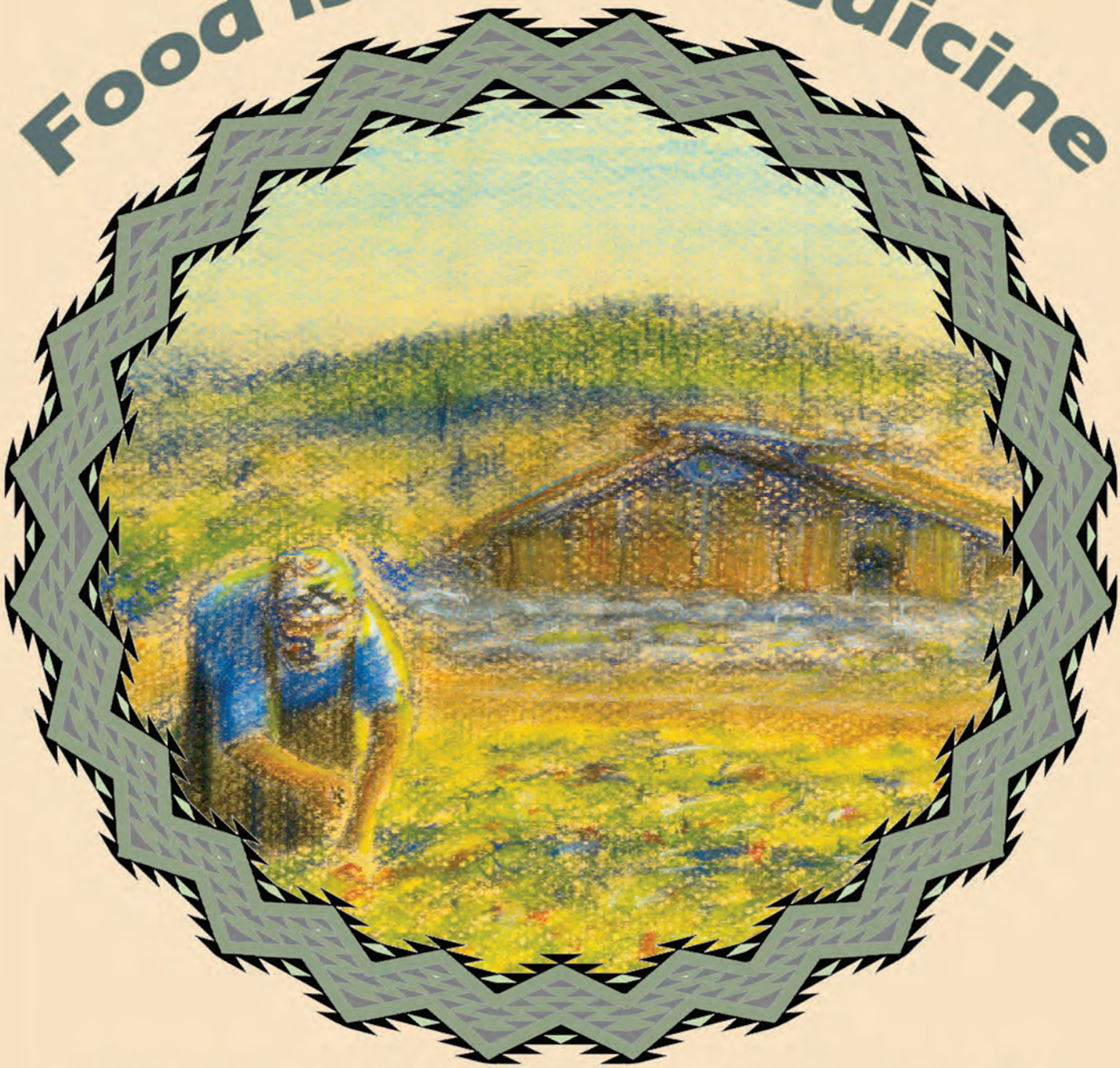
Food is Good Medicine



A Practical Guide to Growing Food in Northwestern California

Written by Eddie Tanner for United Indian Health Services, Inc.

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Introduction

About United Indian Health Services, Inc.

Incorporated in 1970, UIHS is a non-profit tribal health consortium serving American Indians and their families in Humboldt and Del Norte counties. The UIHS consortium is comprised of nine federally recognized tribes of Mattole, Tolowa, Wiyot and Yurok ancestry.

The UIHS Potawot Health Village is located 280 miles north of San Francisco in Arcata, California. The health village includes a two acre organic food garden, fruit orchard and a herb garden collectively known as the UIHS Potawot Community Food Garden. The goal of this demonstration garden is to promote wellness by increasing access and knowledge about locally grown, organic produce and to provide learning opportunities for members of the local American Indian community in an effort to increase home gardening.

About this Book

This book is a component of the UIHS Food Is Good Medicine Project. The Food Is Good Medicine Project is based on a nutrition model that honors traditional native foods and recognizes the spiritual connection that exists between how we gather, prepare and share our food with one another. The Food Is Good Medicine nutritional model was created specifically for American Indians of Northern California based on traditional food ways and values.

This Gardening Guide was developed to compliment a UIHS Core Philosophy which focuses our resources on the promotion of health and the prevention of illness. In this way, we hope that this guide will inspire you to grow your own fresh, healthy produce and to consider supporting local, organically grown food when making healthy food choices for you and your family.

Acknowledgments

This guide was written by Eddie Tanner who worked for the UIHS Potawot Community Food Garden for four growing seasons from 2004 to 2007. Eddie believes that growing and eating our own food makes us healthier in body and spirit. Eddie continues to garden and teach workshops locally.

Edited by UIHS Traditional Resources Program Staff: Paula Allen and Eric Johnson. Additional layout, photos and illustrations by UIHS Traditional Resources Program Staff. Cover artwork by David Mata.

Special thanks to the UIHS Board of Directors, the UIHS Traditional Resources Advisory Committee and the UIHS Diabetes Program.

Breaking Ground

Is the Site Good for Gardening?

1. Sun: The more sun crops get, the better (especially on the coast). Few food plants like shade. Your site should have at least 10 hours of direct sun at the height of summer.

2. Slope & Aspect: The steeper the ground, the higher the risk of soil erosion. If your site is more than slightly sloped, consider making terraced beds with paths in between. Aspect is the compass direction that the slope faces. South and West aspects are warmer, so use these if possible.

3. Topsoil: When you start digging, you'll see that the topsoil is noticeably darker than the soil below. Ideally, your site will have at least 6 inches of topsoil. It is possible to develop gardens on site where topsoil has been removed, but it is a much slower process. If you have less than 6 inches of topsoil, you can make raised beds and fill them with brought in soil. When purchasing topsoil, ask about its source and try to choose one that is extracted responsibly.

4. Overall Soil Depth: The total depth of usable soil is how deep plant roots can penetrate. Roots cannot grow through rock or through very hard clay layers. See how deep you can loosen the soil with a shovel (without having to get out a pick). You need at least one foot of usable soil depth. Fruit trees will need at least two feet.

5. Drainage: Plant roots need air to breath, so if your soil is poorly drained your plants won't be happy. In our climate of wet winters and dry summers, most soils that have puddles of water in the winter will dry out enough by late spring. The later into spring the puddles last, the shorter the effective planting season. A site that is wet year round is only suited to a couple of crops (i.e. blueberries & cranberries).

6. Laying Out the Garden Beds: A garden should be between 4 to 5 feet wide, which allows a person to reach the center of the bed from either side. A 1½-foot path is the minimum width that allows comfortable movement between beds. You may want some 2½-foot paths to accommodate a wheelbarrow. The wider the beds and narrower the paths, the more planting area you get in the overall garden area. Balance this information into any artistic layout your heart desires.

Lay out your beds to allow easy access to your crops.

What's Growing There Now?

Once you've picked out a site, you'll need to clear it of whatever is currently growing on it. The three main ways of doing this are by manually removing the vegetation, chopping and turning the vegetation into the soil, or smothering the vegetation so that it rots away. Manual removal can be done in hours, turning-in can take weeks, and smothering could take months. Whatever method you choose make sure the soil moisture is right before you start (see page on Working with Soil).

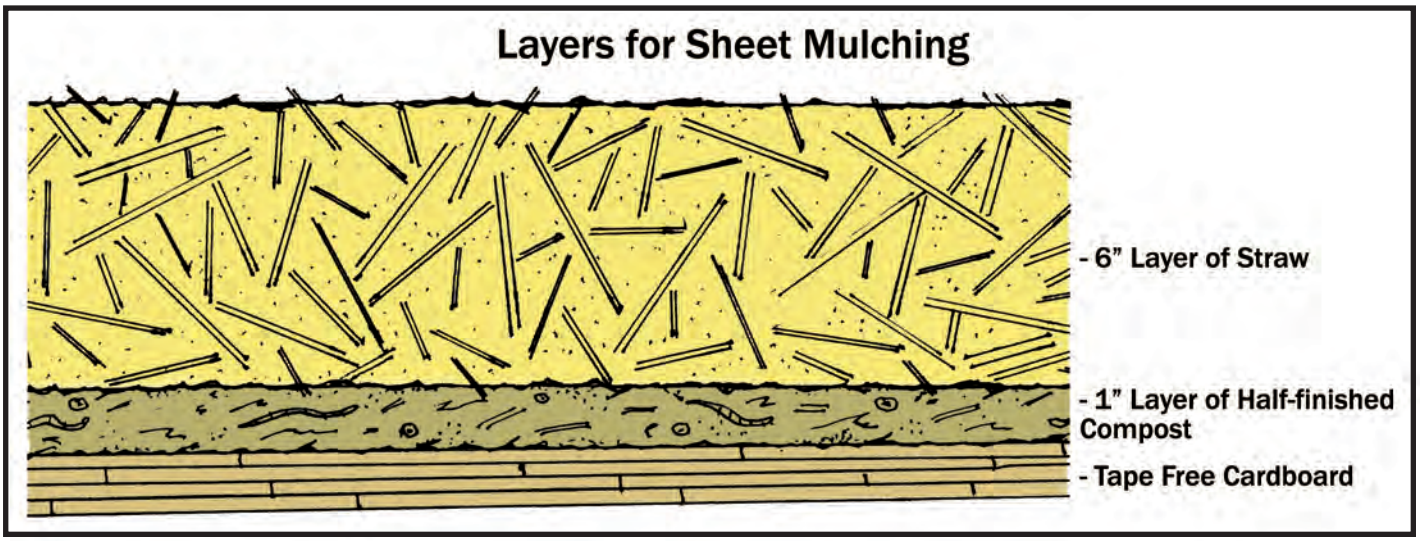
Smothering weeds using the sheet mulching method.

1. Manual Removal: This is the most practical method for removing weeds or sparse grass. Use an eye-hoe to chop the roots of the plants and then use a bow rake to separate the plant material from the soil (see Garden Tools section). Manual removal is also the fastest and most thorough method for removing unwanted turf, but it takes a lot of hard work. Use the eye-hoe to peel off the turf below the grass roots, leaving the bare soil below. Once the turf is removed it can be composted and later returned to the garden.

2. Turning-in: Turn-in turf and other plant material by first mowing the area low and then turning the soil over with a spade or rototiller. Turf doesn't die quickly, so you will have to repeat the turning-in process at least two more times to avoid having the grass take over your garden beds later. Remember to water the soil before each turn-in to make it easier to remove the turf.

3. Smothering: This method doesn't require much labor, but it takes at least a couple of months. Decide on the size and placement of the garden bed and then cover it with a sheet of plastic or with a sheet-mulch. Using a sheet-mulch will make a more fertile garden bed than using a plastic sheet. To do this, lay down four overlapping layers of brown (tape-free) cardboard that has been soaked in water, cover this with a 1-inch layer of half-finished compost, then put down a six-inch layer of straw (not hay). Make sure the patch stays moist. When the cardboard has rotted away, the area is ready to till.

Illustration I: Sheet Mulching Layers



Beds on Flat Ground vs. Raised Beds: In places where there is good topsoil and good drainage, it is not necessary to make raised garden beds. Some gardeners prefer raised beds because they don't have to bend over as far to work. There are two main ways to make raised beds. The first way is to build a frame of sturdy boards from 1 – 2 feet tall, and then fill this frame with topsoil (not potting soil). This gives you a permanent raised bed at the desired height, but requires bringing soil in from off-site. The second way is to make beds that are not framed-in by using the soil on site. To do this, till the entire garden area to near-finished condition, mark out the bed dimensions, then shovel the soil from the aisles onto the tops of the beds, and rake them into shape. This is the preferred method for larger gardens, but be aware that these beds will need to be re-raised each season.

The beginning phase of building a garden bed. The cover crop was mowed followed by a tilling keeping the organic matter in the soil for good drainage.

Making the Bed: Now that you have bare soil, its time to till. Tillage loosens the soil so that plants roots can grow deeper with greater ease. Tillage can also break through hardpans. There are many ways to till a garden bed, and also ways to garden without tilling. This guide describes only the most basic of hand tilling known as The Single-Dig:

1. Make sure the soil is at the right moisture level (see Working with Soil section).

2. Start with bare soil at least as wide and long as you want the bed to be.

3. Spread a 1" layer of compost over the entire bed.

4. Work from the side of the bed to prevent compaction.

5. Use a spading fork to loosen the soil as deeply as possible, breaking large clods with the fork as you go.

6. Use a hoe to break up remaining clods on the surface. If all the soil is still cloddy after hoeing, water the soil and wait a couple of days, then hoe again.

Using a rototiller to mix compost and manure into the garden beds.

7. Use a soil rake to smooth the surface of the bed.

8. Spread any other organic fertilizers or more compost, and rake them into the top 2 inches of the soil.

This tillage should be done between each crop. Rototillers are usually used in large gardens, and though this tool makes tillage very quick, the rototiller tends to damage the soil structure that makes the soil easy to work from year to year. For small gardens, hands tillage (like the single-dig) is strongly recommended.

Working with Soil

What Soils are Made Of: Most soils are 85% – 98% mineral, and 2%-15% soil organic matter. The mineral component is made up of pieces of rock, ranging in size (smallest to largest) from clay to silt to sand to gravel and rock. The ratio of sand, silt, and clay is called soil texture. It is the way the soil feels when you run it through your fingers. Soil organic matter is made of partially decomposed and decomposing plant material and microorganisms.

While it is possible to change soil texture, it is easier to learn how to work with what you've got. The most effective ways to make soils easier to work with is by building up the organic matter (also known as humus) of the soil and by tilling when the soil is at the right moistness.

Maintaining Good Tilth: Tilth is a general term for soil that's good for growing. It mostly refers to the structure of a soil. Soil structure is how the microscopic particles of sand, silt, and clay in your soil group together into the soil chunks we see. A soil with good structure for gardening has many very small chunks as opposed to a few large ones. This condition allows a lot of space for pores that hold air or water and makes it easy for plant roots to grow. In order to keep our soil in good shape there are a couple things we need to do.

1. Minimize Compaction: Avoid stepping on the garden soil. Make well-defined paths between garden beds.

2. Maintain Soil Organic Matter: Soil organic matter, or humus, is really important for soil health. In addition to storing and slowly releasing nutrients to your crops, humus also holds soil structure together, provides food for a diverse population of soil organisms, and buffers pH and toxins in the soil. Soil organic matter is constantly decomposing, so you must continually add more to the garden bed. The two main ways to maintain soil organic matter levels are by adding composts & manures and by growing cover crops (see Cover Crop section).

Till When the Moisture is Right: In addition to the amount of soil organic matter, a soil's moistness is the biggest factor controlling how easy and how effectively that soil can be tilled. This is true for all soils, but especially for clay rich soils. A soil that is too dry becomes hard and dusty and clods won't break easily. A soil that is too wet will smear and clump together instead of crumbling nicely into loose soil. Tilling when the soil is either too dry or too wet tends to destroy soil structure. To find out when your soil is right for tilling, pick up a handful and crumble it in your hand. If it falls apart into many small pieces, then the moisture is good. If it is hard and the pieces remain large, it is too dry. If it sticks to your hands or smears instead of crumbling, it is too wet. A soil that is too wet should be left alone until it dries. There is little you can do to speed the process. A soil that is to dry should be irrigated until the soil is moist to the depth that you are going to till. After irrigating, wait a couple days for water to soak in and re-check the moisture before tilling.

Using a fork to test soil moisture prior to tilling. This photo shows soil that is too wet.

Soil Fertility

Soil Fertility Basics: It takes a lot of work to raise crops from start to finish. If your soil is adequately fertile, that work will be rewarded with good yields.

Feed the Plants by Feeding the Soil: Organic materials (plant & animal wastes) break down in the soil to provide the majority of soil fertility. Some fertility is also provided by adding various minerals. Plants grow strong as they search out these nutrients from the soil.

Compost & Animal Manures: Finished garden compost and/or rotted animal manures should be the basis of your fertility plan. They contain moderate amounts of all of the major plant nutrients in a slow release form and contribute greatly to soil organic matter. Add finished compost or rotted manure to your garden beds in a 1-inch layer twice during each growing season prior to planting or rotating crops.

Balanced Fertilization: For healthy plants we want to supply roughly equal parts of the three prominent nutrients: nitrogen, phosphorus, & potassium. Most animal manures are not sufficiently balanced (see Table 1). Also, compost and rotted manures may not provide enough of the major nutrients. This can be supplemented by adding soil amendments (see Table 2).

Table I - Nutrient contents of manures (approximate):

	Nitrogen (N)	**Phosphorus (P)**	**Potassium (K)**
Garden Compost:	0.8%	0.5%	1.0%
Chicken – dry:	4.5%	3.5%	0.5%
Dairy Cow:	0.6%	0.2%	0.6%
Steer:	0.7%	0.5%	0.7%
Horse:	0.7%	0.2%	0.7%
Pig – fresh:	0.5%	0.3%	0.5%
Sheep:	1.4%	0.5%	1.2%

Table II – Soil Amendments: Here are some organic sources for the major plant nutrients.

Nitrogen (N): fish meal (10%N), blood meal (10%N), alfalfa meal (3%N)
Phosphorus (P): bone meal (20%P), rock phosphate (2.5% available P, 33% total)
Potassium (K): wood ash (5%K), greensand (3%K)
Calcium (Ca): gypsum (23%Ca), oyster shell lime (35%Ca)
Sulfur (S): gypsum (18%S)
Magnesium (Mg): dolomite lime (12%Mg)

In addition to the major nutrients, plants also require very small amounts of Iron, Copper, Manganese, Zinc, Boron, Molybdenum, Cobalt, Chlorine and others. These are known as micronutrients. If you have supplied all the major plant nutrients and adjusted the pH, and you're plants are still having problems, then it could be a micronutrient deficiency. A detailed soil test can determine what is missing and tell you how much micronutrients need to be added.

pH: This is the level of acidity in the soil. The lower the pH reading, the more acidic the soil is. pH influences how well plants can absorb the nutrients in the soil. If you supply all the nutrients, but the pH is off, then your plants will still be hungry. The ideal pH range for most crops is between 6.2 and 6.8, but some crops (e.g. most berries) like a more acidic soil.

A home soil pH kit or a professional soil test will tell you your soil's pH level. Most of the floodplain and bottomland soils in coastal northern California are only slightly acidic, while the soils in the hills and many inland valleys are quite acidic. To lower the acidity (raise the pH) of a soil, we use "lime" (calcium carbonate). The best "lime" for our area is oyster shell flour. In the unlikely situation that your soil pH is too high (above 7) it can be lowered by adding powdered sulfur. To adjust pH, follow the indications from a soil test or use the lime calculator at "http://garden.calyx.garden.org/calculators".

Soil Sampling & Testing: The best way to find out what's going on in your soil is by sending in a yearly soil sample to be tested. The recommended method is to take a random composite sample. To do this, take a shovel and a 5-gallon bucket. Walk as aimlessly as possible through your garden area, stopping every few steps to take a scoop of soil and put it in the bucket. Scrape off surface plant material before each scoop. Your shovel scoops should take a sliver of soil to 6 inches depth. Once you've stumbled across your entire garden, dump the bucket into a clean wheelbarrow and mix thoroughly. Fill a ziplock sandwich bag with some of the soil from the wheelbarrow. This sample is what you will mail in to a soil-testing lab. The following is one such lab. Print an order form from their website, and select the S1B package for the most basic tests. Send in your sample with a check.

A&L Western Agricultural Laboratory
1311 Woodland Ave, Suite #1 Modesto, CA 95351
(209) 529-4080 http://www.al-labs-west.com/files/Soil%20Submittal%20Form.pdf

How to use a soil test report: A soil test report will give you readings for the major plant nutrients ranging from very high (VH) to very low (VL). The following chart and example show how to use these readings.

Table III: Pounds of nutrient to add per 100 square feet, based on soil test rating.

Test Rating	N	P	K
Very High	0.1	0.2	0.15
High	0.2	0.3	0.2
Medium High	0.25	0.35	0.25
Medium	0.3	0.4	0.3
Medium Low	0.35	0.45	0.35
Low	0.4	0.5	0.4
Very Low	0.5	0.6	0.5

Example 1: Your soil test comes back with a Phosphorus reading of Medium Low. You decide to fertilize with rock phosphate. Table III tells you to add 0.45 lbs of phosphorus per 100 square feet. According to Table II, rock phosphate contains 2.5% available phosphorus, so:
0.45 lbs / 0.025 = 18 lbs of rock phosphate per 100 square feet of garden

Because rock phosphate slowly breaks down in the soil, these 18 lbs applied now should provide adequate phosphorus for five years.

Example 2: Your soil test gives a Nitrogen reading of Low. Table III says to add 0.4 pounds of Nitrogen per 100 square feet and you want to fertilize with composted horse manure. Table I tells you that horse manure contains 0.7% Nitrogen, so:
0.4 lbs / 0.007 = 57 lbs of composted horse manure per 100 square feet of garden

This may seem like a lot of compost, but keep in mind that it will slowly release nutrients over the span of a couple years. It also supplies many other nutrients and builds soils structure.

Home Composting

Why Compost: Composting is a good way to recycle yard and kitchen wastes and a great way to fertilize your garden. Composting is the controlled breakdown of organic materials into a mulch that can be used to enrich soils. Finished compost slowly breaks down in the soil to release most of the nutrients your plants need. Finished compost also contains a lot of the soil organic matter that helps build and maintain soil structure (see Working with Soil section).

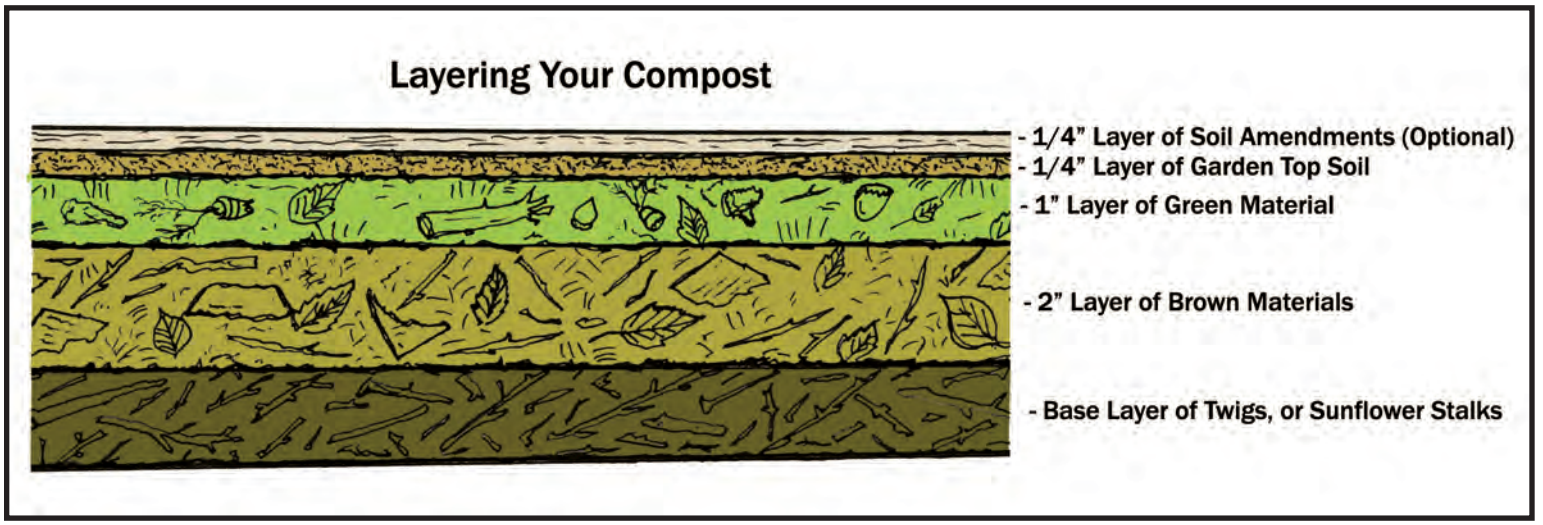
What to Compost:
Browns - straw, leaves, dry grass, newspaper, egg cartons, small twigs, sunflower stalks
Greens – fresh grass, green plant material, kitchen scraps, animal manures (from herbivores only)
Soil Amendments – Rock phosphate, oyster shell lime, rinsed kelp

What Not to Compost: Anything that used to be alive will compost eventually, but some materials take a long time to decompose (i.e. sticks and branches) and some attract animals and flies (meat, oils, & dairy products). Materials that should never be composted include plastics, petroleum products, chemicals of any kind, and feces from cats or dogs.

Different Bins, Same Technique: The following technique is a simple, all-purpose backyard method. These steps can be used inside any compost bin or in an open pile in the corner of the yard.

1. Lay down a base layer of twigs or sunflower stalks. If not using a bin, make this 2-3 ft^2.
2. Make a 2-inch layer of brown material (see list above). This will compress when added to.
3. Make a 1-inch layer of green material (see list above).
4. Make a ¼" layer of garden soil.
5. If any of these materials are dry, water them now.
6. Optional – add a ¼" layer of soil amendments.
7. Before repeating steps 2-5, turn and loosen the pile with a manure fork.

Illustration II: Compost Layers



The more often you turn your pile the faster it will decompose, but frequent turning is not necessary. In order to use the compost you've made, you will need to stop adding fresh materials at some point. For this reason it is important to have two compost piles or bins, so that when one is full you can add to the other while the first one finishes decomposing. You can tell that compost is finished when the material looks like soil (not food or plant parts) and smells sweet, not putrid.

Additional Resources:
"Backyard Composting Made Easy", City of Arcata, Environmental Resources Department.

Table IV: Troubleshooting Compost Problems

What's the problem?	Why is it happening?	What to do?
It smells putrid	lack of air	Turn pile
Too wet	Keep covered	Too much green material so add straw, leaves, or other "browns"
It's not decomposing	Too dry	Water the pile
Too cold		Add lawn clippings or other "greens"
Too many flies	----------	Add thin layer of soil or ash to surface
Rodent problems	----------	Trap them or secure bin with hardware cloth

Worms are important in composting.

Cover Crops

A cover crop is a mix of plants that are grown to feed your soil. They do not produce an edible crop. Cover Crops are important in a garden because they build organic matter (humus), add nitrogen to the soil, protect the soil from erosion, and smother weeds. Cover crops are generally a mix of grasses and legumes (i.e. beans & clover). A cover crop should be grown anytime a garden bed is going to be empty for 2 months or more. To grow these crops, scatter the seed over the bed (about ¼ lb per 100 square feet) and gently rake the bed until most of the seed is under the soil surface. Water it in or wait for rain.

Building Soil Organic Matter (Humus): When plants grow, they breathe in carbon dioxide and absorb it into their cells. When chopped up and tilled into the soil, this carbon becomes the humus that is so important for soil structure and soil microbial life. Both grasses and legumes build organic matter in this way (the grasses especially).

Fixing Nitrogen: Nitrogen is the most commonly needed nutrient in gardens. Members of the bean/pea/clover family (called legumes) form a partnership with a certain kind of soil bacteria that allows them to take nitrogen from the air and turn it into a form that is usable by all plants. In a garden we can use these "nitrogen-fixing" plants instead of nitrogen fertilizer by growing them and then tilling them into the soil. When growing these crops for this purpose we do not want to let the plants make seeds, because when they do this they use up most of the nitrogen that they have added. For this reason we chop up and till in these crops when they begin to flower. In order to get the most benefit from these legume crops, the seed is lightly moistened and covered in an inoculant before sowing. A "garden combination" inoculant can be found at most garden nurseries.

Mix of bell beans, vetch, and oats make a great cover crop.

Nitrogen nodules on the roots of bell beans used in a cover crop mix. This legume pulls nitrogen from the air and adds it to your soil.

Crop Rotation

Crop Rotation is one of the main principles of organic gardening. When a plant is grown in the same place year after year, the populations of pests that feed on that plant continually increase. Also, the nutrients that this type of plant likes become depleted from the soil. We can help our plants stay healthier and free of pests by changing the type of plant that we grow in a particular spot with each planting.

Members of the same plant family tend to be vulnerable to the same pests. For example, broccoli and radishes are in the same plant family and flea beetles frequently attack both crops. For this reason, crops are rotated by family not by individual crop. The ideal crop rotation is to wait three years before planting a crop of a particular family in the same place again.

Table V: Plant families commonly seen in the garden:

Umbel family
Carrot, Parsnip, Parsley, Celery, Dill, Cilantro

Composite family
Jerusalem artichokes, Lettuce, Endive, Artichokes, Many flowers

Crucifer family
Radishes, Turnips, Rutabagas, Broccoli, Cabbage, Kale, Mustard greens

Goosefoot Family
Beets, Spinach, Chard, Quinoa

Squash family
Winter squash, Pumpkins, Zucchini, Cucumbers, Melons, Gourds

Legume family
Peas, Fava beans, Dry & Snap beans, Vetch, Clover, Bell beans, Field peas

Mint family (mainly perennials)
Basil, Peppermint, Rosemary, Oregano, Sage

Alliums
Onions, Garlic, Shallots, Leeks, Chives, Green onions

Grass family
Oats, Wheat, Barley, Corn, Rice, Millet

Rose family (all perennial)
Strawberries, Raspberries, Blackberries, Apples, Pears, Plums, Peaches, Cherries

Nightshade family
Potatoes, Tomatoes, Peppers, Eggplant, Tomatillo

When to Plant Coastal

Crop	February		March		April		May		June		July		August		Sept		October	
	early	late	early	late	early	late	early	late	early	late	early	late	early	late	early	late	early	late
Carrots (ds, ss6); Parsley (tsp); Parsnips (ds)																		
Lettuce (tsp or ds, ss2); spinach (ds,ss2); Cilantro (ds,ss2); Dill (ds, ss3); Fennel (tsp, ss3)																		
Summer Squash (tsp or ds, F); Zucchini (tsp or ds, F); Cucumbers (tsp or ds, F)																		
Broccoli (tsp, ss3); Cabbage (tsp, ss4); Cauliflower (tsp, ss2); Kale (tsp), Chard (tsp); Beets (ds, ss6)																		
Bok Choy (tsp, ss2); Chinese Cabbage (tsp, ss2)																		
Radishes (ds, ss1); Asian Greens (ds, ss2); Arugula (ds, ss2)																		
Pumpkins (ds, F); Winter Squash (ds, F)																		
Peas (ds, ss3)																		
Dry Beans (ds, F)																		
Snap Beans (ds, ss3, F)																		
Winter Cover Crops (ds)																		
Onions (tsp)																		
Garlic (ds)																		
Leeks (tsp); Green Onions (ds, ss4)																		
Oats (ds); Rye (ds)																		
Grain Corn (ds, H, F); Sweet Corn (ds, ss2, H, F); Wheat (ds)																		
Potatoes (ds)																		
Eggplant (tsp, H, F); Tomatillos (tsp, F), Basil (tsp, H, F)																		

Keys: **ds** - direct seed. These crops are sown by placing the seed directly in the soil. **tsp** - transplant. These crops are sown in pots or flats, then transplanted to the garden when they have two true leaves. **ss** - succession. To attain a continuous harvest from these crops during their growing season, you must plant them at regular intervals. The number next to the (ss) refers to the approximate weeks between sowings (i.e. ss2 means sow every two weeks). **H** - hot. These plants are marginal growers here on the coast. For reliable harvests, plant in greenhouse. **F** - frost. These plants are killed by frosts. When and if your garden receives frosts are highly variable. The generalized frost period for the coast. is before May 15th and after Oct 15th. Frost sensitive plants planted outside during the frost period should be protected by floating row covers.

Misc.: Strawberries (Perennial) – May be planted in mid fall or early spring (Mar., April). Will produce strongly for three years, propagate from runners to new patch. Plant ever-bearing varieties (i.e. Albion, Seascape) for an extended harvest period. Protect Blooming plants from frost. **Trees, Berries, and other woody perennials** should be planted while dormant (Dec. – Feb.). **Flowers & Herbs** – Cultivation varies widely, see seed packet or other literature. Rule of thumb: sow annuals like lettuce, early in the season. Sow herbaceous perennials in spring or early summer. **Brussel Sprouts** take a long time to grow. Sow them in early July. **Celery** should be sown in flats no later than the end of June.

When to Plant Inland

Crop	February		March		April		May		June		July		August		Sept		October	
	early	late	early	late	early	late	early	late	early	late	early	late	early	late	early	late	early	late
Carrots (ds, ss6); Parsley (tsp); Parsnips (ds)																		
Lettuce (tsp or ds, ss2); spinach (ds,ss2); Cilantro (ds,ss2); Dill (ds, ss3); Fennel (tsp, ss3)																		
Summer Squash (tsp or ds, F); Zucchini (tsp or ds, F); Cucumbers (tsp or ds, F)																		
Broccoli (tsp, ss3); Cabbage (tsp, ss4); Cauliflower (tsp, ss2); Kale (tsp), Chard (tsp); Beets (ds, ss6)																		
Bok Choy (tsp, ss2); Chinese Cabbage (tsp, ss2)																		
Radishes (ds, ss1); Asian Greens (ds, ss2); Arugula (ds, ss2)																		
Pumpkins (ds, F); Winter Squash (ds, F)																		
Peas (ds, ss3)																		
Dry Beans (ds, F)																		
Snap Beans (ds, ss3, F)																		
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Garlic (ds)																		
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Grain Corn (ds, H, F); Sweet Corn (ds, ss2, H, F); Melons (ds, ss2, F)																		
Potatoes (ds)																		
Tomatoes (tsp, F); Peppers (tsp,F); Eggplant (tsp, F); Tomatillos (tsp, F), Basil (tsp, F)																		

Keys: **ds** - direct seed. These crops are sown by placing the seed directly in the soil. **tsp** - transplant. These crops are sown in pots or flats, then transplanted to the garden when they have two true leaves. **ss** - succession. To attain a continuous harvest from these crops during their growing season, you must plant them at regular intervals. The number next to the (ss) refers to the approximate weeks between sowings (i.e. ss2 means sow every two weeks). **F** - frost. These plants are killed by frosts. When and if your garden receives frosts are highly variable. The generalized frost period for inland is before May 15th and after Oct 15th. Frost sensitive plants planted outside during the frost period should be protected by floating row covers.

Misc.: Strawberries (Perennial) – May be planted in mid fall or early spring (Mar., April). Will produce strongly for three years, propagate from runners to new patch. Plant ever-bearing varieties (i.e. Albion, Seascape) for an extended harvest period. Protect Blooming plants from frost. **Trees, Berries, and other woody perennials** should be planted while dormant (Dec. – Feb.). **Flowers & Herbs** – Cultivation varies widely, see seed packet or other literature. Rule of thumb: sow annuals like lettuce, early in the season. Sow herbaceous perennials in spring or early summer. **Brussel Sprouts** take a long time to grow. Sow them in early July. **Celery** should be sown in flats no later than the end of June.

Seed Sowing & Transplanting

Sowing in the Soil: Some crops are best planted by sowing the seed directly into the soil (see Crop Spacing section).

1. Making a Seedbed: To sow into the soil, the first thing you need is a fine seedbed. Seeds won't germinate evenly if the soil in the garden bed is really chunky. We can make the surface of our bed finer by gently running a bow rake back and forth across the bed. Larger chunks will be picked up by the rake and can be brushed off the side of the bed. If the bed is still too chunky you'll need to thoroughly moisten the surface, wait a day, and then use a hoe to break up the clods.

2. Sowing the Seed: Use a stick or the corner of a hoe to open a furrow (small trench) to lay the seeds into. Most seeds want to be covered with a thickness of soil about twice as deep as the width of the seed. In the wetter months seeds should be sown more shallowly. Read the seed packet to see how thickly to lay down the seed. A general rule is to drop the seeds about twice as thickly as you want the plants to be spaced (see Crop Spacing section). Next, carefully cover the seeds with the soil from the sides of the furrow. Make sure to remove any large clods that fall in. Gently pat down the soil over the furrow so that the soil comes into contact with the seeds.

3. Watering-in: Unless it's going to rain soon, water the bed as soon as you are done sowing the seed. If you are planting a large area all at once, then use a gentle sprinkler. Watering by hand takes patience, because it takes time for the water to soak into the soil to the appropriate depth. Use a watering wand with a gentle spray and slowly water the seedbed until the soil is wet to a depth of 3 inches. Don't let the water pool up on the surface. If your soil tends to form a crust then lay down a sheet of "floating" row cover fabric over the seedbed before watering (see Season Extension section). This fabric will also help the seedbed remain moist. You need to make sure that the top 3 inches of soil remain moist during the entire time the seed is germinating. Most seeds will germinate in 7-10 days. Seeds in the carrot and onion family usually take 14-18 days to germinate. If this much time has passed without any seedlings coming up, you should consider re-sowing.

Sowing in Pots or Flats: Many crops prefer to be transplanted out into the garden after they have already grown into seedlings. Transplanted plants have a faster start that helps them out-compete pests and weeds; you can select the strongest seedlings to plant out; you can ensure that the plants are spaced exactly where you want them; and you can grow more crops in each bed during a season because the crop is not taking up space in your garden for the first 3-4 weeks of its life. To grow a plant for transplanting, start the seeds in a flat or in pots.

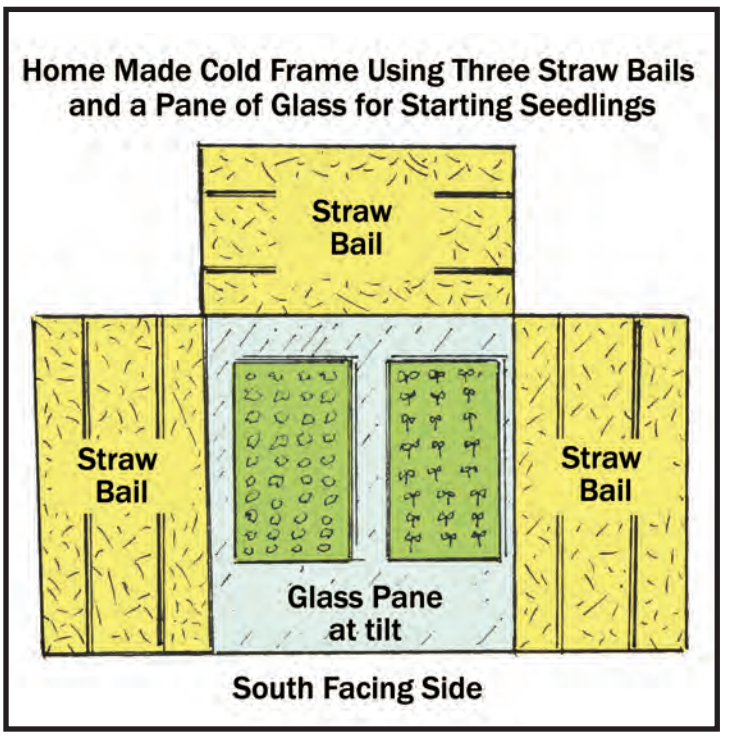
1. The container: There are many containers that can be used to raise seedlings, but they need to be at least 3-inches deep and well drained. The more soil space you give to each seedling, the longer the plant can grow before transplanting without getting stunted. The plastic six-pack containers or other cell type containers are nice because there is little root disturbance when transplanting. However, because they're small, plants may get root-bound or dry out easily. Seedling flats are rectangular boxes (wood or plastic) with slits in the bottom. These offer more root space and thereby more leeway in timing and watering. The downside is that more roots are damaged as the plants are separated from each other for transplanting, leading to transplant shock.

2. The potting soil: Though it is easy enough to make a potting mix, for home gardens it makes more sense to buy it. Many brands work well. Good local soil mixes are the Bridgeville's "Organic Gardener" and Foxfarm's Ocean-Forest Mix. Fill your container with potting soil all the way to the top, tap it against the ground or on a table to settle the mix, and then top it off again.

3. Sowing the seeds: How deep to place the seed depends primarily on the size of the seed. When sowing into containers, the seeds should be covered with a depth of soil that is equal to their width. For many small seeds the easiest way to do this is to lay the seeds down and then carefully sprinkle a light layer of potting soil on top of them. Larger seeds can be pushed down into the potting mix and then covered over. Gently pat the top of the containers so that the potting soil comes into contact with the seeds. It is typical to sow 2-3 seeds in a cell to ensure that one will germinate. If more than one seedling germinates per cell, pick the healthiest one and remove the others. When sowing seeds in a flat, try to picture the size of the seedlings when they reach transplant age. Seedlings that are too close together will compete for light and their roots will become entangled. Label the containers with the date and the variety name.

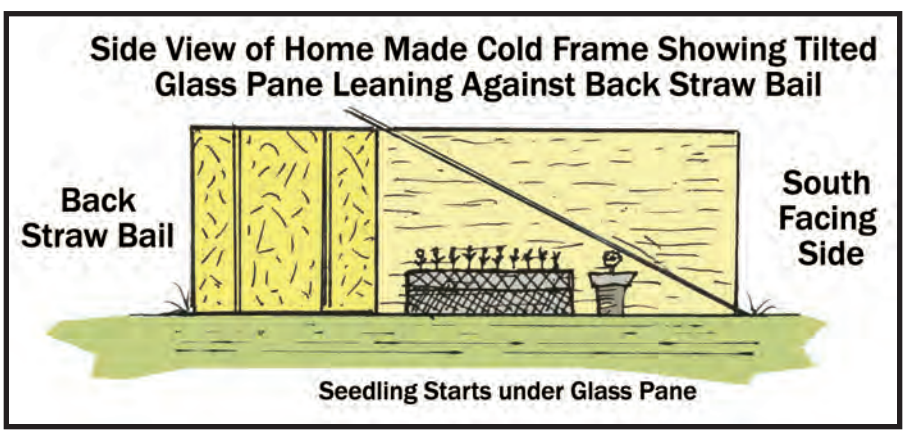
4. Where to raise them: Seedlings need a lot of light to grow, and extra warmth early in the season. Seedlings grown in window sills usually get leggy and weak. If you don't have access to a greenhouse you can construct a simple cold frame. Place three straw bales into an open-ended square (or "U" shape) with the open end facing south, and lean a pane of glass from the ground at the opening to the back of the "U". This will act as a miniature greenhouse. Place the seedling trays on boards that are raised slightly off the ground. Be sure to check frequently for snails and slugs.

Illustration III - Top View of Home Made Cold-Frame



5. Watering: Water as soon as the seeds have been sown. Use a watering can or wand that puts out a very gentle shower. Water the soil slowly without letting the water pool up; wait for the water to soak in; then water some more. Continue until water begins to drip out of the bottom of the container. The soil must remain moist the entire time the seeds are germinating. After germination, water only after the top ½-inch becomes dry.

Illustration IV - Side View of Home Made Cold-Frame



6. When to transplant them: The first leaves to appear are the seedling leaves (cotyledons). The next leaves are the "true" leaves. Seedlings are transplanted when they have grown two true leaves (3-4 weeks from sowing). It is best to harden the seedlings by bringing them outside 4-7 days before transplanting, but be sure to protect warm-season crops from frost.

Transplanting: Once the seedlings are hardened off take them in the container to the place they are to be planted. To harden off the plants, place them outside long enough for them to acclumate to outside temperature. The seedlings should be well watered before transplanting. It also helps if the garden bed is moist.

1. Spacing: Mark out the spacing pattern on the garden bed by making small circles in the soil (see Plant Spacing section).

2. Handling the plants: If you are planting from flats, dig underneath the soil in the flat and carefully separate individual plants. Handle the plants gently by the leaves, not the stem. Leave as much soil on the roots as possible, and place these plants into a small tray. To remove seedlings from pots place your hand so that your fingers are bracing the soil around the base of the seedling, turn the pot upside down, and then push on the bottom of the container with your other hand. The seedling and its root ball should slide right out. Do not pull on the seedling.

3. Planting: Take a trowel and stab it straight down into the soil where you have made a mark. Pull back on the trowel so that a hole is opened evenly down the length of the trowel. The hole should be deep enough that when you place the roots in the hole they are not bent or compressed. How deep you place the plant depends on how the plant grows. Plants that grow all of its leaves from one point above the roots (i.e. lettuce, squash) should be planted so that this point is just above the soil line. Plants that have growth tips along the stem (i.e. tomatoes, cucumbers, broccoli) should be planted so that the current growth tip is a ½ inch above the soil line. Hold the plant at the correct placement with one hand while pushing soil back around the plant with the other. Make sure you're planting only one seedling per space. The soil around the plant should be level with the rest of the bed or slightly depressed. There should not be a mound around the plant or water will run off instead of soaking in.

Pepper starts in greenhouse

4. Watering in: As soon as the plants are all planted, water them gently with a watering can or a hose on very low flow. Wet the soil around each individual plant, let the water soak in, and then water a second time. Unless it is going to rain, the whole bed should be irrigated immediately after planting.

5. Transplant Shock: Plants can get shocked during transplanting and may struggle or die. Avoid this by disturbing the roots as little as possible, by making sure the seedlings are moist before planting, and by watering them thoroughly immediately after planting. It is best to transplant in the evening, so the plants have the nighttime to adjust. Another way to reduce transplant shock is to water the seedlings with diluted fish emulsion a couple hours before transplanting.