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RAISED BEDS AND SOIL MIXES FOR FOOTHILL GARDENS  
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Some garden sites may be too rocky, contain extensive root systems from nearby trees, contain dense hard-to-work clay soil or lack adequate drainage for successful vegetable or flower gardening. Raised beds can be an effective alternative.

When You Design Your Raised Bed

1. Build with durable materials.
2. Put wire mesh on bottom to keep out gophers.
3. Provide drainage so walkways between beds don't flood with water when you irrigate.
4. Elevate above ground to keep out the roots
5. Depth of bed - shallow beds are harder to manage - can quickly dry out. Deep beds give more room for root system.

Location of Raised Beds Depends on Plants to be Grown

Vegetables - six hours or more of sunlight per day.

Ferns, begonias and other shade plants - locate under trees or shade structure

Keep away from base of trees. Continued wetness can cause crown rot and death or decline of trees.

Soil and/or Soil Mix for Beds

Plant nutrients are held by clay particles and decayed organic matter in soils. Sand and Bark or sawdust essentially contribute nothing to nutrient storage.

Plant Roots Must Have Oxygen

That is why potting mixes and the mixes you bring home when you purchase nursery container plants contain a large proportion of bark and sawdust. The wood products create large open voids in the mix which allows water to quickly drain away after irrigation.

Wood products must be added every year to keep the bed full of mix. They are very difficult to mix uniformly by hand or with a rototiller.

Waxes and other products left behind after the decay of wood products cause the soil mix to repel water. The water may find cracks and channels and never wet large areas of the mix.

If you have this type of mix, be sure to dig through it occasionally to see if the mix is uniformly wetted after irrigation.

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### Strengths and Benefits

Provide site for intensive gardening.  
Can eliminate problems from tree roots and may control gophers.  
Maximizes the benefits of imported high quality soil  
Irrigation water confined to a defined area.

### Limitations

Desirable sandy loam soil not always available.  
Sawdust/bark mixes decompose creating poor root environment  
Uniform mixing of sawdust/bark ingredients is difficult.  
Preplant and post plant nutrients must be supplied.  
Mixes may not wet uniformly.  
Deep rooted plants such as tomatoes are limited to available soil volume.  
Water needs close management.

### Using Garden Compost Products, Cedar Sawdust and Other Bark Products in a Mix Wood Products Have Limitations

There is a lot of confusion and misunderstanding on the use of redwood or other commercially available garden compost products or the use of bark and sawdust from one of our nearby sawmills in preparing mixes for raised beds and containers. Animal bedding high in bark, sawdust or straw also falls in this category.

Bark products when mixed the right proportions with soil can make a mix that's physically very nice to work. However, purchased bark and wood products are not the same as compost developed at home in a compost pile nor are these products (soil organic matter).

Bark and sawdust products are attacked by microorganisms as soon as they are mixed with soil. These products over time break down and leave behind approximately 5% soil organic matter. Sometimes at a nursery you will find container plants held over from previous years that are only half full of soil mixes. Microorganisms have consumed the other half.

The desirable physical characteristics of the mix also disappears. Eventually only the original soil is left and the volume in the bed shrinks away. Nitrogen must be added to bark sawdust mixes to satisfy the metabolism needs of the microorganisms. Otherwise plants will develop a yellow-green color and the older leaves will yellow and dry up as they suffer from nitrogen deficiency.

### Nutrition Needs

- a) Raised beds filled with sandy loam soil:  
Preplant - Apply superphosphate 0-20-0 - 5 to 7.5 lb. per hundred square feet. Bone meal or rock phosphate may also be used.  
Post plant - Apply nitrogen throughout growing season and sidedress with a light application of manure to provide minor plant nutrients.
- b) Soil/bark/sawdust mixes:  
Apply superphosphate, bone meal or rock phosphate as noted above.  
Apply nitrogen at the rate of 5 lb. ammonium sulfate (1 lb. N) for each 100 pounds of sawdust/bark added to the mix.

### Growing Organic

Organic sources of nitrogen such as dry chicken manure can create serious problems if you add enough to construct a soil, bark, sawdust mix. Manure has a low nitrogen percentage varying between 0.6% and 4.5%. a phosphorus content that varies between 0.7% and 6.0% and a potassium content that varies between 1.2% and 6.0%.

For each cubic yard of bark/sawdust added to a soil mix you would need between 22.5 lbs. and 50 lbs. of dried chicken manure which will contain between 2.0 and 5.0% nitrogen to make up for the microorganism nitrogen requirement. The normal recommendation for chicken manure additions to garden soil is 12.5 lbs. per 100 sq. ft. Twice or four times the salt load can be added to the system if the garden were to be managed organically by using chicken manure as the nitrogen source. Sounds unlikely?

### Salty Soil Mixes - A Gardening Disaster

The 83% material in manure that remains after we subtract out the nitrogen, phosphorus and potassium are for the most part undesirable salts which can prevent seed germination and burn plants. Soil tests performed on Amador County gardens over fertilized with poultry manure have measured nutrient levels 100,000 times normal. Extra water must be added to leach out the salt. Leaching removes some of the nitrogen and potassium. Therefore any grower and especially organic growers should avoid the use of large amounts of manure and animal bedding since the excess salts will severely limit plant growth and the wood present in the bedding can starve plants for nitrogen during the growing season.

### What Then is the Ideal Mix for a Raised Bed?

Sandy loam top soil would be best if the bed is two feet deep and the native soil underneath has good drainage. If that's not available, try to get a mix with no more than 10% sawdust and bark added.

Oops! You already have a soil/sawdust/bark mix and it's not wetting uniformly. Two things may help:

1. Use a wetting agent or liquid detergent to wet the mix taking care not to let the mix completely dry out between irrigations.
2. Add peat moss with bark/sawdust when you prepare the mix. Peat is almost 100% decayed organic matter and holds plant nutrients. Peat moss also holds moisture if your mix tends to dry out quickly.

Note of Caution! Never add more than 5 to 10% peat to your mix since peat can hold too much water and deprive roots of oxygen.

### Plant Nutrients for Raised Beds

Planting mixes prepared with sand, bark/sawdust and/or peat moss require addition of nutrients because they don't have the natural nutrient reserves available on clay particles and organic matter in natural soils. Loam soils contain a balance of sand, silt, clay and organic matter so plants do well with minimum amounts of fertilizer. That's why the closer you can get to a sandy loam for your raised bed the better off you are.

NUTRIENTS TO BE APPLIED AFTER PLANTING OF RAISED BEDS

Plant Nutrient Needed	Inorganic* Material**	<u>Sources</u>	
		Organic	Material**
Nitrogen	Ammonium Sulfate	Fish emulsion	
	21-0-0		Chicken manure
	Urea		Steer manure
	Controlled release fertilizer		Dairy Manure

\*Nitrogen leaches from soil/soil mixes with rainfall or excessive irrigation.

\*\*Use one of the materials listed.

Add extra nitrogen if bark or sawdust are used in the mix - 5 lbs. ammonium sulfate (one pound of nitrogen) for each 100 lbs. of bark/sawdust added.

NUTRIENTS TO BE APPLIED BEFORE PLANTING RAISED BEDS\*

	<u>Inorganic</u>		<u>Organic</u>	
	Material**	Rate 100 sq.ft.	Material**	Rate 100 sq. ft.
Calcium	Gypsum	5 to 10 lbs.	Oyster shell lime	5 to 10 lbs.
	Dolomite*	5 to 10 lbs.		
Phosphorus	Superphosphate	5 to 7.5 lbs.	Raw bone meal	3 to 5 lbs.
	0-20-0		4-25-0	
	Treble superphosphate	3 to 5 lbs.	Bone meal	
			Steamed 25-25-0	
		Rock phosphate	5 to 7.5 lbs.	
Magnesium	Dolomite	5 to 10 lbs.	Manures also supply these nutrients	
	Magnesium Sulfate	0.5 to 1 lb.		

\*Calcium and magnesium not required the first year if a natural sandy loam soil is used. Apply every second year. Calcium, phosphorus and magnesium required if bark/sawdust is major part of the mix.

\*\*Apply one material from each group.

Soil pH Control

pH is a measure of the acidity-alkalinity status of soil. A pH of 7 is neutral. Most plants do well in a pH range of 6.5 to 7.5. Obtain pH paper from a pharmacy or by purchasing a soil testing kit. The treatment may not be necessary for several years depending on your water quality and the fertilizer products used.

To raise pH from 5.5 toward 6.5:

<u>Source Material</u>	<u>Rate/100 sq.ft.</u>
Dolomite	5 to 10 lbs.
Calcium carbonate	5 to 10 lbs.

To lower pH from 8.5 to 7.5:

Soil sulfur	1 lb.
Ferrous sulfur	1 to 3 lbs.

#### Successful Ways to Grow Organic

Use high quality soil in beds. Favor organic material by (1) adding peat moss; (1) use moderate amounts of manure; and (3) grow a green manure crop.

Warm summer temperatures and mild winter temperatures favor the breakdown of soil organic matter in California. The practices to develop organic matter listed above will need to be done on an annual basis.

Ref:raisbeds