Desert Vegetable and Herb Gardening

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Robert Morris retired on the University of Nevada as an Emeritus Professor and Extension Horticulture Specialist in 2011. He now owns his own consulting business and works with clients in Nevada and internationally. Bob Morris has been consulting professionally internationally since 1993, mostly in arid and desert agricultural locales. He may be reached through his personal email address at Extremehort@aol.com or for University business at morrisr@unce.unr.edu.

Online Resources

University of Arizona Cooperative Extension Master Gardener Manual
http://ag.arizona.edu/pubs/garden/mg/
Gardening in Arizona discussion group
http://forums.gardenweb.com/forums/azgard
Xtremehorticulture of the Desert Blog
http://xtremehorticulture.blogspot.com/
Desert Horticulture Yahoo Discussion Group
https://groups.yahoo.com/neo/groups/desert_horticulture/info

Here are some online resources that I thought the useful to Master . Gardeners in Arizona. My horticulture blog is called Xtremehorticulture of the Desert and hosted by blogger. Please visit this blog and sign up for the weekly newsletter which alerts you of new topics. I started the desert horticulture Yahoo discussion group which you can also join.

Books to Consider

Desert Gardening by George Brookbank

http://www.amazon.com/Desert-Gardening-Brookbank/dp/1555610021

Extreme Gardening by David Owens

http://www.amazon.com/Extreme-Gardening-Organic-Hostile-Deserts/dp/0970501609

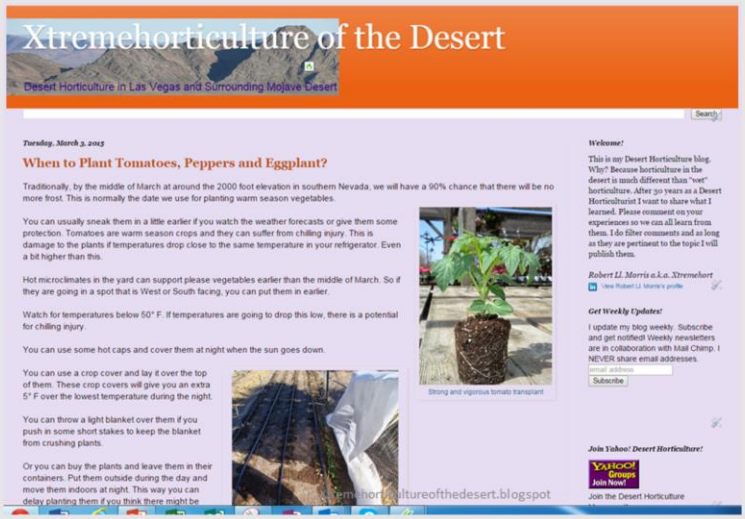
Western Gardening by Sunset Magazine

The Desert Gardeners Calendar by George Brookbank

http://www.uapress.arizona.edu/Books/bid1274.htm

Here are some books you might consider for your gardening library. They are focused on home gardening under desert conditions.

Xtremehorticulture of the Desert Blog



This is my blog. I post on it weekly. There is a search engine for searching the blog using keywords. The search engine is located as a white bar directly under the orange header. Type your keywords inside the white bar and click on the word "Search" located on the extreme right of the white bar. For instance, if you type in the word "tomato"and click on the word "Search" all of my posts that talk about tomatoes will appear. You can open each of these posts and read questions submitted by readers regarding tomatoes. Sign up for my newsletter on the blog and you will receive emails when there are new posts for you to read.

You can visit my blog at http://xtremehorticulture.blogspot.com/

Viragrow Delivers! Blog

I am a horticulture consultant for Viragrow, Inc. a soil and compost company which sells both retail and wholesale bulk and bagged composts and soil mixes. They also carry fertilizers, soil additives and pest control products for both the conventional and organic user I developed their website and their blog. I featured topics related to soils. Visit the blog or sign-up to receive notifications when there are new posts.

You can visit the blog at http://viragrowdelivers.blogspot.com/
You can visit their nearly finished website at http://www.viragrow.com/

Vegetable and Herb Presentation

Site Selection
Soil Improvement
Creating the Garden
Irrigation
Fertilizers
Pest Control
Harvest and Postharvest

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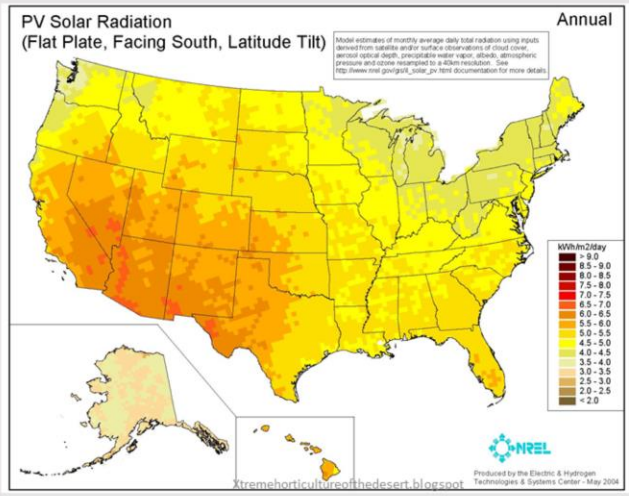
I divided my home garden vegetable and herb presentation into these sections. This is not a discussion of each vegetable. I felt it was more important to discuss some basic principles of vegetable gardening in our hot desert.

Site Selection
Soil Improvement
Creating the Garden
Irrigation
Fertilizers
Pest Control
Harvest and Postharvest

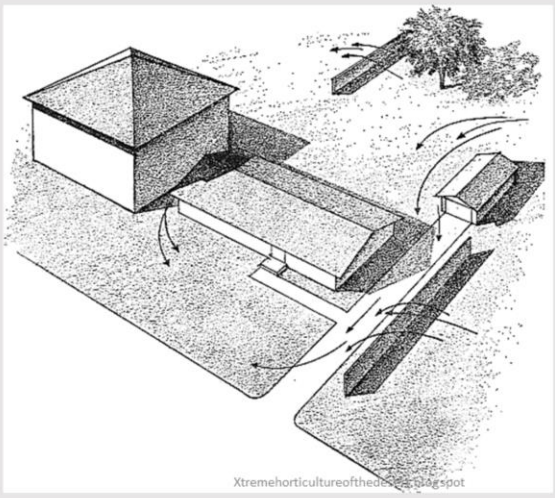
Site Selection: Microclimates



Microclimates. The climate in a geographical location is talked about a lot. These climates determine are planting times for vegetables and herbs. They also affect our management decisions and the quality of vegetables and herbs that we can produce. There is very little discussion about microclimates. Microclimates are subtle changes in the climate that are present in home landscapes. For instance, West and South facing exposures receive more intense sunlight and are typically hotter than North and East exposures. We usually encourage people to plant less hardy plant materials in Eastern and northern exposures which shade them from late afternoon intense sunlight and heat.

If we look at this map of the United States that details solar radiation or the intensity of sunlight, we see that our desert Southwest of southern Nevada, southeastern California, Southern Utah, southern Colorado most of Arizona and New Mexico as well as West Texas receive the highest sunlight intensities in the US. These also represent our three major deserts: the Mojave, Sonoran and Chihuahuan. To produce high quality vegetables and herbs we may need to manage intense sunlight produced in different microclimates.

Site Selection: Microclimates



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We should also consider managing wind in these microclimates. Winter can be very damaging to vegetables and herbs, particularly if wind is a problem during the winter cold and extreme heat of the summer. Wind entering a large open area in the landscape and traveling through a much narrower space such as between homes are between a home in the wall will increase in speed. Higher wind speed creates more damage. Be aware of where wind enters and exits a property and understand it well enough to manage it where it may be destructive to growing areas.

Site Selection: Microclimates

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The use of shade cloth will decrease light intensity, reduce damage from wind and insects. For vegetables and herbs I would recommend either the 30% or 40% in any type of shade cloth. Aluminet reduces the transfer of heat inside small hoop houses like this one while allowing light transmission, particularly when the sun is at very low angles in the sky. These were some trials I did about 15 years ago with Aluminet and tomatoes. Normally black shade cloth is used either woven or knitted.

http://www.greenhousemegastore.com/product/70-percent-aluminet-shade-curtain/shade-cloth_1

Site Selection: Soil

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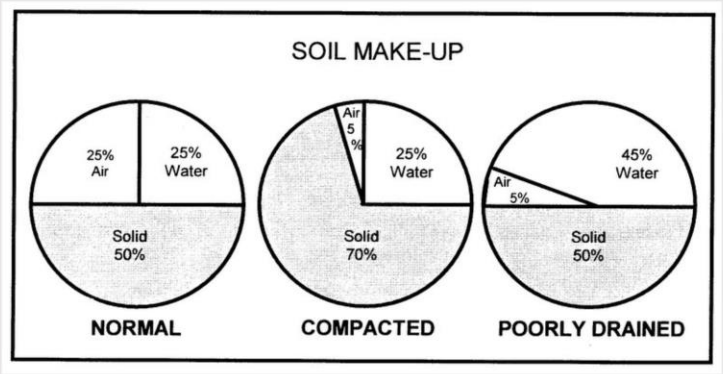
Another concern in site selection is the soil. In some parts of the Mojave desert boron can be in such high concentrations that it will not permit growing in the soil and you must use raised beds. In the Mojave desert that has no history of agricultural production, the soil organic matter content will reach less than 1/10 of 1%. I consider 5% organic matter to be the lower range when growing vegetables and herbs. Some vegetables like onions and carrots may perform reasonably well at 5% organic matter. Others vegetables and herbs do not and require higher percentages of organic matter.

Site Selection: Soils



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A normal, productive soil will have half of its volume occupied by solids (sand, silt and clay) while the other half of its volume are pore spaces between the soil particles. A productive soil will maintain half of the pore space with water and the other half with air after an irrigation has finished and the soil has drained.

Compacted soils such as the soils we see in gardens that do not have enough organic matter or have been trampled upon during production will have the pore spaces squeezed out of it. In compacted soils there may only be 30% of the volume occupied by pore space. This lack of pore space in soils makes it difficult to dig and crops perform poorly; slow growth rates, yellowing, poor health.

Poorly drained soils contain too much water in their pore spaces. This restricts the amount of air that can reach the roots of plants. This lack of air to the roots causes root suffocation; poor root growth and root death. When water is applied to these soils, it has no place to go. It cannot drain because of a high water table or compacted soils or a layer of caliche.

Site Selection: Soils

Approximate Root Aeration Requirements of Selected Ornamentals Expressed as Percent Air Space

Very High 20	High 20–10	Intermediate 10–5	Low 5–2
Azalea	African violet	Camellia	Carnation
Fern	Begonia	Chrysanthemum	Conifers
Orchid, epiphytic	Daphne	Gladiolus	Geranium
	Foliage plants	Hydrangea	Ivy
	Gardenia	Lily	Palm
	Gloxinia	Poinsettia	Rose
	Heather		Stocks
	Orchid, terrestrial		Strelitzia
	Podocarpus		Turf
	Rhododendron		
	Snapdragon		

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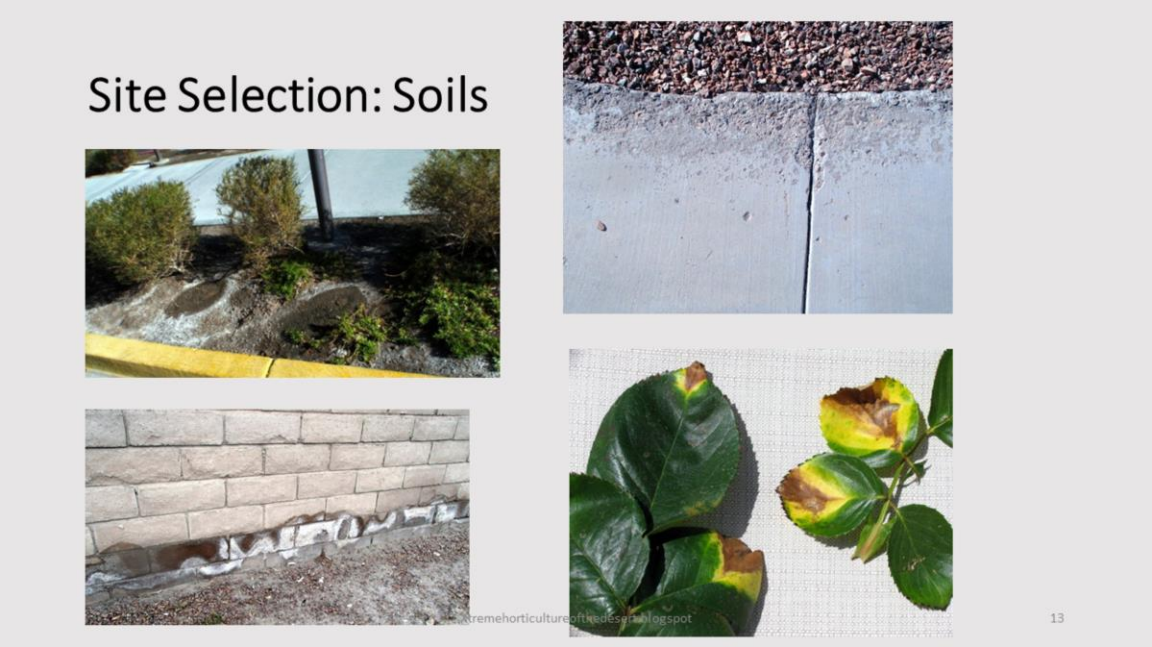
I do not have a table of vegetables and herbs that have different root/soil aeration (porosity) requirements. This table is root/soil aeration requirements of some ornamental plants. These root/soil aeration requirements are the lower limits of what these plants will tolerate. They do not represent ideal aeration requirements.

The point I am trying to make is that all plants have different root/soil aeration requirements. Vegetables and herbs also have different aeration requirements and perform better when these soil porosity is closer to ideal for them.

We can increase soil prosody with the addition of compost or organic matter to the soil. Other non-organic amendments can also increase prosody such as perlite and vermiculite. But compost has the additional advantages of encouraging greater microbial activity, the release of important humic and fulvic acids, the slow release of plant nutrients.



High levels of salts are a common problem in desert soils. Salts are not all bad. In fact, plant nutrients are nearly all salts of one form or another. There are salts which can be damaging to plants. These are salts which contain sodium, chlorides and boron. These three elements when present in salts in significant amounts can cause toxicity to plants. A fourth element found in salts, sulfates, can cause damage to concrete and uncoated steel. We can see this type of damage in the upper right picture. The bottom right picture is salt damage to roses. Most likely the level of salts in the soil surrounding this rose was too high in salts. Applying excessive amounts of fertilizers can cause this type of salt damage. Salts are also present in our desert soils and can wick up block walls with irrigation water and left behind on the wall when this water evaporates as we see in the bottom left picture.

Site Selection: Solar Modification

- East and North versus West and South exposures
- Shadecloth
- Radiation and Reflective Barriers

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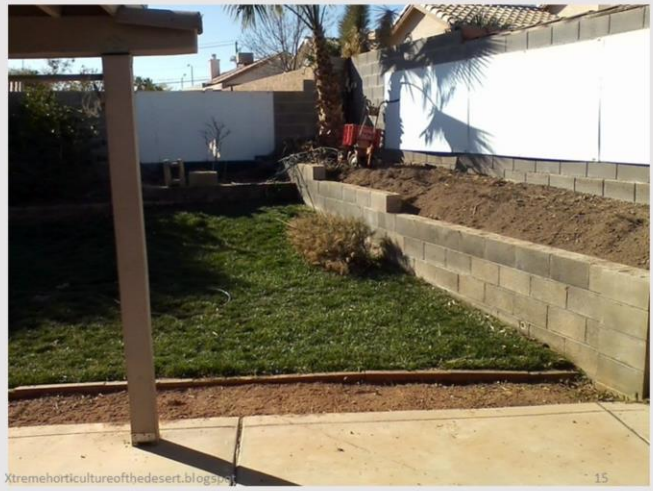
We can achieve some modification of incoming solar energy on our property by having vegetable and herb beds located on the North and East sides of the property versus the West and South exposures. We can also modify the solar energy in a microclimate with the use of shade cloth. As I mentioned earlier, seldom is there a need for shade cloth for vegetables and herbs that provides more than 30 or 40% shade. We can also place vines and construction materials on walls that reflect sunlight toward are growing areas rather than radiant heat from these walls. These materials could be constructed so that they may be removed in the summer and placed during the winter months or vice versa. Here we see shade cloth over a growing area to reduce light intensity on the crop being grown. That shade cloth appears to be providing about 40% shade.

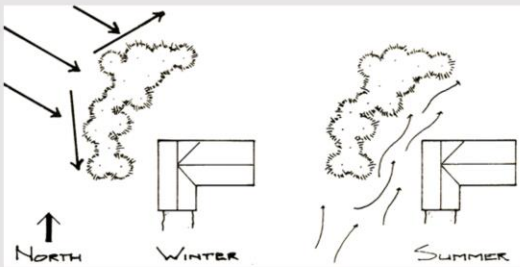
Site Selection: Radiation Modification

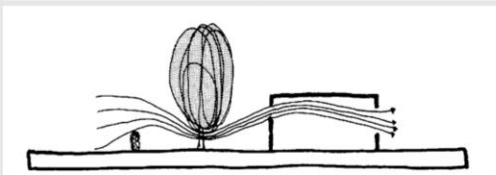
- East and North versus West and South exposures
- Shadecloth
- Radiation and Reflective Modification



Someone contacted me by email saying that he saw people collecting political signs after an election. He asked if he could have some and they gave them to him gladly. He placed them on the walls to increase the amount of light that was reflected onto his property while at the same time decreased the amount of radiant heat from the dark walls.

Site Selection: Wind Modification





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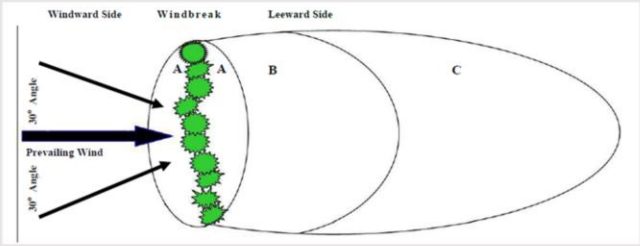
Winds are important to modify on a property, particularly around vegetable and herb growing areas. As I mentioned, winds can be destructive to plants. The right picture shows sweet corn that was blown over during a wind storm in the spring. This could have been avoided by using windbreaks or something to deflect the wind from that area. We can see from the left picture that windbreaks can block wind from a property. Planted areas can be used to deflect wind or redirect wind.

Site Selection: Wind Modification

- Windbreaks
- Wind channeling



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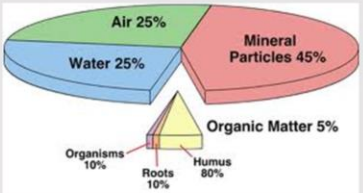
Windbreaks can be made from lots of different materials. A very effective windbreak is chain-link fence fitted with PVC slats. The ideal windbreak has a porosity of about 20% for the wind. This means that the solid portion of the windbreak occupies about 80% of the surface while the openings through the windbreak occupy about 20%. This is enough to slow the wind so it does not create a lot of damage. The area most affected by windbreak is immediately on the leeward side of the windbreak. Wind speed is affected dramatically for distance about three times the height of the windbreak. For instance, if a windbreak is 5 feet high it will modify the wind a distance equal to about 15 feet on the leeward side. Beyond three times the height, damage from the wind is still lessened out to a distance of five times the height of the windbreak. The right-hand picture shows an inventive way of providing both wind protection and protection from late afternoon sunlight.

Soil Improvement: How soils differ

Rich Soil	Desert Soil
• Dark brown color	• Light tan or brown color
• Breaks apart easily	• Hard, rocky or like cement
• Dead plant life (organics)	• Very little "organics"
• Worms and other organisms	• No worms and few organisms
• Dead plants decompose quickly	• Plants decompose slowly
• Drains water easily	• Water doesn't drain
• Low level of salts	• High level of salts
• Low pH, low alkalinity	• High pH, high alkalinity

Desert soils differs significantly from soils that develop under much more rainfall. Desert soils can range in color from light tan to light brown. They are typically hard, rocky and difficult to work. This is because there are so few organics in the soil. Organic matter in the soil contribute to the structure of that soil and make it easier to dig and work. Organic matter provides for microbiological activity and macro biological activity such as worms. In desert soils plant decompose very slowly, they accumulate salts because of a lack of rainfall and poor drainage and are typically high in pH

What is Soil Organic Matter?



Organic 5%

- Dead plant and animal life
- Humus
- Roots
- Living organisms

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Soil organic matter comes from the breakdown of plant and animal life that have died on top of or in the soil. This includes plants that have died and rotted on the soil surface, roots and animal life that have died beneath the soil surface, living and dead microorganisms and the end result of all of this decay which is called a humus. Humus is the "black gold" that so many gardeners talk about. It is a final end product after the decomposition processes occurred and this end product has had a chance to stabilize and "cure".

Soil Improvement

Rainfall + Plant life + Time

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Soil improvement from the addition of organic matter in a natural process results from adequate rainfall, the death of plant and animal life and time. The composting process is very similar to this natural process of producing organic matter and humus in the soil except the time period has been shortened incredibly. The composting process relies on water, the decanting of plant and animal matter in a controlled process that shortens the time period.

Soil Improvement: some plants thrive on organic matter

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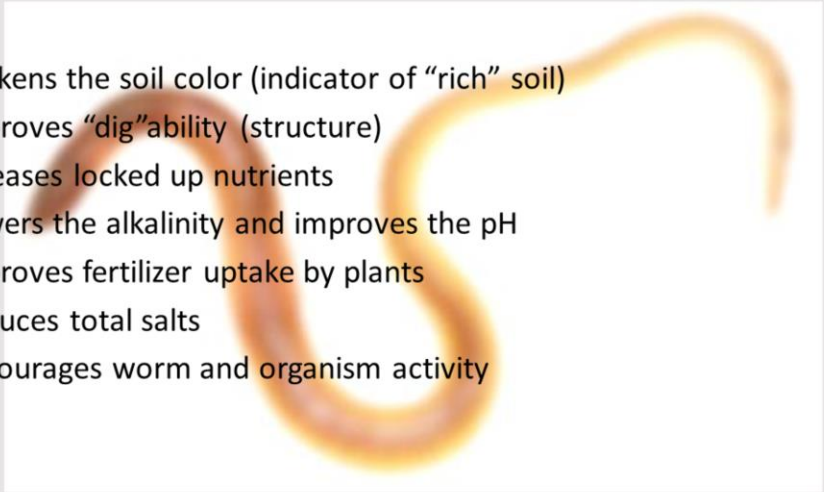
Some plants do not require as much soil improvement or organic matter as others. When nondesert plants are placed into a desert landscape with limited amounts of organic matter, these plans eventually show signs that the organic matter has disappeared. This is because the organic matter that was used at the time of planting provided a change in the physical structure of the soil around the roots as well as its chemistry. The decaying of these the decaying of this organic matter stimulated microorganism activity, provided organic acids that aided the plant in nutrient uptake, improve the porosity of the soil around the roots and provided many other benefits. Soil organic matter disappears over time. In fact, when soil organic matter is used at the time of planting it generally disappears in 3 to 5 years. Plants not accustomed to desert soils show decreased growth, yellowing and scorching leaves and die back. In the left picture heavenly bamboo was planted in decomposed granite and in three years showed yellowing and stunting due to a lack of available iron. Photinia, another nondesert plant, had similar symptoms in 3 to 5 years when planted into a rock landscape. Nondesert plants, include most vegetables and herbs, require the addition of organic matter to vegetable growing areas in desert soils if they are to be productive.

Soil Improvement: Why are Organics Important?



- Darkens the soil color (indicator of “rich” soil)
- Improves “dig”ability (structure)
- Releases locked up nutrients
- Lowers the alkalinity and improves the pH
- Improves fertilizer uptake by plants
- Reduces total salts
- Encourages worm and organism activity

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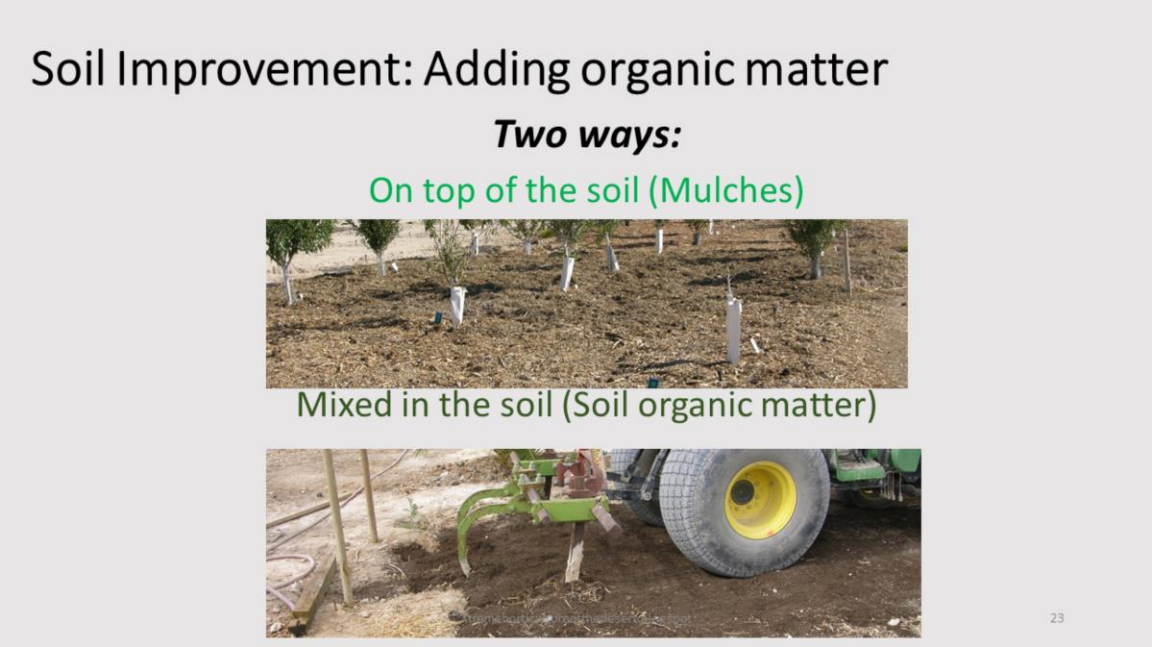
Summarizing, the addition of organics to soil are important because they improve the structure or "dig-ability"of soils. Organics release nutrients that are locked up in the soil because of chemical reasons. Organics lower the alkalinity or pH of a soil and put it in a more desirable range. The addition of organics to desert soils improve fertilizer uptake by plants because of humic and fulvic acids. Because the porosity is improved in desert soils, salts are more easily removed from that soil by leaching with water. Organics encourage earthworm and microorganism activity which has effects on the chemistry and structure of soils. All of these things are reflected in a change in the color of a desert soil from light tan or light brown to dark Brown.



There are two ways to add organics to a soil. One way is to apply these organics to the surface of the soil as a mulch. As long as water is present the layer of organic mulch in contact with the wet soil and microorganisms will slowly decay and turn the upper inch of the soil surface into a rich, dark Brown within a matter of several months of warm weather. The faster way to impact a desert soil is to mix organics into that soil and keeping that soil moist. This is the more labor-intensive method but results in a much faster change. Once organics have been mixed into the soil, adding a layer of compost to the soil surface on an annual basis helps to keep the organics renewed.

Adding Organic Matter to the Garden

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The picture on the left is typical of the soils in the eastern Mojave desert where there has been no agricultural development. These soils have no structure and have nearly zero organic matter. Water does not drain easily because of the lack of structure. These soils must be dug with a pick, not a shovel. Explosives have been used for excavations needed for building developments like golf courses.

The picture on the left shows the soil after it has been excavated with a walk behind soil trencher. A rototiller was not able to break up the soil. the walk behind trencher was set to dig as deeply as possible. Parallel trenches were dug with the trencher as close as possible. The trenches were filled with water so that the soil would become easier to work. The soil was allowed to drain and compost was added to the trenches and top of the soil. Trenches were then collapsed. Water was again added to the surface and allowed to dry. Rototiller was then used to mix the soil and compost as deeply as possible (picture o the right).

Future Additions of Organic Matter

- Organic matter disappears from the soil in 3 to 4 years
- Some vegetables require high levels of organic matter while others do not
- Add 1 inch of compost to the garden bed annually and rototill or double dig it into the bed a depth of 8 to 10 inches

Or

- Add compost to the surface of the soil as a mulch and add it to the backfill when transplanting

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Organic matter that comes from screened compost typically disappears in 3 to 4 years. During the first year, about 40% of the organic matter from compost will "dissolve" into the soil. The second year about 20% of the remaining compost will decompose. In the third year about 10% will be gone.

About 500 pounds of straight compost, rototilled to a depth of 6 inches, is needed every 1000 ft.^{2} to raise the soil organic matter content by 1%. About 3 cubic yards of oompost will cover 1000 square feet, 1 inch deep. Roughly, 1 cubic yards of fairly dry compost will weigh about 1500 pounds.

Compost should be added to garden soils annually. I like to recommend about 1 inch of compost added to the garden and rototilled as deeply as possible every year. If you have a garden area that is 100 ft.^{2}, this requires about one third of a cubic yard (9 cubic feet) every year.

Some vegetables require higher levels of organic matter in the soil than others.

Soil Improvement: soil pH

- Compost
- Sulfur
- Acids

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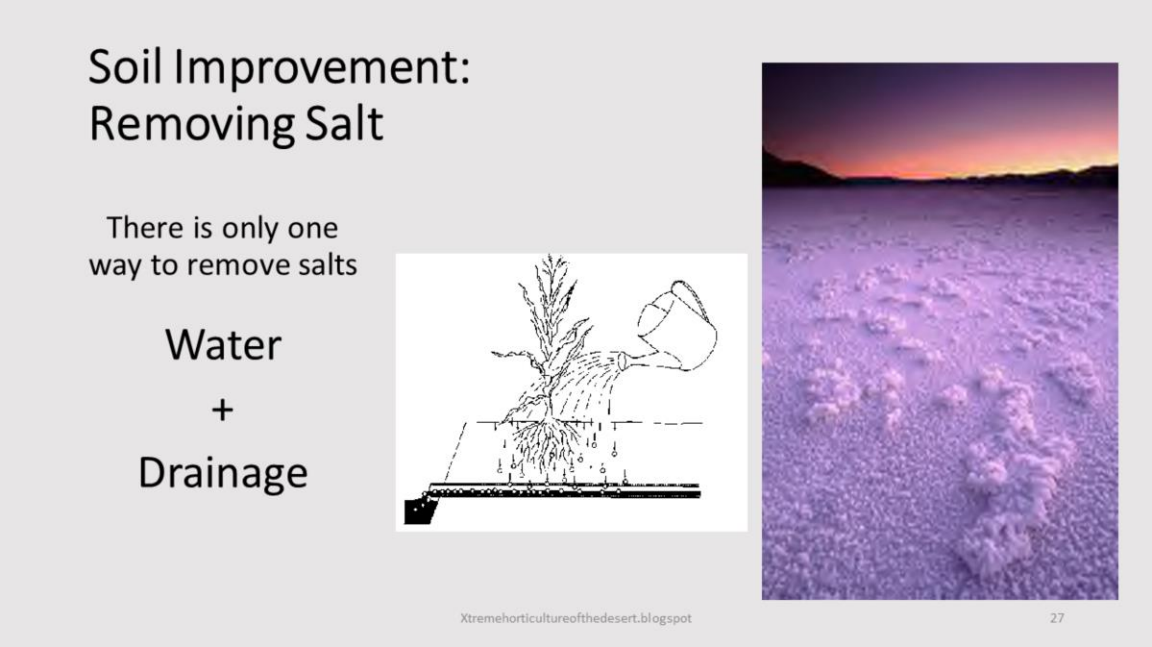
The pH scale is not linear. It is logarithmic. All one unit change in pH, for example pH 8 to a pH 7, is equal to a 10 fold change in the acidity of the soil. A two unit change in the pH is equal to 100 fold change in the soils acidity. I have found the addition of a large volume of compost to soil can lower a native desert soil pH from 8.2 to about 7.6. This pH will be maintained with regular additions of compost. Soil sulfur can also be used but the sulfur must be finely pulverized like flour to be effective. In commercial operations acids are sometimes injected into the irrigation system. The addition of compost to vegetable gardens is the most sustainable approach towards lowering soil pH.



Salt is another big problem in desert soils. Salts are present in desert soils because of the lack of rainfall and very low levels of soil organic matter that improve soil drainage. The only way to remove salts from desert soil is by the addition of water and dissolving these salts from the soil and removing them in the drainage water. Water is needed but good drainage is equally important. Unfortunately most composts that are produced in desert environments can be somewhat high in salinity. When composts are added to our desert soil already high in salinity, water must be added to the soil mix to remove salts and prepare it for planting.

I encourage people to grow vegetables on raised beds once raised beds are created for the garden, human activity that requires walking or stepping on raised beds should be limited to planting and harvesting. All other activities can be done from the perimeter of the bed if the bed is designed correctly. Some might argue that even planting and harvesting should be done without walking on these raised beds. Walking on raised beds compresses the soil and can transport weed seeds and diseases to these beds. Walkways are provided surrounding these beds for this human activity.

Raised beds can be constructed with the sidewalls or without sidewalls. Regardless, raised beds should provide about 12 inches of soil depth for the routing of vegetables and the growing of root crops.

Sidewalls can be constructed of untreated lumber or cement blocks or bricks.

Raised Beds without Sidewalls

Raised Beds without Sidewalls. Raised beds can be constructed without sidewalls. *How?* First, amend the garden area with compost to a depth of 6 to 8 inches. Create 18 to 24 inch walkways through the garden area with a flat-nosed shovel. Ideally, but not totally necessary, the beds should run north to south. Throw the amended soil from walkways on the top of raised beds. Level the soil and shape the edges of the bed to a 45° angle. This angle retains the bed's shape without sidewalls even during irrigations. The beds, after settling, will be about 12 to 14 inches deep. Wet the beds thoroughly and allow them to dry enough on the surface so they can be planted.

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When raised beds are constructed without sidewalls, the natural slope of constructed sidewalls at about a 45° angle will retain the raised beds in their constructed form. Walkways are generally 18 to 24 inches wide. Soil used for the raised beds should be firmed for seeding and transplanting. Firming a raised bed can be done with a rake and water or a roller. When a seed bed is firmed properly, footprints should sink into the soil no more than 1/2 inch.

I would strongly suggest that you use drip irrigation for watering your vegetables. Avoid using the smaller one quarter inch drip irrigation tubing. Instead use the half-inch drip irrigation polyethylene tubing with built-in emitters spaced at 12 inches apart. I would suggest that these emitters supply water at 1 gallon per hour. Drip tubing with built-in drip emitters should be spaced 12 to 18 inches apart depending upon the crops being grown. Crops that are spaced closer together such as onions, garlic and carrots would require tubing spaced 12 inches apart. Plants that require greater spacing could have tubing spaced 18 inches apart. I will build PVC headers and footers for each end of the irrigation lines. I space fittings for drip tubing 6 inches apart so that I can use the headers and footers for different vegetables. Some people construct headers and footers out of the same tubing used for the irrigation lines as you can see in the left picture. The right picture shows you drip tubing with in-line emitters using a PVC header and footer. All PVC pipe exposed to sunlight should be painted to reduce damage from UV radiation. Offset the emitters so that they are spaced triangularly. Emitters should be pointed up to reduce plugging and make it easy to inspect them for plugging when they are operating.

Drip Irrigation Tubing and Tape

- Drip tubing with in-line drip emitters
- In-line emitters spaced 12 inches apart
- Water delivery at 1 gallon per hour at each emitter
- Drip tape at the same spacing for most vegetables. For garlic, onions and other root crops, four inch spacing.

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The left picture is half inch polyethylene drip irrigation tubing showing you a built-in drip emitter. The drip emitter is embedded inside of the drip tubing. These emitters are extremely sophisticated now so that they are pressure compensated and the channels which conduct the water are self-cleaning which reduces the amount of plugging by minerals. All drip irrigation needs to have pressure regulator and filters on the irrigation lines if they are to work effectively. The picture on the right shows a cross-section of both polyethylene drip irrigation tubing on the left and drip tape on the right. Drip tape is another type of plastic tubing which is disposable. It is made for one year of use and then is thrown away or burned. Drip tape is very economical and has built-in emitters spaced as close as 4 inches apart. I find this a perfect spacing for crops grown very close together such as onions, garlic, beets and carrots. If you are very careful using drip tape it may last two or three seasons.

Drip Irrigation Connections

- Timer or clock
- Filter
- Pressure regulator

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The picture on the left shows you the typical components of a small scale drip irrigation set up inside a greenhouse. This same type of setup can be used for vegetable gardens. A small, battery operated timer is connected to the hose bib. After the timer we can see a screen filter and a pressure regulator. Typical pressures for drip irrigation systems can run anywhere from six psi up to 25 psi. Very low pressure systems are ideal for gravity fed drip irrigation systems such as bucket or barrel systems. The picture on the right shows a longer drip system using drip tubing with built-in drip emitters. The header and footer are secured tightly with rebar driven into the ground which holds they drip tubing tightly. Metal staples are pushed into the soil every 6 feet along the drip lines to keep the tubing in straight lines during heavy winds.

Sources for Drip Irrigation Online

The Drip Works
http://www.dripworks.com/

The Drip Store
http://www.dripirrigation.com/

If you cannot find sources for good drip irrigation products you can source them online. The selection and variety of products available for drip irrigation is huge. Be prepared to spend quite a bit of time learning and understanding the products before you purchase them. Some of the name brands available include Netafim, Jain, DIG, Rainbird and Toro as well as others.

Vegetable and Herb Selection

Vegetables eaten as sprouts

Adzuki	Broccoli	Lentil
Alfalfa	Chick pea	Mung Beans
Beetroot	Cress	Mustard
Onion	Oats	Sunflower
Peas	Barley	Vegetable seed that is
Red Clover	Rye	**NOT** Solanaceae family
Red Radish	Amaranth	
Soybean	Sesame	

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Vegetables and herbs are used from a variety of stages and plant parts. Many vegetable seeds can be used for sprouting.

http://www.burpee.com/vegetables/sprouting-seed/
http://www.seedaholic.com/edibles/vegetables/seeds-for-sprouting.html#Vegetables

Vegetable and Herb Selection

Vegetables eaten as leafy greens

Amaranth
Arugula
Beet greens
Bok choy
Broccoli Rabe
Brussels sprout
Cabbage
Celery
Ceylon spinach
Chard
Chicory
Chinese cabbage
Chrysanthemum leaves
Collard greens
Corn salad
Cress
Dandelion
Endive
Epazote
Fluted pumpkin
Garden Rocket
Plantain
Kale
Lamb's lettuce
Lettuce
Miner's Lettuce
Mizuna
Mustard
Napa cabbage
New Zealand Spinach
Orache
Pak choy
Pea leaves
Poke
Radicchio
Radish tops
Sea kale
Sorrel
Spinach
Summer purslane
Sweet potato
Swiss chard
Turnip greens
Water spinach
Winter purslane
Yarrow

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Many vegetables and herbs are used as Lee fig greens and give her a variety of flavors, textures and used as garnishes or juiced.

These vegetables feed heavily on nitrogen during the growing season. They must be constantly fed with a source of nitrogen all through their growing time. Establish them from seed or transplants with a starter fertilizer high in phosphorus. Once they begin to grow, supplement them with nitrogen for faster growth, a darker green color and larger leaves.

Vegetable and Herb Selection

Vegetables eaten for botanical fruits

Bell pepper
Bitter melon
Cucumber
Eggplant
Hot pepper
Pumpkin
Squash
Sweet corn
Sweet pepper
Tomatillo
Tomato
West Indian gherkin
Zucchini

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We use a variety of vegetable fruits that arise from flowering vegetables.

Vegetables that produce flowers and fruit should be established with a starter fertilizer high in phosphorus. Once they begin to grow you can fertilize them lightly with high phosphorus fertilizers either applied to the soil or sprayed on the foliage.

Vegetable and Herb Selection

Vegetables eaten for edible flowers and flower buds

Artichoke
Broccoli
Cauliflower
Squash blossoms
Zucchini flowers

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The flowers themselves are sometimes used such as squash blossoms.

https://www.pinterest.com/jayleeg/squash-blossom-recipes/

Male flowers are normally produced at the beginning of the growing season. They don't have to go to waste. Harvest and use them. Some restaurants will pay $.25-$.50 each if they are fresh.

Vegetable and Herb Selection

Vegetables eaten for Bulb and stem

Cardoon
Celeriac
Celery
Elephant Garlic
Fennel
Garlic
Kohlrabi
Leek
Nopal
Onion
Spring Onion/Scallion
Shallot

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Vegetables grown for their bulbs and stems are easy to grow in desert soils and in desert environments. Make sure to fertilize them regularly during the growing season and use surface mulches in the garden to reduce stress and improve the quality of the product. Many of these are shallow rooted and will require frequent irrigations.

Vegetable and Herb Selection

Vegetables eaten for Root and tubers

Bamboo shoot
Beetroot
Burdock
Canna
Carrot
Cassava
Chinese artichoke
Daikon
Earthnut pea
Elephant Foot yam
Ginger
Hamburg parsley
Jerusalem artichoke
Jícama
Parsnip
Pignut
Potato
Prairie turnip
Radish
Horseradish
Rutabaga
Salsify
Scorzonera
Sweet Potato
Taro
Turnip
Water chestnut
Yam

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Vegetables that we grow for roots and tubers will require adequate amounts of phosphorus during their growing time. They will also require deep soils free of rocks. They must be thinned to the desired distance apart very soon after they germinate to give them room for their roots and tubers to grow.

Vegetable and Herb Selection

Vegetables eaten for edible pods (Legumes)

American groundnut	Lentil	*Snap pea*
Black-eyed pea	Lima Bean	*Snow pea*
Chickpea	Mung bean	Soybean
Common bean	*Okra*	Tepary bean
Fava bean	*Pea*	Velvet bean
Garbanzo	*Peanut*	Winged bean
Green bean	Pigeon pea	Yardlong bean
Indian pea	Runner bean	

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Most of the vegetables we grow for edible pods are legumes. Make sure the soil for legumes has been inoculated with the beneficial bacteria needed for converting the nitrogen in air into the nitrogen they use as a fertilizer. We typically avoid feeding these vegetables high nitrogen fertilizers but instead concentrate on high phosphorus fertilizers. Many of them will benefit from small supplemental amounts of nitrogen.

Vegetable and Herb Selection

Perennial vegetables and herbs

Aloe, *asparagus*, artichokes, chicory, *chives*, Echinacea, dandelion, *fennel*, ginseng, Jerusalem artichokes, lavender, lemongrass, lovage, *marjoram*, *mints,* sorrel, *rosemary*, *sage*, *tarragon*, *thyme*, yarrow

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Perennial vegetables and herbs will typically die during the colder winter months and regrow again in the spring. It is usually a good idea if the tops of these plants do not die to cut them to the ground in December and remove the tops from the field so that we also remove potential disease and insect problems. Many of these can be grown in large containers. Some of these crops like asparagus should not be composted and returned to asparagus growing areas since these residues may affect future yields.

Vegetable and Herb Selection: Time of Year

Winter

November

Beets (s), broccoli (s,T), carrots early in the month (s), green beans (s), pole beans (s), onion seeds (s), peas (s), radish (s), turnip (s), Brussels sprouts (T)

December

Beets (s), broccoli from seed, green beans (s), pole beans (s), spinach (s), Swiss chard (s), Brussels sprouts (T)

January

Beets (s), Brussels sprouts (T), broccoli (T), radish (s), Spinach (s), Swiss chard (s), roasting garlic (clove)

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Some vegetables and herbs like basil perform better during the heat of summer rather than the cool or cold winter months. Others perform best during the cooler to cold winter months. Still others perform best when temperatures are not too hot or too cold. For this reason we can divide our vegetables into three growing seasons for planting times: the winter vegetables, the summer vegetables and the spring/fall vegetables. Planting times for these vegetables vry with latitude and altitude and microclimates. Consult local planting guides for approximate planting dates. These will vary with local climates and microclimates but it is still a good place to start.

Vegetable and Herb Selection: Time of Year

Spring and Fall

February

Beets (s), broccoli (s,T), cabbage (T), carrots (s), sweet corn(s) (later in the month), kale (s), lettuce (s), onion sets, potato (later in the month), radish (s), spinach (s), Swiss chard (s), turnip (s)

March

Bush beans (s), broccoli (s,T), brussels sprouts (T), cabbage (T), carrots (s), sweet corn (s), eggplant late in the month (T), green beans (s), pole beans (s), kale (s), kohlrabi (s), lettuce (s), onion sets, onions (T), peppers late in the month (T), potatoes, radishes (s), spinach (s), Swiss chard (s), tomato late in the month (T), turnip (s)

April

Sweet corn (s), cucumber (s), eggplant (T), green beans (s), pole beans (s), melons late in the month (s), peppers (T), tomatoes (T), summer squash (s)

September

Beets (s), broccoli (s,T), cauliflower (T), carrots (s), kale (s), lettuce late in the month (s), spinach (s), Swiss chard (s), Brussels sprouts (T)

October

Beets (s), broccoli (s,T), cauliflower (T), carrots (s), garlic (clove), green beans (s), pole beans (s), kohlrabi (s), lettuce (s), radish (s), spinach (s), Swiss chard (s), tomato (T), Brussels sprouts (T)

November

Beets (s), broccoli (s,T), carrots early in the month (s), green beans (s), pole beans (s), onion seeds (s), peas (s), radish (s), turnip (s), Brussels sprouts (T)

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Many spring of vegetables can also be planted in the fall because of very similar weather conditions.

Vegetable and Herb Selection: Time of Year

Summer

May

Cucumber (s), eggplant (T), melons (s), peppers (T), sweet potato (slips), summer squash (s)

June

Melons (s)

July

Sweet corn late in the month (s), green beans (s), pole beans (s), melons (s)

August

Beets (s), broccoli late in the month (s,T), cabbage late in the month (T), cauliflower late in the month (T), sweet corn early in the month (s), green beans (s), pole beans (s), spinach (s), Swiss chard (s), winter squash at lower elevations (s)

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Summer vegetables frequently originate from tropical climates and we grow them as summer annuals. The high temperatures of our desert can cause problems for these vegetables in setting fruit. Temperatures from 90 to 95° F can cause pollination problems and fruit abortions. The saving grace occurs during occasional breaks in the hot weather when fruit set can occur. Some of these vegetables like tomatoes will suffer from chilling injury at temperatures below 50° F. Hot caps and other protective covers don't always protect from freeze damage. They may also protect plants from chilling injury.

Vegetable and Herb Selection: Time of Year

Generally we separate annual vegetables and herbs into those we can plant in the spring and others we can plant in the fall. Planting dates vary with latitude and altitude. A good calendar for planting dates that varies with elevation can be found in the Arizona master gardener manual online.

http://ag.arizona.edu/pubs/garden/mg/

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In our southern climates we have basically three planting seasons; winter, summer and spring/fall. In many ways, the time of year when vegetables and herbs are the most difficult to plant and care for are the hot and dry summer months. Some people refer to these months as our "winter" season referring to the very cold winters of the northern states. The spring/fall months allow us to grow basically the same crops but in reverse since our spring transitions from cold to hot months and are fall from hot to cold. Some people have better success with spring crops when they are planted in the fall because of the forgiving temperatures of the cooler months as these crops mature. Tomatoes for instance will produce a spring crop and a fall crop but stop producing during the hot summer months when temperatures rise above 95° F

Vegetable and Herb Selection: Varieties

- Varieties make the difference between okay and great!
- Open pollinated vs close pollinated and saving seed

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I would caution any vegetable gardener to pay particular attention to the varieties they select. Selecting the right variety may mean the difference between no production, some production and abundant production. It can also be the difference between vegetables that taste good and those that taste great. Talk with your gardening friends and join discussion groups that have members from your climate zone and learn which varieties have been successful for them. Experiment with varieties and keep accurate records of your production and your taste trials. Saving seed from superior plants from vegetables and herbs which are open pollinated and replanting these seeds will, in time, improve your selections. Save seed from superior plants and superior fruits from these plants. Discard seed from inferior plants and inferior fruits. Start an annual seed exchange so that these seeds can be shared among gardeners.

Vegetable and Herb Planting: Families and Rotation

COMMON FAMILY NAMES	VEGETABLE CROPS in FAMILY
Onion (Amaryllidaceae) All bulbs (also amarylis flower)	chives, garlic, leeks, onion
Brassica/Crucifer	broccoli, Brussels sprouts, cabbage, collards, cauliflower, kale, kohlrabi, radish
Amaranth (Chenopodiaceae)	beet, Swiss chard, spinach
Aster (Compositae)	lettuce, endive, artichoke, sunflower
Cucurbit	gourd, melon, watermelon, squash, cucumber, pumpkins, loofa
Grass (Gramineae)	Sweet corn
Legume (Fabaceae) Nitrogen fixing	peas, beans, cowpeas, peanuts
Solanaceous	tomato, pepper, eggplant, potato, tomatillo
Carrot (Umbilliferae)	celery, carrot, dill, cilantro, parsley, fennel, parsnip

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A very important concept in vegetable and herb gardening is crop rotation. Crop rotation is the planting of vegetables that belong to different families in different locations in successive years. Many diseases and insects are common to vegetables of the same family.If we continue to plant vegetables of the same family in the same spot year after year those locations will concentrate disease and insect problems that become increasingly more destructive in successive years. By not planting vegetables of the same family in the same location year after year, we break the disease and insect cycles that develop when similar crops are continuously grown in the same spot.

Do not plant vegetables of the same family in the same locations for 3 to 5 years. In other words, we want a three to five-year crop rotation in place in our individual vegetable growing areas. An example would be to plant crops in the tomato family (Solanaceous) the first year, followed by vegetables in the carrot family (Umbilliferae) in the second planting followed by vegetables in the cucumber family (Cucurbit) the third planting.

Fertilizers

- Vegetables should be fertilized at the time of planting and regularly during the growing season
- Choices of fertilizers include organic and conventional
- Choices of fertilizers also include quick release and slow release
- Choices of fertilizers also include soil applications and foliar applications
- Generally speaking, organic fertilizers are usually slow release while conventional fertilizers can be either slow release or fast release

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There are 16 or 17 essential nutrients that plants must have if they are to survive. 13 or 14 of these nutrients are taken up by plants from the soil through their roots. As vegetables and herbs grow in our gardens, they remove nutrients from the soil and concentrate these nutrients in plant parts. We derive much of our mineral nutrition from the vegetables and herbs that we consume. When we harvest these vegetables and herbs and do not return them to the soil, these nutrients are removed from the soil forever.

We must replenish these nutrients in the soil frequently. In conventional vegetable production this is done with mineral fertilizers. Inexpensive conventional fertilizers typically release nutrients quickly when added to the soil. Organic fertilizers typically release nutrients slowly. Conventional fertilizers add a very narrow range of plant nutrients in known quantities and at high concentrations. Organic fertilizers add a wide range of plant nutrients.

Fertilizers can be applied to the soil or to the plants themselves using liquid sprays. Water soluble fertilizers can be conventional or organic. These fertilizers are sprayed on plant leaves with a wetting agent which helps the nutrients pass through the outer layer of plant tissue which is usually covered with a waxy or hair-like covering which will repel water if a wetting agent is not used. Wetting agents are important components of all liquid sprays applied to plants.

The term "organic" is becoming very cloudy and sometimes misleading. In some instances it can refer to its source, either plant or animal life. We also have the label of "organic" which has been promoted by the USDA in its organic certification program. Generally speaking if fertilizers are derived from plant or animal life they may be considered "organic". But just because of fertilizer comes from organic sources does not necessarily qualify it in USDA's organic certification program. This program is tightly regulated and the term organic is closely guarded by the federal government.

In organic vegetable production fertilizers are derived from plants or animals. Composts concentrate plant nutrients by decomposing plant residues enough so that these minerals can be returned to the soil. Composts are supplemented with animal and plant byproducts such as blood meal, bone meal, sea kelp, fish emulsion, guanos and others.

Organic fertilizers have other benefits that conventional fertilizers do not have. Organic fertilizers can contain nonessential ingredients that help make nutrients more available to plants and stimulate biological activity.

What Fertilizer to Use

- You should have a minimum of two different types of fertilizers in your inventory: a high phosphorus fertilizer and a high nitrogen fertilizer
- A third fertilizer in a 1:1:1 ratio would make it ideal
- High potassium in a fertilizer is always desirable
- Prepare the soil at the time of planting from seed or transplants with a high phosphorus fertilizer
- Leafy green vegetables require a high nitrogen fertilizer
- Flowering and fruiting vegetables require a high phosphorus fertilizer

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Most fertilizers have three numbers that appear on the outside of the fertilizer bag or container. These numbers represent the nitrogen, phosphorus (P2O5) and potassium (K2O) content of the fertilizer in that order. A fertilizer ratio is the ratio of these plant nutrients as they are expressed on the label. For instance a 10-10-10 fertilizer is in the ratio of 1:1:1 while a 20-10-5 fertilizer is in a 4:2:1 ratio. When recommending a fertilizer for specific plants the first two numbers, nitrogen and phosphorus, usually determine how the fertilizer will be used. Leafy green vegetables that do not produce flowers or fruit that we eat are given high nitrogen fertilizers, or fertilizers with a high first number. An example would be 10-2-5. Nitrogen fertilizers stimulate leaf and stem growth.

High phosphorus fertilizers stimulate flower and fruit growth as well as root growth. High phosphorus fertilizers are usually applied just before planting seed or transplants and again to stimulate vegetables that produce flowers and fruit such as tomatoes, eggplant, peppers, squash, cucumbers etc. An fertilizer example for these plants might be 2-10-5. Notice the last number, potassium is always either a moderately high or high number. Potassium is important to plants during times of stress.

When to Fertilize

- Apply fertilizer at the time of planting
- Apply fertilizer regularly through its growing season

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Fertilizers are applied just before growth begins. The type of fertilizer we apply is determined by what we want that vegetable or herb to do. So just prior to planting seed or transplants we want to make sure that enough phosphorus is present in the soil to encourage strong root development. Fertilizers applied before planting, pre-plant fertilizers, are high in phosphorus. As plants are beginning to grow, the appropriate fertilizer should then be applied to encourage the type of growth we desire. Leafy green vegetables require high nitrogen fertilizers during their growth. Vegetables that flower and fruit require high phosphorus fertilizers during their growth. If high nitrogen fertilizers are applied to vegetables that flower and fruit, these vegetables will tend to produce leaves and stems rather than flowers and fruit. Nitrogen, the first number on the fertilizer label, is nearly always the most limiting nutrient for plant growth. This is because nitrogen is lost easily in irrigation water and to the air. A lack of nitrogen causes slow growth and light green color in leaves and stems. It is most important to apply small amounts of fertilizer frequently during the growth of vegetables. If fertilizers are applied to the soil than light applications every 4 to 6 weeks might be appropriate. If fertilizers are applied to the foliage as sprays, then light applications every 2 to 3 weeks might be necessary.

How to Apply Fertilizers

- Apply granular fertilizers mixed with the soil at the time of planting
- Sidedress vegetables with fertilizers through the growing season
- Apply liquid, foliar fertilizers every 3 to 4 weeks
- When applying liquid fertilizers to the foliage always add a wetting agent to the fertilizer solution

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Pre-plant fertilizers containing phosphorus and applied to the soils should be mixed with the soil prior to planting seed or transplants. Once vegetables and herbs begin their growth, fertilizers can be applied to the foliage as liquid sprays or sprinkled lightly 2 to 3 inches to the outside of a row. Sprinkling of fertilizer lightly to the outside of a row is called side dressing. If fertilizers are applied to the leaves of vegetables as a foliar spray, always use a wetting agent to help the nutrients penetrate through the leaf surface and apply it in the early morning hours when temperatures are still cool. If possible, use distilled or deionized water or adjust the water you are using with white vinegar to a pH of 6.5 to 7 using litmus paper to adjust it.

Pests and Insect Management

- Plant diversity in the garden
- Selection of healthy and insect free plants from the nursery
- Removal of bottom leaves
- Plant inspection on the underside of leaves (monitoring)
- Early control before populations build
- Hand removal
- Mechanical removal (vacuums)
- Trap crops
- Traps (newspapers, yellow sticky cards)
- Repulsion (Aluminum foil, marigolds)

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Insects and diseases are less of a problem when growing vegetables and herbs in the desert than in wetter climates. The major reasons for disease development in vegetable crops are failure to rotate crops, overhead irrigation particularly in the late afternoon, lack of air circulation, low organic content in the soil and failure to apply fertilizers often enough. After vegetables and herbs become established in the garden, it is important to thin the canopies of these plants to encourage air circulation and allow for pollinators like bees to reach the flowers. Drip irrigation should be used on vegetables or if overhead irrigation is used, apply the water in the early morning hours so there is enough time left in the day for the leaves to dry before sunset. Don't bring the city plants home from the nursery. You are just asking for problems.

The major reason for insect problems in vegetables and herbs is failure to control their populations when they are first getting established. After plants in the garden have been growing for a couple of weeks, remove the leaves that are within 6 inches of the soil surface. The underside of the lowest leaves are typically were most of the insects begin to build populations early in the season. These leaves are also very difficult to spray. Always inspect the bottoms of leaves for pests. Pests do not accumulate on the upper surfaces. Consider insect control methods that do not involve pesticide applications as your first line of defense. This includes removing pests by hand, use of cordless vacuums, trap crops and repulsion of pests by soil

surface layers of aluminum foil.

When nonchemical methods of control are no longer adequate, consider "organic" insecticides such as Bt (Dipel, Thurcide), Spinosad, Neem oil, soap sprays, horticultural oils and pyrethrum products. Organic products can be just as deadly as conventional insecticides. Just like conventional insecticides, organic products do not know a good bug from a bad bug. The Bt products control "worms" or caterpillars such as those that attack tomatoes, sweet corn, and other vegetables. Spinosad will control these as well as Western flower thrips and young leafhoppers but they are hard on bees. Neem oil can also be used for some disease control. Soap sprays, if they are sprayed directly on insects, will kill virtually any insect but it does not leave behind a residue for killing insects later on. Horticultural oils can be used on some vegetables that are not in flower if applied when temperatures are cool. It basically acts by suffocating insects with a blanket of oil. I would use of four different products in rotation and avoid applying anyone product over and over again. The backbone of an organic spray program are going to be soap sprays. Do not use liquid detergents that are made for dishes. Too many additives. Use a commercial soap spray or make one from Castile soap or Dr. Bonners. I would add a BT or Spinosad spray, neem oil and a pyrethrin product. Never spray plants that are blooming. Spray the undersides of leaves. Spray in the early morning or at dusk.

Disease Management

- Select healthy plants for your garden
- Use a diversity of plant materials
- Keep plants healthy with proper fertilizer application and irrigations
- Provide air movement through leaf removal and proper plant spacing
- Avoid overhead irrigation. Use drip irrigation.
- Remove plants that are diseased and cannot be saved.

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Don't bring home plants that need your help. Leave them at the nursery. Plant a wide diversity of crops and the more they are mixed together in a garden the more chance you will avoid disease problems. Avoid overhead irrigation if at all possible. Use drip irrigation. Provide air movement through plants that have a very tight canopy. Do this by removing leaves so that there are openings in the canopy for air and be movement. Keep vegetables adequately fertilized and make sure you're adding organic amendments to your vegetable garden each time you plant. Healthy plants have fewer diseases. Remove diseased leaves or plants as soon as you see them. If you must apply fungicides, apply them early in the disease development stage. Most fungicides are preventive and not curative. They prevent diseases from spreading but very few of them will cure a disease once a plant is sick.

"Organic" Disease Control

- Disease control, unlike insect control, focuses on prevention more than curing a problem
- Organic pesticides for disease control include Neem, baking soda, compost teas, sulfur dusts

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Organic pesticides for disease control include neem oil, compost tea applications to the foliage, sulfur dusts and a few others. But remember disease control focuses on prevention rather than curing the plant of a disease.

Weed Control

- Use of surface mulches and removing weeds by hand at least once a week control most weeds before they become a problem

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The best form of weed control is remaining diligent and removing weeds from the garden as soon as you see them. Applying surface mulches will also help. Clean straw is hard to find and it does not decompose in the garden that easily. The best surface mulch I have found so far is horse bedding in the form of pine shavings. This surface mulch will decompose quickly in garden soils after it is turned under. Surface mulches also conserve water, reduce weed populations, help keep the soil cool, and help vegetable seed to germinate during the hot summer months by preventing the soil from drying out too quickly.

Postharvest Care of Vegetables

- Pick in the morning. Tender herbs and vegetables should be plunged into cool water immediately after harvest.
- Keep vegetables and herbs out of direct sunlight after harvesting
- Reduce field heat with ice, cool or cold water depending on the vegetable.
- Store vegetables at their proper temperature and humidity

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Delicate vegetables like leafy greens and herbs should be harvested in the early morning hours. Take with you a bucket of cool, clean water that you can plunge the vegetables and herbs into to help prevent them from wilting and preserve their moisture. When harvesting vegetables, never leave them in the sun for any length of time. As soon as vegetables are plucked from the mother plant their source of water is cut off. The water they were getting from the mother plant was used to help keep their surface temperatures cool through transpiration. The combination of losing a supply of water, the buildup of field heat through radiation and the heat of respiration causes the temperatures of vegetables to rise very quickly after harvest. It is important to plunge them into cool, and in some cases icy, water, to drop their temperature and preserve their storage life if you are not planning to eat them right away. Store vegetables at the proper temperature and humidity. Most vegetables store best at 95% humidity. There are a few exceptions such as potatoes and onions. Tropical vegetables such as tomato should not be stored in the refrigerator since they will develop chilling injury.

Happy Gardening!

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Thank you for not sleeping!