

RAISED BEDS



A Guide to Raised Bed Gardening in Miami-Dade County, Florida

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Introduction

So you want a vegetable garden, but don't have a large area to till up for the project? Your "soil" is hard as rock? A good way to compensate for such lack of space and rocky soil is by gardening in raised beds. Doing so helps you overcome problems with our less-than-perfect soil.

A raised bed for vegetables can be as simple as raking the soil into flat-topped mounds (berms) several inches higher than paths. Or, for deeper beds, you can box soil with landscape timbers (raised bed).

Raised beds, especially in Miami-Dade County, offer a number of distinct advantages, particularly for growing vegetables:

- Digging is not needed.
- Helps plants grow better. For root crops such as sweet potato, carrots or malanga, it is much easier to provide needed space for the edible plant parts to grow.
- Replenishing soil is easy to do. This helps to overcome the build up of disease or nematodes. Depleted soil can be quickly removed from a raised bed and replaced.
- Ease of cultivation, especially for those with limited mobility.
- Lessens the risk of plants becoming water logged, particularly in areas

with poor drainage. This limits the chance of root rot diseases.

- Reduces soil compaction and prevents damage to soil and plants from foot traffic.
- Saves resources; fertilizer is applied only in the beds, not broadcast over the entire garden area.
- By using peat-based and organically enriched soils, the pH is in the "ideal" range for most plants.



There may be a few disadvantages to using raised beds, the major one being cost if the bed walls are to be durable. One other consideration is that additional irrigation may be needed. For this reason it is advisable to install some type of drip irrigation system to efficiently water your plants.

The Garden Site

Location

Before constructing any raised beds consider whether the location chosen is appropriate, bearing in mind the requirements of the plants that will be planted. Vegetables, fruits and most flowering plants will need at least 8 hours of full sun each day, while some bedding plants such as begonias and New Guinea impatiens will need some shade.

Do not place a raised bed near trees or large shrubs since the roots of these plants will probably grow up into the soil in the bed. Avoid areas where fire ants are a problem as they are liable to nest in the soil.



Preparing the site

Remove unwanted plants prior to planting. Hand pulling weeds is effective, particularly if the area is small. Covering the area in thick black plastic can kill

small plants and grass. Leave the plastic in place for several weeks. Remove the plastic before building your raised beds.

Avoid using herbicides if at all possible since there may be delayed effects months later. Use herbicide only as a last resort, since it is both expensive and potentially toxic to people and non-target plants. If you do use an herbicide, verify that it is compatible with any food crops that will be planted.

Woody plants and brush can be eliminated with chainsaws, heavy-duty mowers, or suitable herbicides (call your local extension office). If you want to remove any trees, first ask call the Miami-Dade County Department of Planning (305) 372-6585 to see if a permit is needed.

Wall Materials

The walls of a raised bed can be constructed from wood, masonry or synthetic lumber. Each of these materials will be reviewed below as well as how they can be used to construct a raised bed.

Natural Wood Apart from damage due to wood-boring insects, optimum conditions for wood decay prevail year round in South Florida. Wood that has good natural resistance to insect damage and decay such as the heartwood of red cedar is useful, but where there is direct contact with wet ground, deterioration can be far more rapid. In addition, cost is much more than for pressure-treated lumber or synthetic wood.

On site application of a wood preservative is not recommended. Penetration of the wood is too superficial

and may not protect wood that is in direct contact with the ground. Expect marked deterioration of the wood within 1-2 years.



Old railroad ties and telegraph poles

Neither of these sources of wood are readily available in Miami-Dade County. Never use these products if they are oozing wood preservatives.

Both of these products are relatively cheap sources of treated wood, but some care is needed before using. If such wood must be used, exposed surfaces should be covered with heavy black plastic.

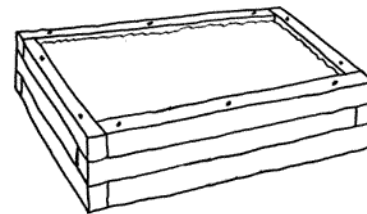
Pressure treated wood If you want to use wood, pressure treated wood is the best choice for durability in Miami-Dade County. This type of lumber is exposed to a chemical preservative, which is forced to infiltrate the wood under pressure. The most commonly used preservatives are mixtures of chromium, copper and arsenic (chromated copper arsenate, CCA's) and are being removed from the market. Safer methods of preserving wood are under development.

Concerns using treated wood CCA bonds with wood to form water insoluble compounds and are thus regarded as being

non-leachable. If there are still reservations as to the safety of pressure treated lumber, apply an oil-based sealer before use and/or line the interior sides of the bed with heavy black plastic.

When pressure treated lumber is sawn or drilled, precautions need to be taken when disposing of any sawdust. Wear a mask and bag all sawdust - under no circumstances should this material be used for composting. Do not burn any left over scrap wood. A wood preservative such as copper naphthenate should be applied to any exposed surfaces after the lumber is worked.

Landscape lumber This lumber is the



center of a log with both top and bottom surfaces machined flat, but has rounded

sides. This wood is dipped in preservative and is mostly heartwood (see above) and so will not last as long as pressure treated wood.

Synthetic lumber As the name implies this is a manufactured product, and it offers a number of advantages:

- Environmentally friendly since it contains from 50 - 100% recycled plastic, with some products also containing waste wood fibers.
- Resists decay and insect attack, even when in contact with the ground, and without the use of toxic chemical preservatives.
- Unlike wood, synthetic lumber will

not crack, splinter or warp, and does not require the application of sealers or paint, though it is possible to paint them to enhance their appearance.

Some of these products are available in attractively dyed plastic, while others should be allowed to weather after which they can be painted. Plastic lumber can be worked in the same way as lumber, drilled and sawn. Pre-cut synthetic lumber is available and often sold as kits.

There are some disadvantages to the use of synthetic lumber, cost can be higher than using pressure treated lumber, especially for larger projects. There is also the question of durability under the intense UV radiation experienced in South Florida. Check to see if stabilizers have been added to combat this problem.

A minor problem is the build up of mildew that can occur on surfaces that remain in the shade.

Presently, there isn't any evidence that plastic based landscaping lumber poses any health risks.

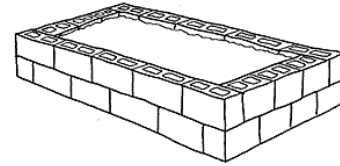
Masonry Stone, brick or pre-cast concrete (including "cinder blocks") can be used to construct raised beds and offer a wide range of choices. They offer the following advantages:

- Concrete building blocks are inexpensive and durable.
- Permanence and strength if mortar is used during construction
- Some products are available that can be keyed together without using mortar. Such products are

more expensive but require little skill in assembling.

When using these products, a level surface is needed for the walls.

If the walls are to be built without using mortar, make sure they are only one or two courses tall.



Various manufacturers offer landscaping masonry with an attractive natural stone finish, which can add much to the aesthetic appeal of the garden. These products are more expensive than ordinary concrete blocks.



Planting Beds

Planting beds for growing vegetables or ornamental plants can make small-scale gardening in Miami-Dade County easy. The following guidelines can be used in preparing planting beds:

- **Dimensions:** A bed *width* of 4' or less is a comfortable size for most people. The *length* of each bed depends on the site and your needs - 25' is useful with a 4' width, since

this totals 100 sq ft of surface area, a round number that simplifies calculating fertilizer applications or planting density. For most purposes, ideal bed height can be from 6 - 12" tall.

- **Paths:** The use of foot wide walkways at 12 -15' intervals can be provided to give easier access to each side of longer beds. Make major dividing paths at least the width of a wheel barrow -- more if wheel chair access is necessary.

Constructing Raised Beds

At its simplest, a raised bed can be just a *mounding of soil* surrounded by stones, with a covering of mulch to aid in keeping the soil in place and conserve soil moisture.

A more *functional system* for establishing raised beds is to use a permanent retaining structure. Bed walls can be constructed out of wood, masonry or synthetic lumber.

Before building the beds, make sure the site is level.

Board Wood Pre-drill the ends of each board and attach them to each other with galvanized metal braces and screws to form the corners of the bed. Do not use nails as this could split natural timber, though for synthetic lumber it is possible to use self-tapping screws without pre-drilling.

Masonry As stated earlier, the bed can be as shallow as 6-8", which is the height of a standard cinder block. You can simply lay the block on top of the ground without further preparation.

Where building a deeper bed, the first course should be laid 4-5" below the



soil surface. Align each course of blocks with a level in a staggered pattern with construction re-bar driven into the ground at each corner to hold the bed in place. For added strength, the blocks can be mortared together, leaving spaces for drainage. Bed walls that are more than 2' in height, or are to be used as garden seats (capped with plastic lumber or treated wood) should always be mortared.



If masonry other than standard construction blocks is used (e.g. Matt Stone or Anchor Wall Stone) follow the manufacturer's guidelines. Do not use keyed blocks to build a bed of more than 2' in height.

Pathways and Pavers



Where there are several raised beds, consideration will have to be given to

provide ease of access to the beds for regular cultivation of the crop after planting.

Walkways between beds should be at least wide enough to accommodate a wheelchair or garden cart and have a smooth free draining surface.



This can be accomplished by covering the ground with a heavy-duty landscape fabric and a layer of pea gravel or organic mulch. Before installing the fabric remove all rubble and spread an even 1" layer of sand.

A popular option is to use organic mulch wood chips or bark directly on the soil surface although this may encourage snail infestations if it remains wet.

Stone pavers are an aesthetically attractive option. If purchased new, they may be expensive, but such materials can often be salvaged. You may want to put a low-growing, desirable plant in between the pavers to lessen the need for periodic removal of weeds that grow between the joints.

Soils for Raised Beds

Soil is one the most important elements when considering a garden site. Purchase a good quality **potting soil** for the raised bed. You can use compost as well or a mixture of compost and potting soil. Both of these products are easily found at most garden centers.

For large beds, buy a good quality soil, which can be bought by the truckload (don't use fill dirt or muck soil). Well-drained soil is a must for any successful garden. Soils should remain crumbly when moist – if it forms a sticky ball when compressed in your fist, it needs amending with builder's sand or perlite.

Before Adding Soil

The bottom of the bed should be lined with landscape fabric. As an alternative, use several layers of newspapers or old carpeting over the ground.

Only when you are ready to plant should soil be added to the beds. Fill the beds with soil to within 2-3' from the top of the bed and level the soil without compacting it.



Planting

Because the soil is improved and there is no need to walk between plants, vegetables can be spaced more closely. This increases the yield per square foot. Within wide beds, seed can be scattered randomly or sown in shallow furrows two or three inches apart. Thin plants enough to allow growing room. This works well for lettuce, spinach and root crops.

If "cinder blocks" are used, fill the holes with soil so that they can be planted as well. Also, to use the planting area more efficiently, plant in blocks of plants instead of in rows.



manure, and table scraps such as meat and fats. Disease-free plants and weeds without seeds make very good materials to put in your compost pile.

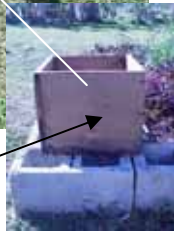
Advice and published materials on composting, including the construction of composting bins, is available from your local County Extension Service.

What to Plant

Basically, choose plants that appeal to you and are suited for our subtropical climate (zone 10). Contact the Extension office for lists of recommended plants and varieties.



Planting box for deep rooted plants such as carrots



Compost



Compost is the product of the decomposition of organic wastes under controlled conditions. It is an excellent soil amendment, and can be generated on-site for free and is easy to do.

Avoid using animal waste other than horse or cow

Vegetables

Those persons from more temperate latitudes, and new to Miami-Dade County, will soon become accustomed to growing most of the common "cool climate" vegetables, such as tomatoes, sweet peppers, and broccoli, through the mild south Florida winter. A useful first step is to obtain a copy of the UF-IFAS publication "A Guide to Vegetable Growing in Florida" from your local County Extension Office.

Although vegetables can be grown year round in south Florida, the main planting season is between September and March.

It is recommended for a new vegetable garden that transplants be used rather than growing from seed. This is a more reliable means of obtaining a successful harvest for beginners, and thereby sustaining enthusiasm as the garden becomes established.

At a later date, if there is an interest in growing vegetables from seed, ensure that the varieties chosen are resistant to the more common pests and diseases prevalent in Florida.

There is increasing interest in using seeds from "heirloom" varieties, since they are claimed to produce better tasting vegetables. Plants grown from such seeds will usually need more attention as they do not necessarily have the resistance to pests and diseases. The same applies to home grown seeds since most will not necessarily come true to type.



Fruit

Raised beds created for growing vegetables can also be used for fruits such as pineapples (12 -16 months to



harvest) and strawberries (plant in late October to early April).

The size of the garden and the plants already present will determine the number and types of fruit that can be planted.

There are however many fruit bearing trees from which to choose, some of which can also provide shade and landscaping interest.

Papayas are popular and can easily be grown from seed, however plants commonly decline after 2-3 years due to a viral disease and for this reason it is usual to replant every 1-2 years.

Bananas are another popular fruit crop, that can lend a lush tropical look to any garden. They do take some space, and removal of established banana plants can be difficult.



Flowers

When selecting:

- Choose plants that are adapted for the sub-tropics (zone 10). Many plants available through national mail order nurseries may not succeed in Miami-Dade County.

The Miami-Dade County Extension Office has numerous lists of plants for

South Florida. These should be consulted for detailed information.

Irrigation of the Garden



Choosing an efficient means of irrigation in addition to mulching will help reduce the amount of water that needs to be supplied to a raised bed garden.

A reliable means of watering a raised bed garden is essential, especially during our dry winter months. For most gardeners this will mean using city water, though in some instances well water is used especially if a full irrigation system is installed.

If you are planning to dig a well, you will need to find out from your local city government or the South Florida Water Management District if a permit is needed. You may wish to have the water tested for salinity, pH and particulate content.



If you are using city water on your garden, do not use any that passes through an installed water softener since this could increase the salinity of the soil (reverse osmosis and magnetic systems are safe).

In order to comply with Miami-Dade code requirements the water outlet must be fitted with an anti-siphon device to prevent back flow of water into the main supply.

The system used to irrigate the garden can range from a simple hand held watering can to an installed automated irrigation system (micro-jets, drip tape, soaker hose, drip irrigation on timers). Whichever system you choose it is important that water is not wasted (water only the root zone) and not lost by evaporation. For this reason lawn sprinklers are a poor choice because water is broadcast over a wide area. Wet foliage is therefore unavoidable and encourages disease.

As a rule of thumb, winter grown vegetables should receive a total of 1-2" of water per week (the upper limit more appropriate for raised beds) from rainfall and irrigation. It is useful to install rain gauges¹ to assess how much supplemental water should be supplied. Another indicator is if the top 1" of soil has dried out. Water should be applied in one or at most two deep applications per week.

Home-made rain gauge

A simple rain gauge can be made by using an indelible pen to mark 1/2" increments on any straight-sided clear container, such as a jam jar. Make sure that the diameter of the container opening is the same as that of the base.

The best time of day to water is in the morning just about sunrise, though this is not so important if a drip irrigation system

¹ A simple rain gauge can be made using an indelible pen to mark 1/2" increments on any straight sided clear container, such as a jam jar. Make sure the diameter of the container opening is the same as the base.

or soaker hose is being used. Avoid watering late in the day to avoid the risk of foliar disease and plant edema (bump-like swellings) in susceptible crops.



Watering By Hand. If you are using a hose, attach a water breaker nozzle and wand extension to permit gentle watering around the base of the plants, taking care not to drag the hose over any plants. For a large garden temporary stand-pipes can be installed, linked to the main water outlet, reducing the length of hose that needs to be maneuvered around the plant beds. For a small vegetable garden a watering can with a long neck (to reach under the lower leaves) fitted with a fine rose spray (to gently soak the soil) is recommended.

Simple Gravity Feed Irrigation Systems

These systems use a water reservoir and allow water to slowly seep into the soil. Soda bottles can be used hold water and the water flow regulated by a special plastic cone that fits onto the bottle. A more elaborate system uses a water filled plastic bag, mounted on a stake, to feed water through tubing to a series of drippers placed at the base of the plants (available through mail-order).

These and similar devices are useful for a small garden, especially if it is

difficult to get water to the site.

Soaker Hoses and Drip Tapes. For larger gardens, where piped water is available, there are more appropriate systems. The use of porous rubber soaker hoses is ideal for the garden. They are buried or laid across the surface of the soil in the plant bed where they "sweat" moisture along their entire length. In order to function properly, keep the water pressure low (no more than 10 psi) and use a 200 mesh filter to remove water particles that could clog the hose.

Additionally, you can use a timer(s) to permit automatic watering. Timer settings should be reviewed according to water needs (factoring in rainfall and soil conditions) on a regular basis. For systems using an irrigation pump, an automatic rain shutoff should be installed to prevent unnecessary watering.



There are other types of simple irrigation systems including drip tape (same use as a soaker hose). Both systems are available at most retail garden centers. You can cover the hose or tape with mulch.

More Complex Irrigation Systems The most expensive and efficient irrigation systems use drip emitters to deliver a slow

trickle of water directly to the root zone of a plant or group of small plants. Used in conjunction with black plastic mulch, problems with weeds can be greatly reduced.

There are a variety of different types of emitters. Emitters can be chosen according to the situation, with some



more suited to watering vegetables and bedding plants and

others for landscape shrubs or individual trees. Different types of emitters should not be placed on the same irrigation line.

It is also possible to supply liquid fertilizer (fertigation) through these systems by using fertilizer meter injectors.

It should be possible for a competent "handyman" to install an irrigation system having no more than 200' of lateral lines and operating at 25-30 psi (main supply). For a more extensive system the input of a qualified irrigation specialist is highly recommended.

Although investing in an irrigation system will ensure more economical use of water and save time, the benefits will only be realized if the system is routinely monitored (e.g. leaks and blocked emitters) and repaired as needed. Micro-irrigation systems of the type described above are susceptible to clogging from minerals present in water or, less likely for city water, growth of algae or slime-producing bacteria. The lines should be regularly back flushed and frequent use helps to prevent plugged openings.

Signs of Plant Problems Due to Incorrect Soil Moisture

Most of the problems encountered in growing vegetables and many annual bedding plants are related to over or under-watering. Here is a brief summary of water related problems.

- ❖ Too little water causes wilting. Drying winds can also exacerbate the problem, with plants exhibiting scorched leaf margins. Dry soil can also cause nutritional problems since with less water uptake there is a reduced uptake of available soil nutrients.
- ❖ Too much soil moisture causes plant roots to die through lack of oxygen as a result of poor soil aeration. Plant leaves become pale green and wilting occurs if the soil is waterlogged. Soil that is too moist encourages root and stem diseases, and these will cause plants to suddenly wilt and die.

Mulching



Mulching plants helps retain soil moisture and suppresses weeds. Organic mulches enrich the soil as the mulch decomposes, improving soil structure and

slowly releasing nutrients. These are particularly beneficial, since the organic content of Miami-Dade's soils is low.

Organic mulches are highly recommended for all plants including most trees (except citrus) and shrubs, and should be maintained at a depth of 2-3" but not touching plant stems or tree trunks. Remember to renew mulch as it decomposes.

There are many organic materials that can be used for mulch:

- Pine bark makes an excellent mulch which breaks down slowly. Pine bark nuggets are long lasting and good for keeping down weeds, whereas shredded pine bark is less liable to float away if flooded and is less expensive.
- Avoid products that compact down easily (e.g. finely shredded bark) or form a crust when dry (peat). Such materials repel water and interfere with soil aeration.
- Wood chips can temporarily deplete soil of available nitrogen. If wood chips are used they should be no smaller than an inch and add fertilizer after the mulch is spread.
- Avoid using colored wood chips as mulch on food crops. There is some concern over arsenic leaching out into the soil.

Inorganic materials such as marble chips, gravel or plastics also can be used for mulch. Points to consider about inorganic mulches:

- Inorganic mulch materials are not as effective in retaining soil moisture and contribute nothing to improving the soil.
- Landscape fabrics can be used, however, some weeds are able to

grow through them. Use landscape fabrics that are thermally spun-bonded, as this type is more resistant to penetration by weed roots or shoots.

- Non-woven black plastic mulch is useful for growing certain vegetables and pineapples. Use with an irrigation system (e.g. a soaker hose). Black plastic mulch should not be used until mid fall in Miami-Dade, otherwise the soil can become too hot.



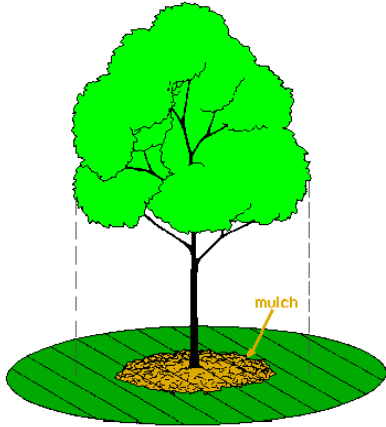
Plant Nutrition

Applying fertilizer to plants

Most plants will require fertilization at some time during the year. Nitrogen (N) and potassium (K) are rapidly leached out of Miami-Dade soils, while phosphorus (P) is bound so there is less need for this fertilizer component.

Fertilizers should be broadcast over the plant's root zone. Fertilizer spikes and banding could damage roots by chemical burning. Injecting fertilizer into the soil is inefficient and may pollute ground water.





Apply fertilizer in the plant root zone (striped area in diagram)

Organic fertilizers can be used and have the advantage of slowly releasing nutrients as they breakdown in the soil into a form that can be used by the plant. You may need to add a quick-release traditional fertilizer if plants are showing nutritional deficiencies.

Slow-release fertilizers are preferable in most instances since they help to slow the rapid leaching of nutrients. In a few cases, such as a nutrient-deficient plant where more rapid availability is necessary, individual chemicals (potassium sulfate, magnesium sulfate, or manganese sulfate) may be needed. Some micronutrients can be applied as foliar sprays if needed.

Plant nutrient deficiencies can often be diagnosed by symptoms that affect the plant's appearance, such as leaf color and shape, as well as abnormalities in the developing fruit. In many instances nutrient deficiencies as well as excess fertilization can kill plants, or so weaken a plant that it is more prone to insect attack or disease.

A word of caution – overfertilizing plants can be very detrimental, causing excessive plant growth (more prone to

insects and diseases), reduced fruit and vegetable yields, as well as polluting our water.

For details on the symptoms of nutritional deficiencies and fertilizer recommendations, consult your local Extension office.



Pests and Disease

The first principle in controlling pests and diseases is to follow good gardening practices so that plants receive adequate light, water and nutrition and are therefore less susceptible to disease or insect attack. Use least toxic pest controls before resorting to more toxic pesticides.

For handling pests and disease in your garden, keep in mind the following suggestions:

- Do not spray chemicals without first knowing the nature of the problem. If you need help, contact the Miami-Dade County Extension Service.
- If you must spray, use least toxic materials first, such as an insecticidal soap or ultra-fine horticultural oil for insect pests. Be especially careful of what and

when material can be sprayed on food crops (Read The Label).

- More toxic insecticides can make the problem worse by killing natural predators and parasites that help to control pest populations. Also, many pesticides (i.e. Sevin) are highly toxic to bees, so avoid spraying when bees are active.
- Disease problems on vegetables can often be reduced by watering plants in the early morning and keeping moisture off the foliage.
- Choose disease resistant varieties of vegetables.

Optional Structures for Raised Beds

Trellises and Row Covers Augmenting a raised bed with either of these structures is useful, and even necessary, when growing many vegetables. Use a trellis for vegetable crops that require physical support (such as tomatoes, beans, cucumber or chayote). Trellising can be in the form of a frame that is sunk into the soil, or a cage with the lattice supported by metal or plastic hoops. Place trellises on the north end of bed to avoid shading nearby plants.



Sprawling plants, such as cucumber vines, can grow vertically on a frame or trellis. Pole beans, snap peas and small varieties of squash can climb a chain link fence or an A-frame from which fruits



hang for easy picking. Tomato towers, purchased or homemade, are convenient for all climbing vegetables.

Use string or plastic mesh rather than chicken wire to provide the latticework for plant support/attachment. After harvesting is finished the plants and netting can all be disposed of together, rather than trying to disentangle plant parts from wire mesh.

Row covers are invaluable if crop damage from birds is anticipated, and can be purchased as an add on to a raised bed kit or constructed using metal wire hoops or plastic tubing as supports for protective netting.



Elevated Beds You can make a planting box with a plywood bottom (make sure to drill holes for drainage) and place on legs for wheelchair access. This is also helpful for those who aren't able to bend over.



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