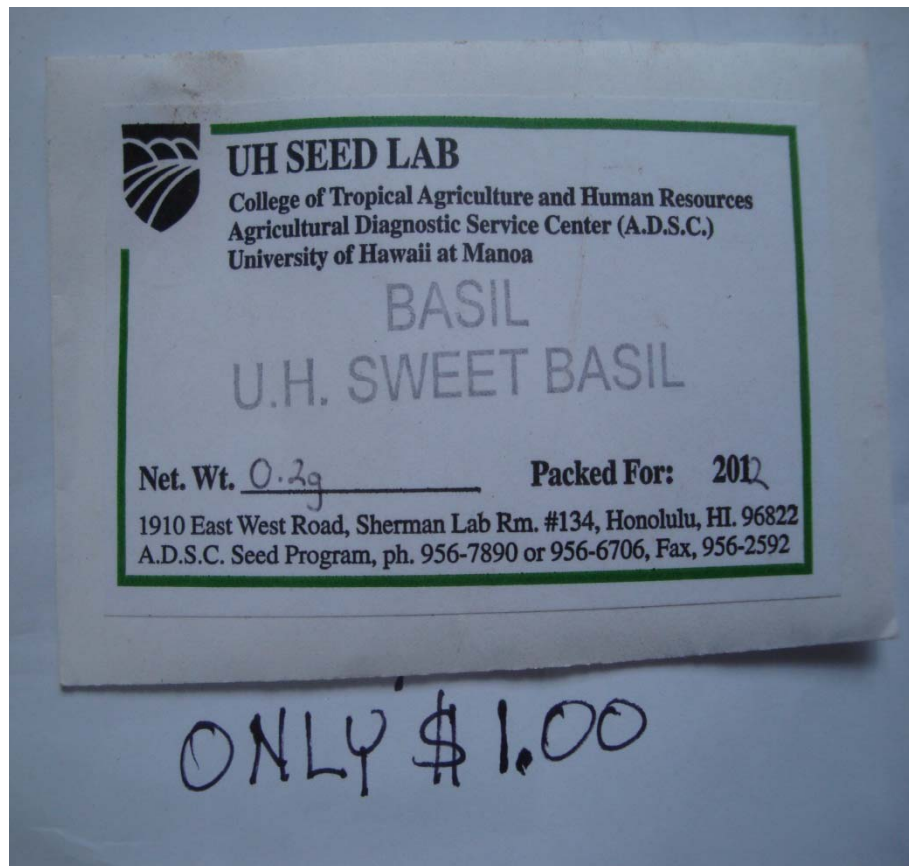


Let's plant!



Seeds or Seedling?

Seeds



Seedling



Plan Your Garden Plot

Create a garden plan/layout on paper first:

➤ Read seed packet information & then:

➤ Draw in seeds **or seedlings**

12" apart, plant 1 per square

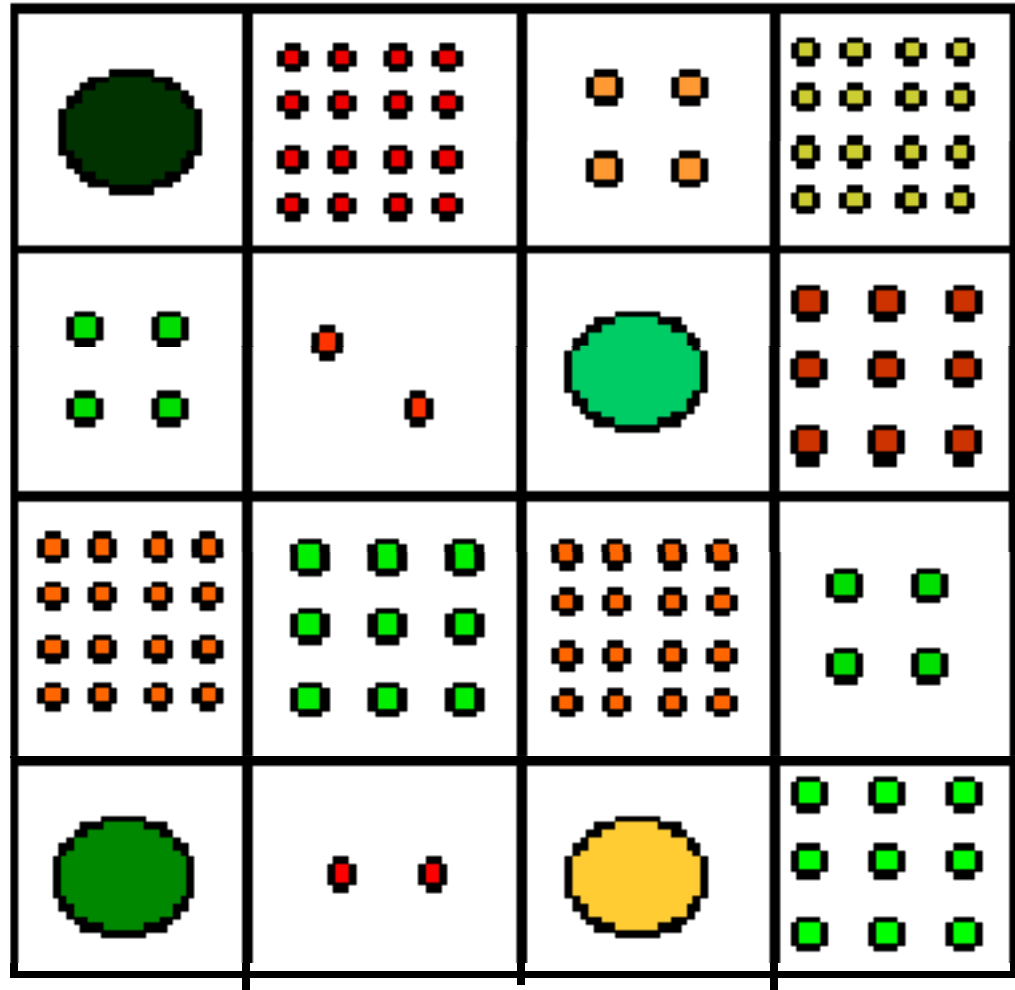
6" apart, plant 4 per square

4" apart, plant 9 per square

3" apart (or less), plant 16 per square



Square Foot Gardening



Planting Guide

Rule of Thumb if no directions:

- Very fine seeds; do not cover, lightly press into soil & water with fine mist.
- Very small seeds; depth of 1/4in soil.
- Medium to large seeds; depth of 1/8 to 1 1/4in soil.



In the field measurements

“Rule” of Finger

- Seed packets will often have specific instructions, e.g., ‘sowing depth’, ‘spacing’, etc. . .
- cuticle = $\frac{1}{2}$ ”
- 1st knuckle = 1”
- 2nd knuckle = 2”
- ❖ **In classroom have students measure their finger.**



Starter Plant Container Options

Bio-degradable:

- Cardboard egg cartons
- Newspaper pots ~ make your own
 - These options are by far the easiest to transplant as the entire container goes straight in the ground!

Re-usable:

- Plastic garden pots
- Recycled containers

Reduce/Reuse/Recycle



Care of our Seeds

➤ Pre-moisten soil BEFORE planting (smaller seeds may wash away)

❖ *We DO NOT “bury” the seeds; as they are not dead. We DO “plant” or “cover” them & while doing so, we give them our energy & love ~ Gigi Cocquio*



Seed Germination

- Keep seedlings out of direct sunlight & in a convenient place to keep an eye on them
- Check often to ensure potting medium stays moist (but not saturated)



Cover Cloth (Starting seeds)



Transplant Seedlings

- When plants have 3-4 true leaves they are ready to begin the transition to their permanent home
- “Hardening” is the process of transitioning a plant into full sun BEFORE transplanting
- Hardening will reduce the stress on the plant & make for easier establishment into the garden & a generally healthier plant

Ready to transplant



Let's make some seed starter pots

Remember this slide??

Let's make pots from this!



Weeds

Tomato or a Weed?



What is a weed?

A weed is identified from a human perspective as a plant species or community occupying an ecological niche that creates an undesirable effect by its mere presence.

Translation: A weed is any plant out of place.

Acronym: P.O.O.P. = Plant out of Place.



Weed Control

- 1) Mulch
- 2) Mechanical Cultivation
- 3) Organic
- 4) Homemade recipes
- 5) Synthetic/Chemical



Mulch

Type of Mulch	Pro	Con
Black Plastic Landscape Fabric Weed block	Works well	Unattractive
Straw	Cheap, an organic means, Looks good	Chickens scratch Blows in the wind
Wood Chips Free Mulch	Free (usually)	Can attract pest or come with pest.

Mulch is any material placed over soil in the garden. It's designed to retain moisture, deter weeds and keep the soil from eroding.

~Can weeds be mulch?



Mulch

Considerations

- **Mulch materials vary. Consider availability, cost, appearance, effect it has on the soil — including chemical reactions and pH, durability, combustibility, rate of decomposition, how clean it is — some can contain weed seeds or pathogens.**



Mechanical Cultivation

Pro: Environmental friendly, hands on

Con: Hard Work



Organic

Pro: Can be safer for the planet

Con: Cost \$\$, effectiveness



Effectiveness Of Organic Weed Control

Oahu Master Gardener Test Plots- 2011

Method	Cost	Total Hours	# times to apply	% Effective	Notes
Flaming	\$40	1.hr	6 weeks	40%	Not effective on Nut Grass, Good on all other
Clove Oil	\$30	1.5hr	6 weeks	40%	Not effective on Nut Grass, Good on all other
Newspaper/Compost	\$10	4hr	1 time	100%	Can plant immediately
Hand Weeding	\$0	8hr	1 time	99%	Can plant immediately
Weed Block	\$6	.5hr	1 time	40%	Not effective on Nut Grass, Good on all other
Black Plastic	\$4	.5hr	1 time	100%	Must wait 4-6 weeks to plant, or cut hole in plastic

For a 10 X 10 foot plot (100sq. Ft.)



Homemade Recipes

Pro: Cost savings

Con: **Reliability?** **Safety?** lacks lab testing for the plant or impact on the environment.



Synthetic/Chemical

Pro: May be least of your physical effort. May cut crop loss, may be more cost effective than Organic.

Con: Check state and school policies to use. May cause conflict in your school garden with cultural beliefs.

Best Practices for Hawai'i School Gardens
FST-45 — August 2011 UH-CTAHR



Weed Prevention Strategies

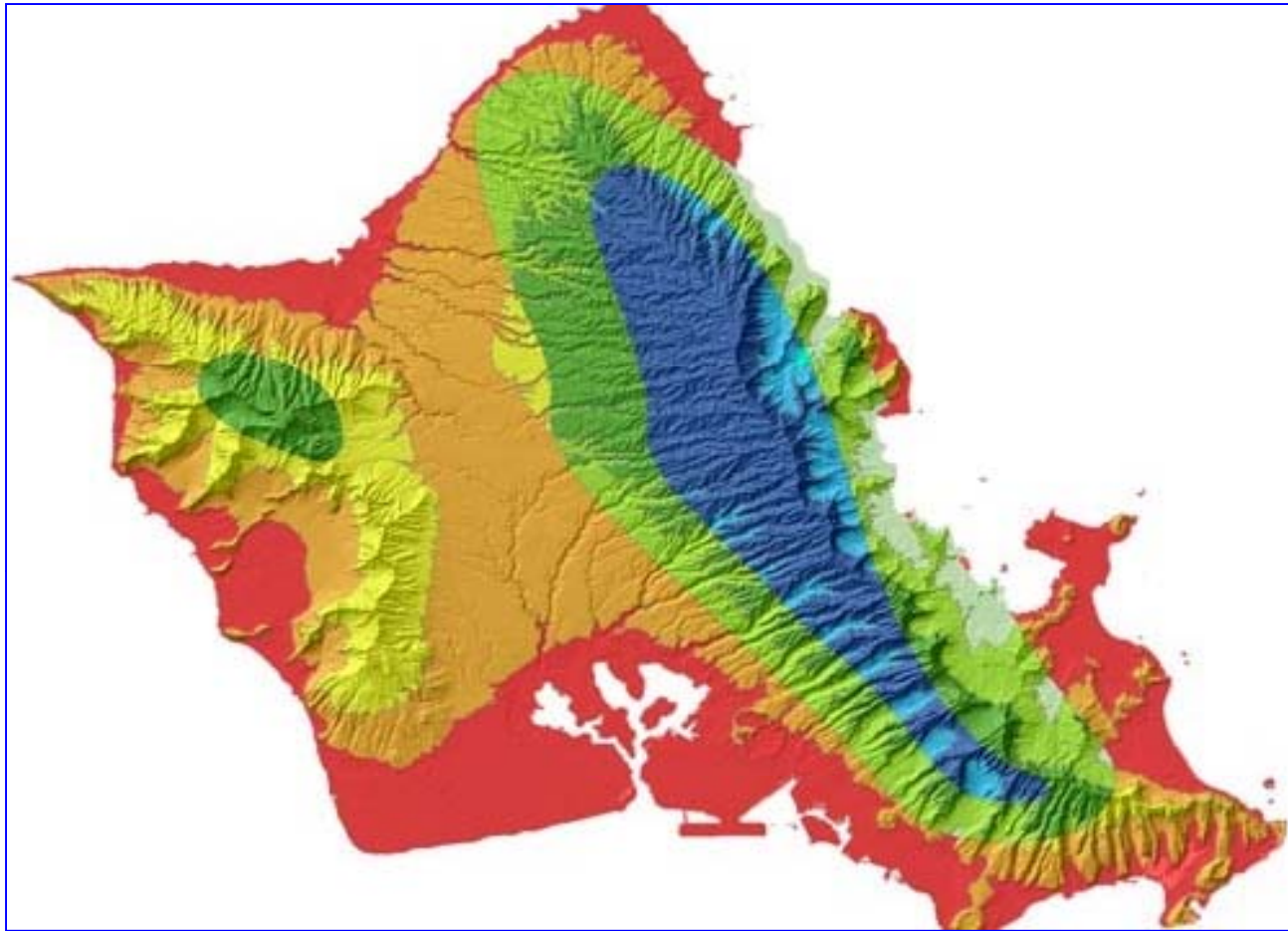
- 1. Don't allow weeds to go to seed.**
- 2. Clean equipment before moving from infested (any) field.**
- 3. Obtain uncontaminated crop seed from a reputable source.**
- 4. Thoroughly compost (131 F for 3 days) manure and other residues that might contain seeds.**
- 5. Filter surface water if possible.**
- 6. Apply fertilizer and irrigation directly to the crop row if possible.**
- 7. Work with your neighbors.**



Watering Choices

- 1) Rain
- 2) Watering Can
- 3) Hose
- 4) Automated Irrigation System





Rain

Pro: Cheap, Natural and Plants prefer Rain

Con: Unreliable in timing and quantity





Watering Can

Pro:

Portable, measureable & anyone can do it.

Con:

Weight of the water,
Control on plant, Clogs & Water spills.



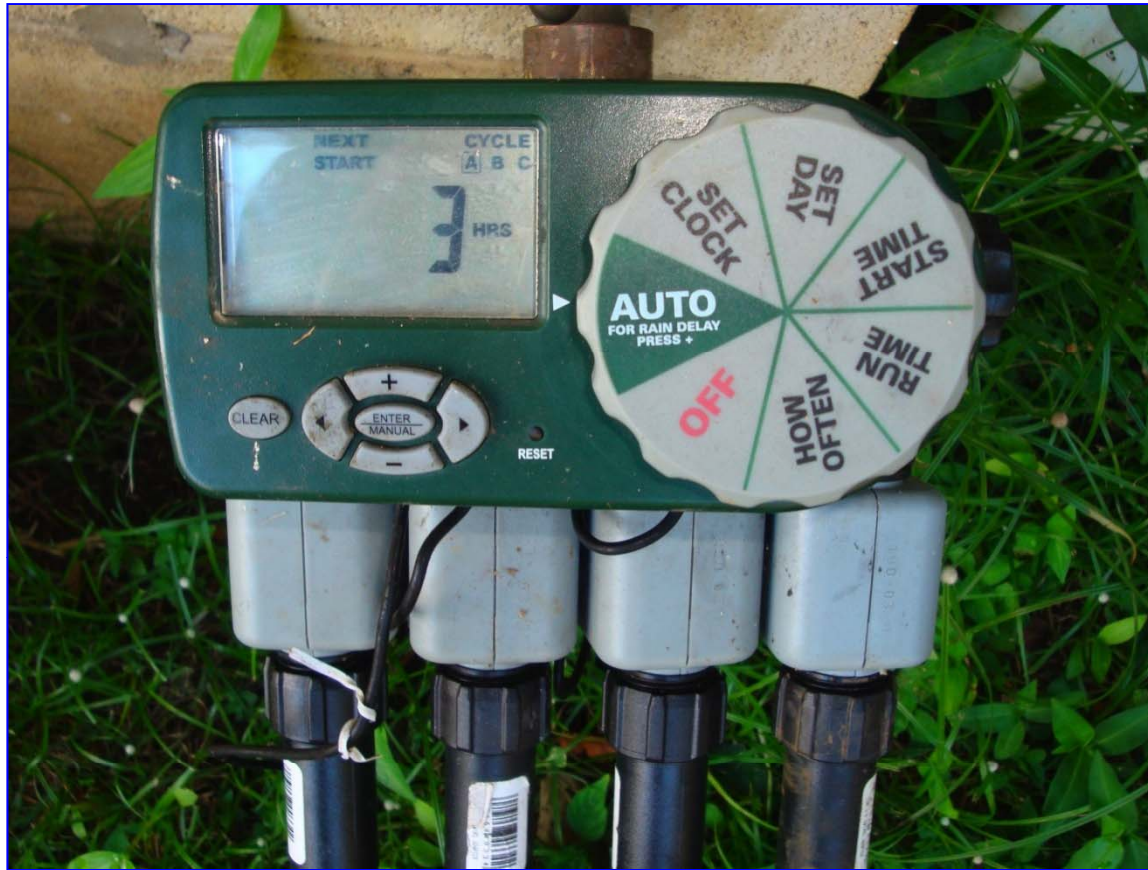


Water Hose

Pro: _____ fill in the blank.

Con: _____ fill in the blank.





Automated Irrigation

Pro: Guarantee plant watering, Water control, Less plant disease, Control your water bill.

Con: Initial cost, Less hands on, may find yourself relying on it



How and when to water?

- 1) Sight
- 2) Feel
- 3) When

Water stressed



Watered



Water Journal

- 1) Describe soil moisture content
- 2) Weather conditions of the day
- 3) Health of Plant prior to watering
- 4) Time of the day you watered
- 5) Duration of watering
- 6) Amount/quantity of water
- 7) Any additional entry you feel needed

~School activity; Make a Journal.

Let's hear from Bob about STEM



Which is ready for harvest? Why?



When to Harvest?

- Personal
- Cultural
- By the directions



Harvest the seeds, too!



- Consider growing crops for seed as well as food (Koba Onions shown)



Food Safety - Threats

- 1) Manure, Compost, Fertilizers & Compost Tea
- 2) Herbicides
- 3) Insecticides
- 4) Your applied home recipes
- 5) Nature (ex. Rat Lung Disease)
- 6) Your water source
- 7) Animals in the garden
- 8) Weather (flooding of the garden)



Food Safety - Safeguards

- 1) Always wash hands before and after gardening
- 2) Always wash your vegetables/fruits
- 3) Place harvested veggies in clean container
- 4) Clean garden tools before and after
- 5) Use CTAHR web site for guidance

<http://www.ctahr.hawaii.edu/foodsafety-ces/>

http://manoa.hawaii.edu/ctahr/farmfoodsafety/?page_id=34



Garden Demonstration Stations

1 Mulch & Weeds – Bob

2 Vertical & Roof Top Garden - Mark

3 Organic Garden- Karen

4 Raised Bed Garden – Betty

5 Container Garden - George



Thank you to all our contributors!

Oahu Master Gardeners Contributing to this Presentation:

K. Kim 2011, 2012
G. Kutterer 2011, 2012
R. Speer 2011, 2012
A. Yorba 2011, 2112
C. Ano 2011
L. Miller 2011
A. Teves 2011
B. A. Alexander 2011

Additional Assistance Received From:

N. Davison, U-H, CTAHR 2011

And countless un-named others who volunteered info and ideas for this presentation.



Adult plant and seedlings of each crop

Adult

Seedling

Adult

Seedling

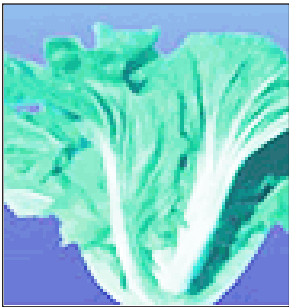


Kale, Dinosaur

Kale, Dinosaur

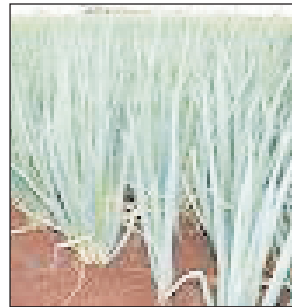
Lettuce

Lettuce



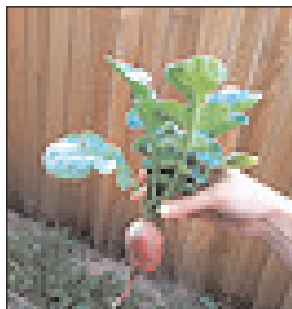
Mustard Cabbage

Mustard Cabbage



Green Onions

Green Onions



Radishes

Radishes



Carrots

Carrots



Beans, Pole

Beans, Pole



Corn, Sweet

Corn, Sweet

Adult plant and seedlings of each crop

Adult

Seedling

Adult

Seedling



Cucumbers

Cucumbers



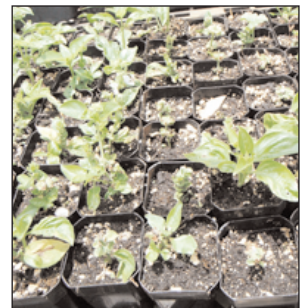
Sweet Potatoes

Sweet Potatoes



Tomato, Grape

Tomato, Grape



Basil, Sweet

Basil, Sweet



Lemon Grass

Lemon Grass



Rosemary

Rosemary



Dill

Dill



Citrus

Citrus



PLANTING GUIDE

For Gardens in the School
 Aug 16 2011
 Urban Garden Center

VEGETABLES

Name	Planting Month (from-to)	Days to Harvest	Uses	Problems	Seeds Available
Beans, Pole (Poamoho)	Jan-Dec	55-70	Stir fry/side	Bean Fly	U-H
Cabbage (Mustard)	Dec-Feb	40-60	Saimin	Cabbage Worm/ Rust	Various Seed Catalogs
Carrots (Nantes)	Dec-March	90-120	Snacks/salads	Early/late Blights	Various Seed Catalogs
Corn, Sweet (#9Yellow	Silver)	April-July	60-95	Roast	Mosaic Virus	U-H
Cucumber (Lehau)	April-Oct	50-65	Salads	Pickle Worms	U-H
Eggplant (Waimanalo Long)	Jan - Dec	90-110	Stir Fry	Mites/Bacterial Wilt	U-H
Kale (Dinosaur)	Nov-April	50-60	Kale Chips	Cabbage Worms	Johnny's Seeds
Lettuce (Manoa) *	Sept-April	50-90	Salads	Slugs/snails	U-H
Lettuce (Bambi) *	Nov-Dec	50-90	Salads	Slugs/snails	Johnny's Seeds
Onions, Green (Koba) *	Jan-Dec	50-75	Salads/Saimin	Thrips/aphids	U-H
Pepper (Kaala)	Nov-March	80-100	Stir Fry	Thrips/Pepper Maggot	U-H
Potatoes, Sweet	Mar - May	180-210	Baked/Roast	Potato Weevil	Local Nurseries
Radishes (Cherry Belle) *	Oct - March	20-30	Salads	None	Various Seed Catalogs
Tomato, Grape (Komohana) *	Sept - May	80-85	Salads/snacks	Fungal disease, fruit	U-H

HERBS

Name	Planting Month (from-to)	Type	Uses	Problems	Seeds Available
Basil (Sweet)	Year-round	Annual	Ethnic Recipes	Downy Mildew	U-H
Dill *	Year-round	Annual	Ethnic Recipes	None	Various Seed Catalogs
Lemon Grass	Year-round	Perennial	Ethnic Recipes	Rust	Local Nurseries
Rosemary *	Cuttings- spring	Perennial	Ethnic Recipes	Spittle Bug	Local Nurseries

FRUITS

Name	Planting Month (from-to)	Days to Harvest	Uses	Problems	Plants Available
Avocado (Holiday & Wurtz) *	Year-round	2-3 years	Guacamole	Root & Stem Rot	Local Nurseries
Citrus, various	Year-round	2-3 years	Juices	Citrus Scab/Black Fly	Local Nurseries

NOTE: *=Consider Planting in a container

MATERIALS

Qty	Description	Source (O'ahu)	Approx. Total Price
1.5	4"x4"x51" ChoiceDek grey deck posts, #62374	Lowe's	\$40
4	12' Trex composite decking boards, #576538	Home Depot	\$135
40	3" stainless steel deck screws plus driver bit	Home Depot	\$17 (75-pack)
1 cubic yard	Soil/Compost ("Lawn & Garden Blend")	Hawaiian Earth Products 682-5895 (or other source)	\$35.70 (plus delivery cost)
To cover 4'x8' area	Cardboard and newspaper (to kill grass without having to dig it out)	Check with cafeteria or local grocery stores for empty boxes	Free



TOOLS

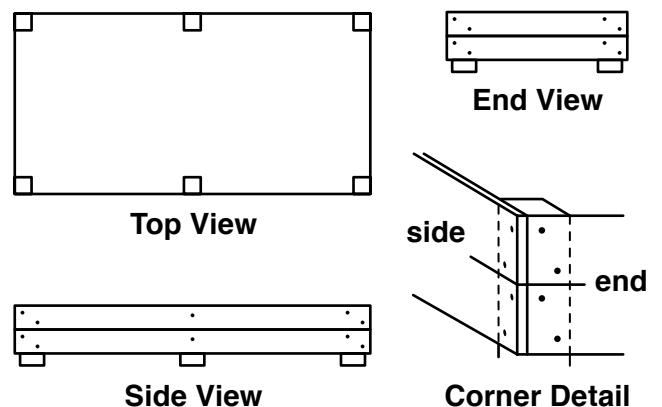
Drill, saw, tape measure, extension cord, pick, shovel, wheelbarrow, buckets.

BUILDING INSTRUCTIONS

1. Cut deck posts into six equal length pieces (about 1 foot each).
2. Cut each decking board into an eight-foot and a four-foot board.
3. Assemble as shown in the diagram. For transport, it is easiest to assemble the ends off-site (posts and four-foot boards), then attach the sides on-site.
4. Place one post in the middle of each 8' side, on the inside of the bed. Screw in place to both top and bottom boards (this will prevent bowing over time).

INSTALLATION INSTRUCTIONS

1. Dig a trench in the soil for the border to fit into (with slightly deeper holes for posts). At least 1/4 of the total border height (about 3 inches) should be below ground.
2. Place the border in the trench. Take the time to adjust the trench as needed so that the border is level and straight. Fill soil into trenches to firm in place.
3. Completely cover the grass inside the border with a thick layer of cardboard and newspaper. Wet both sides so it will begin to break down.
4. Fill the garden bed with a mix of soil, compost, and decomposed mulch to the top of the border; do not over-fill.
5. Amend the soil with natural amendments (e.g. compost, vermicast, fully composted manure). Water the soil well and cover with cover cloth for shade. Keep the soil moist and let the bed rest for about a week before planting.
6. Optional: Instead of using imported soil, build a layered compost pile inside the garden border, water it regularly to assist with decomposition, and plant into the finished compost (about a 2-3 month process).
7. Optional: Place dry cardboard/newspaper and a thick layer of mulch (e.g. wood chips) in the pathways around the garden bed to keep grass away.



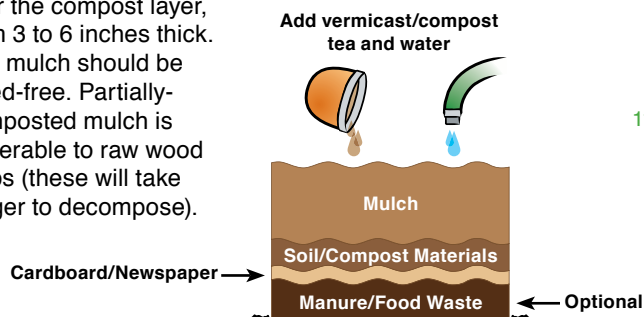
WHY SHEET MULCH?

Sheet mulch gardens make use of free or low-cost, locally available “waste” materials, such as cardboard and yard waste, to create living soil for growing gardens. Though this process takes time, sheet mulch gardens eliminate the need to dig out grass or import soil to your site. Students may explore the decomposition process as the sheet mulch breaks down, gaining increased appreciation for nature’s essential process of nutrient cycling and the intricate balance of soil life.



STEPS FOR CREATING A SHEET MULCH GARDEN OF ANY SIZE

- Site Prep:** If there is brush or tall grass present, cut it down and leave it in place.
- Manure/Food Waste Layer (Optional):** Wet the area and cover with composted manure and/or food waste (pre-consumer fruit and vegetable waste) so that the majority of the grass is not visible, about 1 to 2 inches of material. (These materials are high in nitrogen and will help to kill the grass and attract earthworms to the garden.)
- Cardboard/Newspaper Layer:** Cover thoroughly with wet newspaper (at least 1/2 to 1 inch thick) and/or cardboard. The pieces should all overlap, leaving no exposed areas. Water the newspaper and cardboard until they are saturated. This can be assisted by slicing the top of the cardboard, allowing water to infiltrate, or soaking the cardboard in water-filled garbage cans or wheelbarrows as you work.
- Soil/Compost Layer:** If finished compost and/or soil is available, place it on top of the cardboard/newspaper layer; this will allow for immediate planting. If these are not available, create a compost pile by adding compostable materials (chopped yard wastes, greens and browns) over the entire cardboard/newspaper layer. Wet thoroughly to begin the composting process.
- Mulch Layer:** Add mulch over the compost layer, from 3 to 6 inches thick. The mulch should be weed-free. Partially-composted mulch is preferable to raw wood chips (these will take longer to decompose).



- Water:** Thoroughly water all layers until saturated. This is key to rapid decomposition, as the soil microbes need moisture to do their work. Water regularly if weather is dry.
- Vermicast/Compost Tea:** Add the “tea” to the sheet mulch to inoculate it with living microbes that are an important part of a healthy garden and to help speed the decomposition process toward healthy, living soil!
- Cover Crops (Optional):** Grow a cover crop from seed (such as sunn hemp) to help improve the soil and discourage weed growth. Chop and incorporate the plants into the soil/sheet mulch before they become woody.
- Pathways:** Once the sheet mulch has turned into soil, be sure to create distinct garden beds and pathways. It is important to avoid soil compaction by only walking in the garden pathways. Optional border materials may include logs, bricks, painted rocks, string, etc.
- Planting Guidelines For Sheet Mulch Gardens:**
 - For vines (sweet potato in particular), slips can be planted into the mulch.
 - For seeds and small transplants, pull away the mulch and plant into finished compost or soil (which may be added as a layer or in specific areas for immediate planting).
 - For larger transplants pull all the material away, cut a hole in the cardboard and plant into the soil below. Then replace the layered materials around the new planting, being careful to not have the mulch be too thick around the stem as this can cause rot.
- Garden Care:** Be sure to continually care for your soil by adding good-quality compost and other natural amendments. A monthly application of vermicast (dissolved in water and applied to garden soil) will contribute greatly to the health of your garden.



Vegetable Gardening in Containers

Joseph G. Masabni*

If your vegetable gardening is limited by insufficient space or an unsuitable area, consider raising fresh, nutritious, homegrown vegetables in containers. A window sill, a patio, a balcony or a doorstep will provide sufficient space for a productive mini-garden. Problems with soilborne diseases, nematodes or poor soil conditions can be easily overcome by switching to a container garden. Ready access to containers means that pest management is easier. Container vegetable gardening is a sure way to introduce children to the joys and rewards of vegetable gardening.



* Assistant Professor and Extension Horticulturist, The Texas A&M System

Crop Selection

Almost any vegetable that will grow in a typical backyard garden will also do well as a container-grown plant. Vegetables that are ideally suited for growing in containers include tomatoes, peppers, eggplant, green onions, beans, lettuce, squash, radishes and parsley. Pole beans and cucumbers also do well in this type of garden, but they do require considerably more space because of their vining growth habit.

Variety selection is extremely important. Most varieties that will do well when planted in a yard garden will also do well in containers. Some varieties of selected vegetables which are ideally suited for these mini-gardens are indicated in Table 1.



Small fruited tomato varieties make excellent hanging baskets.

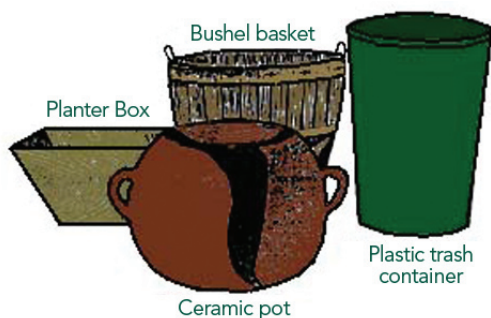
Table 1. Varieties for Container Grown Vegetables

Broccoli (2 gallons, 1 plant)	Packman, Bonanza, others
Carrot (1 gallon, 2-3 plants. Use pots 2 inch deeper than the carrot length)	Scarlet Nantes, Gold Nugget, Little Finger, Baby Spike, Thumbelina
Cucumber (1 gallon, 1 plant)	Burpless, Liberty, Early Pik, Crispy, Salty
Eggplant (5 gallons, 1 plant)	Florida Market, Black Beauty, Long Tom
Green Bean (2 gallons minimum, space plants 3 inches apart)	Topcrop, Greencrop, Contender, (Pole) Blue Lake, Kentucky Wonder
Green Onion (1gallon, 3-5 plants)	Beltsville Bunching, Crysal Wax, Evergreen Bunching
Leaf Lettuce (1 gallon, 2 plants)	Buttercrunch, Salad Bowl, Romaine, Dark Green Boston, Ruby, Bibb
Parsley (1gallon, 3 plants)	Evergreen, Moss Curled
Pepper (5 gallons, 1-2 plants)	Yolo Wonder, Keystone Resistant Giant, Canape, Red Cherry (Hot), Jalapeno
Radish (1gallon, 3 plants)	Cherry Belle, Scarlet Globe, (White) Icicle
Spinach (1 gallon, 2 plants)	Any cultivar
Squash (5 gallons, 1 plant)	Dixie, Gold Neck, Early Prolific Straightneck, Zucco (Green), Diplomat, Senator
Tomato (5 gallons, 1 plant)	Patio, Pixie, Tiny Tim, Saladette, Toy Boy, Spring Giant, Tumbling Tom, Small Fry
Turnip (2 gallons, 2 plants)	Any cultivar

Growing Media

Any growing media must provide water, nutrients, and a physical support in order to grow healthy plants. A good growing media must also drain well. Synthetic or soilless mixes are well suited for vegetable container gardening and may be composed of sawdust, wood chips, peat moss, perlite, or vermiculite. These are free of disease and weed seeds, hold moisture and nutrients but drain well and are lightweight. Many synthetic soil mixes such as Jiffy Mix®, Bacto®, Promix®, and Jiffy Pro® are available at garden centers. Soilless mixes can also be prepared by mixing horticultural grade vermiculite, peat moss, limestone, superphosphate and garden fertilizer. To 1 bushel each of vermiculite and peat moss, add 10 tablespoons of limestone, 5 tablespoons of 0-20-0 (superphosphate) and 1 cup of garden fertilizer such as 6-12-12 or 5-10-10. Mix the material thoroughly while adding a little water to reduce dust. Wet the mix thoroughly before seeding or transplanting. Soil mixes are made up of equal parts of sphagnum peat moss or compost, pasteurized soil, and vermiculite or perlite. Composted cow manure is then added to improve the soil's physical properties and as a nutrient source. Soil mixes tend to hold water better than soilless mixes.

Containers



Almost any type of container can be used for growing vegetable plants. For example, try using bushel baskets, drums, gallon cans, tubs or wooden boxes. The size of the container will vary according to the crop selection and space available. Pots from 6 to 10 inches in size are satisfactory for green onion, parsley and herbs. For most vegetable crops such as tomatoes, peppers and eggplant, you will find that 5 gallon containers are the most suitable size, while 1 to 2 gallon containers are best for chard and dwarf tomatoes. Smaller container sizes are appropriate for herbs, lettuce, and radish crops. They are fairly easy to handle and provide adequate space for root growth.

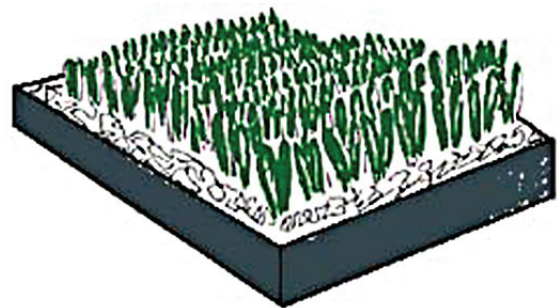
Any well-drained container can become a productive mini-garden.

Container materials are either porous or nonporous. Glazed, plastic, metal, and glass containers are nonporous. Regardless of the type or size of container used it must drain adequately for successful yields.

Adding about 1 inch of coarse gravel in the bottom of the container will improve drainage. The drain holes work best when they are located along the side of the container, about $\frac{1}{4}$ to $\frac{1}{2}$ inch from the bottom.

Seeding and Transplanting

Vegetables that can be easily transplanted are best suited for container culture. Transplants may be purchased from local nurseries or can be grown at home. Seeds can also be germinated in a baking pan, plastic tray, pot, or even a cardboard milk carton. Fill the container with the media described above and cover most vegetable seed with $\frac{1}{4}$ inch to $\frac{1}{2}$ inch of media to insure good germination. Another method is to use peat pellets or peat pots which are available from nursery supply centers. Landscape cloth or screen in the bottom of the pot will improve drainage and invigorate plant growth.



Green onions, radishes or beets can be grown in a cake pan.



Covering the seed flat with a clear plastic bag will hasten germination.



A "tube" or bag garden is an easy method to grow vegetables.

The seed should be started in a warm area that receives sufficient sunlight about 4 to 8 weeks before you plan to transplant them into the final container. Most vegetables should be transplanted into containers when they develop their first two to three true leaves. Transplant the seedlings carefully to avoid injuring the young root system. (See Table 2 for information about different kinds of vegetables.)

Table 2. Planting Information for Growing Vegetables in Containers

Crop	Number of days for germination	Number of weeks to optimum age for transplanting	General size of container	Amount of light*	Number of days from seeding to harvest
Beans	5-8	-	Medium	Sun	45-65
Cucumbers	6-8	3-4	Large	Sun	50-70
Eggplant	8-12	6-8	Large	Sun	90-120
Lettuce, leaf	6-8	3-4	Medium	Partial Shade	45-60
Onions	6-8	6-8	Small	Partial Shade	80-100
Parsley	10-12	-	Small	Partial Shade	70-90
Pepper	10-14	6-8	Large	Sun	90-120
Radish	4-6	-	Small	Partial Shade	20-60
Squash	5-7	3-4	Large	Sun	50-70
Tomato	7-10	5-6	Large	Sun	90-130

*All vegetables grow best in full sunlight, but those indicated will also do well in partial shade.

Fertilization

Available fertilizers will be either time-release or water soluble. Time-release fertilizer is mixed with the potting media at planting time. Osmocote® is a pelleted time-release fertilizer with 14-14-14 formulation. Water soluble fertilizers, on the other hand, are added to water and used when plants begin to grow actively. Peters® 20-20-20 or Miracle Gro® 15-30-15 are two examples sold in most garden centers.

The easiest way to add fertilizer to plants growing in containers is to prepare a nutrient solution and then pour it over the soil mix. There are many good commercial fertilizer mixes available to make nutrient solutions. Always follow the application directions on the label. You can make a nutrient solution by dissolving 2 cups of a complete fertilizer such as 10-20-10, 12-24-12, or 8-16-8 in 1 gallon of warm tap water. This mixture is highly concentrated and must be di-



A potato bag is a unique way to grow potatoes.

the mix becomes water-logged, the plants will die from lack of oxygen. Avoid wetting the foliage of plants since wet leaves will encourage plant diseases. Remember to use the nutrient solution for each watering except for the weekly leaching when you will use tap water.

Water-holding gels are becoming popular for use in container gardening. These starch-based gels are called hydrogels. They absorb at least 100 times their weight in water and slowly release that water into the soil as it dries. To be effective, they should be incorporated in the soil mix before planting.

Mulches can also be placed on top of the soil mix to reduce water loss. Compost, straw, pine needles, grass clippings, shredded bark, and moss are examples of mulches and vary in their effectiveness.

Light

Nearly all vegetable plants will grow better in full sunlight than in shade. However, leafy crops such as lettuce, cabbage, greens, spinach and parsley can tolerate more shade than root crops such as radishes, beets, turnips and onions. Fruit bearing plants, such as cucumbers, peppers, tomatoes and eggplant need the most sun of all. One major advantage to gardening in containers is that you can place the vegetables in areas where they can receive the best possible growing conditions.

Harvesting

Harvest the vegetables at their peak of maturity when a vegetable's full flavor has developed. Vine-ripened tomatoes, tender green beans and crisp lettuce will have the best flavor.

At the end of the harvest season, discard the plant and soil from the pot. Do not reuse the same soil for a second season of production. Infected soil or mix will spread disease into the second season unless it is properly composted. Properly composted planting media can be reused.

luted before it can be used to fertilize the plants. To make the final fertilizing solution, mix 2 tablespoons of the concentrated solution in 1 gallon of water.

If you use transplants, begin watering with the nutrient solution the day you set them out. If you start with seed, apply only tap water to keep the soil mix moist enough until the seeds germinate. Once the plants emerge, begin using the nutrient solution.

While the frequency of watering will vary from one crop to the next, usually once per day is adequate. If the vegetable produces a lot of foliage, twice a day may be necessary. Plants require less water during periods of slow growth.

At least once a week, it is advisable to leach the unused fertilizer out of the soil mix by watering with tap water. Add enough water to the container to cause free drainage from the bottom. This practice will flush harmful minerals out of the the soil mix.

It is a good idea to occasionally water with a nutrient solution containing minor elements. Use a water-soluble fertilizer that contains iron, zinc, boron and manganese and follow the label directions carefully.

Watering

Proper watering is essential for a successful container garden and one watering per day is usually adequate.

However, poor drainage will slowly kill the plants. If



"Cages" can be used with containers to support tomatoes, cucumbers and pole beans.

Diseases and Insects

Vegetables grown in containers are susceptible to the same insects and diseases that are common to any vegetable garden. You should check your plants periodically for diseases and for foliage and fruit-feeding insects. If you detect plant disease or harmful insects, use EPA-approved fungicides and insecticides in a timely manner. Contact your local county Extension agent for the latest information on disease and insect control on vegetable plants.

Table 3. Common Problems in Container Gardening

Symptom	Cause	Corrective Measure
Plants tall, spindly, and unproductive	Insufficient light	Move container to area receiving more light
	Excessive nitrogen	Reduce feeding intervals
Plants yellowing from bottom, lack vigor, poor color	Excessive water	Reduce watering intervals; Check for good drainage
	Low fertility	Increase fertility level of base solution
Plants wilt although sufficient water present	Poor drainage and aeration	Use mix containing higher percent organic matter; increase number of holes for drainage
Marginal burning or firing of the leaves	High salts	Leach container with tap water at regular intervals
Plants stunted in growth; sickly, purplish color	Low temperature	Relocate container to warmer area
	Low phosphate	Increase phosphate level in base solution
Holes in leaves, leaves distorted in shape	Insects	Use EPA-recommended insecticide
Plant leaves with spots; dead dried areas, or powdery or rusty areas	Plant diseases	Remove diseased areas where observed and use EPA-recommended fungicide

Container Gardening Success

Container gardening can be successful if you follow guidelines above. Plant growth and vigor will vary depending on the location and attention you give your plants. The following guidelines are golden rules for any home vegetable garden:

1. Inspect your plants daily and, if necessary, water, trim, train or pruning.
2. Check your plants daily and remove of pests and weeds and treat diseases.
3. Continue your education by soliciting advice from experienced gardeners.
4. Make time to sit down and enjoy the fruits of your labor.



PLANTING GUIDE RESOURCES

Aug 16 2011

Vegetable 'How to' Resources

Poamoho' pole bean

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/RES-051.pdf>

Home garden beans

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HGV-8.pdf>

Carrots

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HGV-1.pdf>

Chinese Leafy & Root Crops in FL, Guidelines

<http://edis.ifas.ufl.edu/pdffiles/CV/CV14000.pdf>

Corn production in the tropics: the Hawaii

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/corn2003.pdf>

Growing hydroponic cucumbers in a plastic trash container

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HG-44.pdf>

Farmer's Bookshelf - Eggplant

<http://www.ctahr.hawaii.edu/fb/eggplant/eggplant.htm>

Lettuces for the Home Garden

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HGV-2.pdf>

Mustard Cabbage

<http://urbanext.illinois.edu/veggies/mustard.cfm>

<http://www.ctahr.hawaii.edu/new/FJGI/index.htm> (MustardNL.pdf)

Onions: Bulb and Green Bunching

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HGV-16.pdf>

Bell Pepper

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HGV-3.pdf>

How to Grow Radishes in FL

<http://edis.ifas.ufl.edu/cv132>

Sweet Potato Production Guides for Hawaii

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/RES-146.pdf>

Good history: [The Sweet Potato in Hawaii](#)

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/B-50.pdf>

Vegetable 'How to' Resources cont'd

Nutrition: Sweet Potato

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/CFS-SP-1A.pdf>

Another Resource: [Pharmaceutical and Nutritional Values of Sweet Bioproducts & Recipes](#) [Ingella White, Ph.D., WCC](#)

Field tomato production guidelines for Hawaii

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/RES-141.pdf>

Home garden tomato

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HGV-5.pdf>

Herbs for Growing and Enjoying

<http://www.ctahr.hawaii.edu/NEW/resources/Herbs.pdf>

'UH Sweet Basil': a new basil cultivar tolerant of fusarium wilt

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/NPH-3.pdf>

Dill

<http://edis.ifas.ufl.edu/mv060>

Herbs in the FL Garden

<http://edis.ifas.ufl.edu/vh020>

Rust of lemongrass

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/PD-57.pdf>

Planting a Tree

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/L-4.pdf>

Avocado

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/HC-4.pdf>

Citrus culture in Hawaii

<http://www.ctahr.hawaii.edu/oc/freepubs/pdf/B-71.pdf>

Poster of 99 varieties of citrus:

<http://www.fruitlovers.com/CitrusPoster.html>

MINDFUL PLANTING helps the garden grow and instills a spirit of respect and appreciation.

1. Demonstrate first then allow students to loosen the soil to make room for air, water and roots to grow. Level the soil. Put all tools away.
2. Demonstrate first before handing out seeds to students.
3. Plant seeds at a depth of about 2 to 3 times their height. *Small seeds, such as lettuce and carrots, may be sprinkled over the soil (or in a shallow trench) and covered with a light layer of soil. For larger seeds such as beans, sunflowers, and corn, create a hole with one finger (about 1" deep) and plant one seed per hole, usually about 6" apart.*
4. Walk around the garden bed and hand seeds to students.
5. Encourage students to observe the seeds closely, noticing a diversity of shapes, sizes, textures, patterns, and imagining the tiny life inside. *Share observations with your neighbors.*
6. Encourage students to hold the seeds gently in their hands. *Name your seed, tell it a secret, make a wish! Give your seed the loving energy it needs to grow.*
7. Be aware of the vocabulary you use: we want to "cover" the seeds instead of "bury" them, because they are alive! When planting say, "Good night seeds!" Pat the soil firmly but gently, do not pack it down.
8. Once the seeds are planted, invite students to imagine the seeds waking up (sprouting) and growing into healthy seedlings, then tall, strong plants! Act out the life cycle together.
9. Watering: It is immensely important that the seeds and soil receive adequate moisture in their first few weeks of life. Show students how to water:
 - Water the soil gently, like "raindrops, not waterfalls."
 - Allow the earth to "sip and swallow" before another drink is given.
 - Avoid making large puddles, keep the water spout moving so the water has time to soak into the soil.
 - To help younger students take turns you can count "one-butterfly, two-butterfly" then switch.
 Students and teachers need to water and visit the gardens every day, checking often to be sure the soil is moist. Assign daily "Garden Monitors" in your class. Once the sprouts are growing, show students how to water the soil, instead of the leaves.
10. Cover cloths (e.g. burlap bags or sheets) may be used to cover the soil as soon as the seeds are planted. This protects the soil and seeds from the sun and birds. The cover cloth should be removed AS SOON AS the sprouts emerge. Hang to dry and store for future use.



ĀINA, LAND WHICH FEEDS US

*We plant in the soil, not in the dirt.
We do not work in the garden,
We "Take Care of the Garden."
We cover the seeds when we plant them,
We do not bury them,
The seeds are alive not dead.
We say "Good Night Seeds" after we plant them.
When we hold the seeds in our hands,
We give them energy.
When the seeds have grown
They give us energy.
We do not plant with our hands,
We plant with our Heart;
Our Hands are the extension of our Heart.*

Provided By
HOA ĀINA O MAKAHA

SITE EVALUATION FORM

Your teacher has talked to the Maintenance Staff and they have located several possible sites for your class garden project. Using this form choose the site you think would work best to grow yours crops. HINT: The more "YES" responses the better!

<u>CRITERIA:</u>	<u>YES</u>	<u>NO</u>	<u>COMMENTS</u>
<u>PLACE:</u> Is the proposed area free of large rocks, trash & other debris? Ask what was done on the area you would like for your garden.			
<u>LIGHT:</u> Is there sun for 6-8 hours a day? Watch where the buildings and trees cast their shadows.			
<u>AIR:</u> Do you feel a gentle breeze when standing in this area? You do not want your plants growing with strong winds or NO wind.			
<u>NUTRIENTS:</u> Is there enough room in the area to place a compost bin and/or store other amendments you want to add to your garden?			
<u>THIRSTY:</u> Is there a water faucet nearby? The ideal would be for your adult volunteers to help set up an automated irrigation system.			
<u>SOIL:</u> When you pour a watering can full of water onto the soil, does the soil 'drink it up'? Feel the soil, does it crumble easily? Look at the area after a rain. Is it free of puddles?			

~ "PLANTS" acronym courtesy of Junior Master Gardener Program