Raised Bed Gardening

By Kate Gardner, Planet Natural – reprinted with permission www.planetnatural.com

For centuries, people have been gardening in raised beds. Since these are merely garden beds where the soil level is higher than that on the paths around them, it may not be obvious what advantages they offer -- except to gardeners with bad backs, that is, who don't have to stoop as far to tend plants. Actually, though, raised beds improve drainage, use space more efficiently, increase yield, and simplify the control of weeds and pests. These are things that benefit all gardeners, including those whose backs are in excellent condition.

Advantages of Raised Beds

Improved Soil

The soil in raised beds is usually superior to that in row gardens in part because it never gets stepped on (much less subjected to the weight of machines) and therefore does not get compacted. Beyond that, filling beds usually becomes an opportunity to get high-quality soil and to fine-tune the mix of fertilizer and amendments. This is a more affordable (and therefore attractive) prospect than it might at first seem since none of these additions get wasted on or in paths: all the good stuff goes into the beds themselves.

Improved Drainage

Raised beds are made to order for those whose native soil drains either too quickly *or* too slowly. The mere fact of being raised improves drainage in clay soils, but the real kicker is that you can mix the soil to your own specifications, creating a fine loam even where clay or sandy soil prevails.

Increased Yield

Raised beds warm up more quickly than does the surrounding soil in spring, so it's possible to plant in them earlier than in a flat bed. The light soil improves the movement of both water and air, and roots can spread out in search of nutrients more easily than in compacted dirt. It's therefore possible to plant a raised bed more densely than one would the same amount of space in a traditional garden, which translates into higher yields. Learn more about intensive square foot gardening here.

Yields increase also because more of the garden can be planted than in conventional gardens. A traditional garden laid out in narrow rows devotes over half its space to paths. Raised beds require either wide rows or enclosed beds, both of which can cut the amount of space used by paths by a third to a half. As a result, more of the garden can actually be used to grow things, rather than to walk around them.

Simplified Weed & Pest Control

The dense planting in a raised garden makes weeding difficult, so it's a good thing that it also crowds weeds out. The walls of most raised beds create at least a partial block to many blowing seeds and to most rhizomous plants. Where aggressive weeds are a problem, raised beds can be established on top of a layer of weed cloth, blocking roots out completely. When sequential planting and cover crops are used, ensuring that there is no bare dirt for weeds to colonize, weed problems drop off to almost nothing.

Other pests can also be more easily controlled in a raised bed. Rodents can often be blocked-out below with metal screens, and birds from above with netting or row covers. Of course, any garden can be covered, but since raised beds are usually small and intensively planted, doing so is easier than in a large, conventional garden. Snails and slugs can't easily find their way into raised beds, and are more easily located and removed once they do make it.

Easy Access
Even those who don't have back problems can appreciate stooping less or not at all when they garden. For those who do have back problems, (or knee problems, or any of a dozen other physical limitations) the raised bed can make the difference between gardening and not gardening. Permanent enclosed beds, built to the correct height and width (usually about two feet high and three wide) make it possible to garden from a wheelchair. Large timbers provide room to sit down right next to the growing space, without kneeling or squatting, saving wear and tear on knees and other joints.

Potential Disadvantages

If you try hard enough, you can probably come up with a couple of possible disadvantages to raised beds. Fortunately, careful planning can do much to offset even these problems.

First, it can be harder to work the soil deeply in a raised bed with sides. Digging compost or fertilizer into the top few inches of soil is a breeze, especially as the soil tends to be nice and loose to begin with. But working with a shovel can be an act for a tight-rope walker, especially if the bed is over a foot high.

However, a good soil mix should eliminate the need for deep digging. To add nutrients, compost can be laid over the top of the bed in spring and fall; worms will do the mixing work. Slow release fertilizers can be mixed with the compost in fall or dug into the top few inches of soil in spring or between crops. Liquid fertilizers can also be applied as foliar sprays. In other words, deep digging shouldn't be necessary.

The second potential disadvantage is one you might read about here and there: raised beds supposedly require more water than the equivalent space in a ground level bed, and not only because they usually support more plants per square foot. Few raised beds have water-tight sides, so some evaporation occurs there. Furthermore, since the soil in raised beds is warmer than that in flat ones, evaporation rates rise again. Finally, dense planting increases water use and loss through transpiration.

All of these things are true, but it doesn't always follow that a raised bed will require more water than one at ground level. A large row-garden watered with any sprinkler system will use (and waste) more water than a raised bed with a drip hose, because the sprinkler waters paths as well as garden rows. Even if the rows have individual drip hoses, they are probably vulnerable to a higher evaporation rate because more soil is exposed than in a densely planted raised bed.

At any rate, the real question is not whether a raised bed requires more water *per square foot of soil*, but whether it requires more *per plant*. If one separated the crops in a raised bed garden into individual ground level beds, the water needed to irrigate them all (even with drip hoses) would almost certainly be more than that needed to water the single raised bed they share.

This is not to imply that water use isn't an issue: it is, and water use in raised beds can be reduced by building a tight, solid structure lined with impermeable plastic, and by using drip hoses or similar systems rather than sprinklers. Drip systems put water where it's needed, near the roots, which reduces loss through evaporation.

Good watering practices also make a difference. These include watering only in early morning or evening, only when plants really need it, and always to a depth of six to ten inches. Some water in the top layer of soil is always lost to evaporation, while more of the water that penetrates soil deeply can actually be taken up by plants. But plants with shallow roots cannot reach it. Deep, infrequent watering (of mature plants, of course, not seedlings) helps plants develop deep, complex root systems, which in turn lowers water use.

In order for those deep roots to develop, the soil must hold water well. A soil mix high in organic matter will retain water for several days to a week, allowing plants to draw moisture and nutrients from deep in the bed. So even the soil mix can help reduce how much water gets used, and wasted, in a garden bed.

The last "problem" with raised beds is that they have to be built. And the only answer to that one is -- yes, they do. But they're worth it, and building them needn't take a huge amount of your time or your money. The list of Other Resources at the end of this article includes sites that give step-by-step procedures for making a specific raised bed to specific specifications, as well as sites that take a broader approach. The rest of this article covers a number of different types of raised beds in some detail.

Making a Raised Bed

Types of Raised Beds

Temporary raised beds are simply mounded earth, usually in rows two to four feet wide. Permanent beds can be built of wood, brick, concrete, metal, stone, or plastic. Even bales of straw can be pressed into service for what might be called a semi-permanent structure. Planting in pots or container gardening is similar to growing in miniature raised beds and offers many of the advantages of their larger cousins.

If you want something permanent but you'd rather not build your own structure, pre-fabricated raised bed kits can be bought online from a number of different companies. Or, stock watering troughs made of metal or various plastics create an instant container. (Well, almost instant; it *is* necessary to drill holes in the bottom.)

The metal troughs in this picture appear shallower than they actually are, as they were sunk in the earth.

Planning

Site Selection
If you're already a gardener, you know that location, location, location holds true for gardening beds as well as for houses. Keep in mind sun, wind, water, and drainage when selecting a site.

Though a permanent raised bed garden can overcome most drainage problems, it's still not ideal to build one in an area that doesn't drain well. If the soil below it is water-logged or hard-packed, even a raised bed will have difficulty draining. However, if that's otherwise the best or the only choice, check the design section below for compensating features you can build into your plan.

Water In and Water Out: Irrigation & Drainage
Efficiency becomes more and more important as major aquifers drop to unprecedented levels and extended droughts and water shortages affect more and more cities and regions. Even if you live where water appears to be plentiful, it is wise to plan for possible shortages or drought.

Conventional sprinklers use water inefficiently because much falls on paths and more evaporates, both in the air as it travels towards its destination, and then from leaves once it arrives. Sprinklers simply don't work in gardens with high raised beds, since the walls of the beds block the water.

An automatic sprinkler system with spigots at soil level in the raised beds (not at ground level below them) eliminates the problems mentioned above, but leaves another one which applies to all sprinkling systems: they wet foliage, not soil, and damp foliage is vulnerable to disease and fungi, especially in humid climates.

Fortunately, there is an excellent alternative.

Drip irrigation may sound expensive or high-tech, but nothing could be simpler either to understand or to use than a soaker hose. These porous, flexible hoses can be wound around in a confined space, but like ordinary hoses they are also somewhat stiff, so there are limits to their flexibility. It can take a bit of time to get the best arrangement for a particular bed -- and doing this after planting can be nightmarish. It's all too easy to knock over young, vulnerable plants. Take the time, therefore, to set hoses before planting, or at least before seedlings emerge. Read more about drip irrigation for home gardens here - PDF format.

Hoses draped over a planter violate many people's aesthetic standards, and those lying about on paths can trip the unwary. To avoid these hazards, hoses that bring water from a spigot can be buried to the edge of a bed and then run up the inside of it. If all goes smoothly, the end of the hose will be just at the level of the dirt in the bed, where it's available to connect to a soaker hose.

If your local soil doesn't drain well, either because it's boggy or because it's hardpan, you'll need to compensate. One of the simplest plans is to use an enclosed container -- something with a bottom, such as the watering troughs mentioned above -- and set it on cement blocks. In a really boggy site, though, those blocks will themselves need to be set on long, broad timbers, which will distribute the weight of the bed over a greater surface area.

Alternatively, a trench can be dug sloping downwards from the bed to a "sink" some distance away. Filling the trenches with pebbles helps prevent them from silting up. For more details about building drainage trenches, see the Texas A&M page on "Planning a Raised Bed Garden."

Even soil that drains adequately should be graded to avoid problems during heavy rains. It's a well-known dictum of landscaping that all beds should slope away from structures and away from the center of the bed. Most experts recommend a drop of a quarter inch over each horizontal foot, which works out to about a 2 percent slope.

Containers such as barrels and large pots generally dry out faster than ground-level soil or larger raised beds, both because they have much more surface area in relation to the volume of soil they contain, and because they are so densely planted. Hand watering is always an option, but it's also possible to have a drip system installed, or to build your own from kits and parts available at hardware stores.

Yet another, more low-tech option is described by Gayla Sanders, who blogged her way to gardening fame with **You Grow Girl**. In both the blog and the resulting book by the same name, Sanders describes the innovative and inexpensive techniques she uses on her Toronto roof garden. One of these techniques is the "Soda Pop Drip Irrigation System," which converts any large pop bottle into the kind of watering system every plant thirsts for. You just cut off the bottom of the bottle, drill holes in the lid (carefully, with a small bit), fill the bottle, and invert it, setting it into a prepared hole. Sanders recommends burying at least a third of the bottle, so that the water reaches the plants' roots rather than merely moistening the surface soil. All the details, with pictures, are available on her website (link above).

Height, Width, Depth
Raised beds don't have to be very high to be effective. Even a six-inch rise will mean warmer, less compacted soil, and a commensurate increase in soil quality and therefore in plant growth and productivity.

It's possible to increase soil depth without building the bed higher, by the technique known as "double digging." This involves digging all the soil out of the planned plot down to one spade depth. This soil is set aside. Then, you loosen the soil to the depth of one more spade-length, before returning the topsoil bit by bit and *mixing the layers*. This technique lightens and aerates the lower layer of the soil, in essence giving your plants a deeper layer of topsoil in which to grow.

The width of a raised bed is a matter of comfort and preference. Four feet seems to have become the recommended standard, because most people can still weed and tend plants at a two-foot reach, but not much beyond. The whole point of a raised bed -- that the soil doesn't get compacted -- is lost once the thing becomes so large that you have to walk all over it in order to tend it.

Gardening from a wheelchair usually requires a higher but narrower bed. Christopher Starbuck, of the University of Missouri Extension, recommends a bed two feet high and three feet wide. However, wheelchairs and wheelchair users differ significantly, so it's best to consult the particular person, if that's possible.

One Bed or Two?
Suppose you have a space measuring approximately thirteen feet by seven. Leaving space around the outside for access, do you build one bed measuring four feet by ten, or two smaller beds?

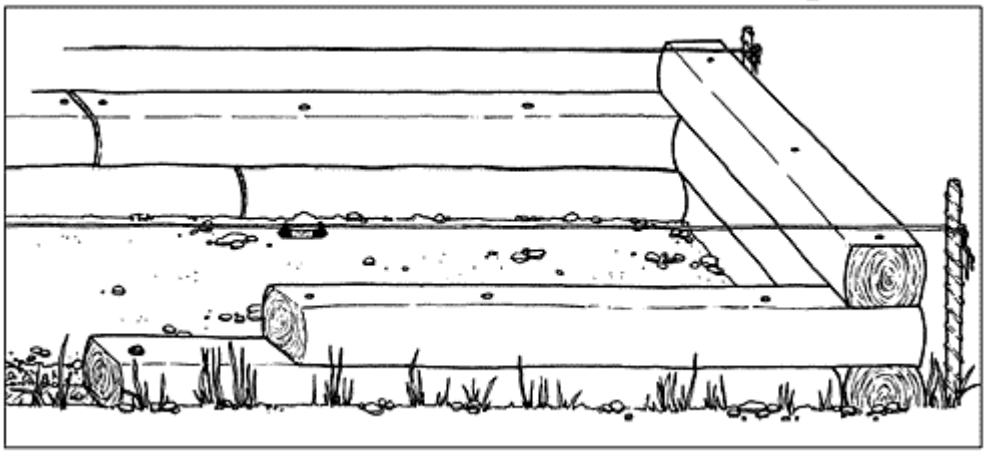
If you're tall and flexible, reaching the center of a four-foot wide bed will not be a problem. Take away either of those advantages, though, and the bed's center becomes increasingly elusive. For our height- or flexibility-challenged client, reaching the center of a four-foot wide bed, all down its ten-foot length, can be -- well, a challenge. This person might be much happier with two beds, each about four feet by four, with a path between them. This arrangement means that she (or he) can now reach the bed from all four sides.

Path Width
Four-foot wide beds, with paths of twenty to twenty-four inches between them, get the most growing area out of a small garden, while still leaving room to navigate.

While anyone with limited space wants to maximize planting area, it's important to resist that temptation to make paths so narrow that you have to edge down them sideways, for in the push to limit the space "wasted" on paths, you'll eventually reach a point of diminishing returns. You'll know you've reached it when your paths are so narrow that your wheelbarrow won't fit down them, or you tumble into your carefully tended peppers trying to carry a bucket of compost between them.

Materials & Design
As should already be clear, both materials and design are widely variable. **Used railway ties** are an old standard, but since they were often treated with creosote, they have gained a bad reputation. While it is generally a good rule of thumb to avoid treated woods, the creosote in railway ties wears away with time, so if the ties appear dry (not slick, sticky, or oily) they are probably safe to use. If you have any doubts about these or any other wood, line the bed with a safe, impermeable material such as heavy-duty plastic (see Does Pressure-Treated Wood Belong in Your Garden?).

Ties, landscape timbers, or 4X4s can all be used in one of the simplest and most familiar designs, in which the timbers are laid on the ground and stacked to the desired height. Cedar is a favorite for this design for the same reason that it is used for hot-tubs and saunas: water doesn't rot it.



from Texas A&M's page on Constructing a Raised Bed Garden.

Some designs call for rebar to be driven through the timbers into the soil, and for upper timbers to be attached to lower ones with spikes. However, many people stack timbers directly on the ground, laying them like bricks so that each timber overlaps two in the row below it. The dirt filler stabilizes the timbers from the inside, and a piece of rebar or two along each outside wall, driven firmly into the dirt close to the timbers, will stabilize them from the outside.

Another popular design uses **boards** instead of timbers. At the corners, abutting boards are attached to L-shaped metal brackets or to posts (2x2 and up, depending on the size of the bed). Posts provide even greater stability if they are sunk into the ground.

Concrete blocks make a stable structure even without mortar, if you are only building them two or three rows high. Be sure to arrange the blocks as bricks are laid, so that each block overlaps half of two in the row below. If one block is set directly on top of the one beneath it, all bets concerning stability are off.

Retaining wall brick comes in various sizes, shapes, and colors, including curved bricks for curving walls. These bricks make building a breeze, as they're designed for stability without mortar.

Stone is another option, but building a stable stone wall is an art beyond the scope of this article (or its author). Flat stones are, obviously, much easier to deal with than rounded ones, and a low wall built of large flat rocks can be built by the determined beginner.

The stock watering troughs mentioned above make a pre-fabricated **metal** or **plastic** container. Since these troughs have bottoms, they're especially useful for areas where weeds are rampant or water scarce. The holes you drill in the bottom will allow for drainage, but don't give much access to weeds, and the nearly-solid bottom can significantly slow water loss.

Most materials do not affect the design as long as you're working with conventional rectangular beds, but if you want a curved wall, boards and timbers are probably out. However, **concrete**, **stone**, and **metal** all offer the possibility of curved (or semi-curved) walls. A proficient metal-worker can make beds to specifications, whether curved or straight. Those to the right were built to curve gently around a patio, and were slanted to make the most of southern sun in a northern state.

Old tires, a more unconventional building material, can also be used to create unconventional garden shapes. To learn how to transform aging tires into garden walls, visit the Samuel Roberts Noble Foundation, which has a great page on the topic.

Dealing with Existing Vegetation

As mentioned above, a fair number of people have laid a box made of timbers or boards on the ground, piled soil inside it, and ridden off into a happy gardener's sunset. If that ground, however, is already inhabited by an aggressive, rhizomous grass, or by weeds such as bindweed, kudzu, or creeping bellflower, it's best to kill off the existing vegetation before building the raised bed.

This can be done by covering the area with black plastic for two months, or by repeated spraying with organic mixtures such as lemon or clove oil. A single spraying will kill existing vegetation, but not deep tubers or extensive root systems.) Anything not killed by such treatments, which deprive plants of the foliage that feeds their roots for an entire season, will also not be killed by spraying conventional chemicals such as Roundup or 2-4D.

Building a bed on top of a good, tough weed barrier eliminates the need for these treatments. While cloth prevents earthworms and other organisms from traveling freely through different levels of soil, it can sometimes be the best choice. To prevent weeds from growing up around the edges of the cloth, make sure it extends all the way up the sides of the container. Another option is to lay down a piece of weed cloth that extends a foot or more beyond the dimensions of the container, covering the outside with bark or some other mulch.

An aggressive rhizomous grass can (and probably will) migrate under a timber and up through a foot or two of dirt, and once established, it can be surprisingly difficult to eradicate or remove. A barrier (or edging) that extends down into the earth below the root zone of the grass and up the inside of the container will block such incursions. While metal flashing is absolutely impermeable, it is also inflexible, so it can be more difficult to secure flush to the wall of the container. Weed cloth, on the other hand, can be stapled or even taped to the container wall, using duct tape, or it can be extended up the sides of the box.

The governing guideline for dealing with existing vegetation is this: know what you're dealing with, and plan accordingly. In particular, be aware that some plants can invade from the side, as well as from beneath.

Construction

The list of resources at the end of this page includes several blow-by-blow accounts of actual raised-bed building projects complete with photographs. These demonstrate the wide variety of options available, and the range of materials and designs.

Preparing the Site

Before you begin, read through the instructions below to decide which steps apply to your plan.

Remove vegetation if necessary. Either lay down plastic sheeting -- preferably black -- as much as two months before you plan to build, or hand-weed or spray with an organic weed killer. Even hand-pulling or cutting back weeds will help remove seeds from the site, especially in summer or fall.

Unless you're building on top of weed cloth, **loosen the soil** with a shovel, to facilitate mixing layers later. Mixing avoids abrupt changes in soil quality, which can interfere with plant growth.

Any hoses or connections for **irrigation** parts that will run up the inside of the beds should be put in place before edging or walls are installed. Consult someone local about how deeply hoses must be buried to avoid freezing in your region. Running a hose up the center of a planter (rather than next to the wall) will help protect it. Leave enough slack to angle or curve it as it nears the surface of the box, so it lies horizontally when it emerges, instead of poking straight up, which would make for an awkward connection to a drip hose.

Before you bury the feeder hose, cap the open end with a screw cap, a bit of plastic and an elastic band -- anything to keep dirt out. Bury the hose below the depth to which any "foundation" or edging will reach, bring it up inside the perimeter of the bed, and then find a way to keep it out of the way as you work. A plant support designed for delphiniums or possibly a tomato cage can keep the hose upright as you fill the bed later.

Building the Bed

Foundations. For brick, stone, or concrete walls more than 2' high, lay a concrete foundation 16 to 18" wide and 6 to 12 inches deep. Concrete can be poured directly into a dirt trench dug for this purpose, and should be left to cure for several days. A piece of 3/8" rebar inserted into the wet cement so that it lies horizontally the whole length of the wall provides reinforcement as soil shifts and settles. According to the Texas A&M site (see link below), this is especially important in clay soils. The surface should be carefully smoothed and leveled, so that the wall built on it will be stable.

Walls with concrete foundations won't need separate edging, unless you have very deep-rooted weeds. If you do, install edging at the bottom of the trench dug for the foundation, before pouring concrete.

For a wall that doesn't require a concrete foundation, dig a shallow trench to accommodate the bottom several inches of timbers, stones, or wood. A trenching shovel makes a neat, narrow cut, but leaves a curved bottom that isn't ideal for receiving squared timbers, so when you have the sides at the desired depth, sprinkle some loose dirt on the bottom and smooth it with the edge of the shovel. A square shovel leaves a flat bottom perfect for wider stones.

For a raised bed built of wood, dig deep holes at the corners to accommodate posts.

Install plastic or metal edging as a weed barrier at the perimeter, unless you're planning to use weed cloth. Metal flashing, which comes in various widths, makes a nearly impermeable barrier and can be easily bent around curves or corners. However, unlike the narrower metal edging made for the purpose, it can't be pounded into place, but must be placed in a pre-dug trench. Plastic edging works well for straight or gently curved shapes, but the curved lip on most types resists bending at a 90 degree angle. Since it is usually only 6" wide, it only deters shallow-rooted weeds.

Lay weed cloth if you're building on top of it, overlapping adjoining edges by six inches or more. Dirt between the edges will separate them, providing a pathway for weeds, so do your best to keep the overlap clean. Hold the cloth in place with rocks or garden staples. To prevent really pernicious weeds from emerging through the staple holes (some weeds can and will seek out holes that small and separate) cover them with duct tape. Weed cloth that will extend out beyond the edges of the bed should be fitted down into foundation trenches, so it doesn't tear when timbers or stones are lowered. Cloth that will cover the inside walls should be weighted with stones or some loose dirt, then folded towards the middle of the bed and if necessary tied there, like a sheaf of corn, to keep it out of the way.

The Structure

Watering Troughs. Since stock watering troughs come in a single, solid piece (no assembly required), they are probably the simplest containers available -- so simple that including them in the "construction" section may seem quite odd. However, even these containers do need a couple of prefatory steps before they're ready to use.

First of all, since they're designed to hold water, they won't drain, which is not a good thing in an outdoor garden bed. A number of large holes therefore need to be drilled in the bottom. Any standard drill fitted with a wide-bore bit suitable for drilling metal should work fine.

Brick. Wet the concrete foundation and, starting at one corner, spread mortar down the center in a stripe about an inch thick and two feet long. Set the first brick at the corner, tapping it with the mortar trowel until the mortar is only half an inch thick or so. Spread mortar on one end of the next brick and lay it about 3/8th of an inch from the first. Again, tap it into place and scrape away the excess mortar. Repeat until you have laid the first "course," or row. Lay the second course so that each brick overlaps two bricks in the row below. Continue this overlapping structure until the desired height is reached.

Concrete Blocks. Walls built of conventional concrete blocks probably don't need mortar if they are only one or two courses high. Taller ones should be laid and mortared as bricks are.

Some blocks designed for walls have projecting tabs or lips built into their backs so that they lock in place and can't be shoved forwards by the pressure of dirt behind the wall. These blocks do not require mortar. Check the particular blocks you're using, and ask for information at the store where you purchase them.

Timbers. Landscape timbers should be laid flat, with no space between adjoining pieces. For extra stability, drill holes through the timbers at a 20 degree angle and drive rebar through them and at least twelve inches into the earth below. Lay upper layers like bricks, so that they overlap two timbers below them, especially at the corners. The end of one timber should never align with the end of a timber underneath it. Again, this is especially important at the corners. Consult the diagram above to see the correct alignment. Galvanized spikes can be used to secure each layer to the one below, but with low walls this may not be necessary.

Wooden Boards. Depending on the size of the bed, a wooden box can be constructed ahead of time and then set in place, or it can be built in situ. It's important to level the ground beneath the frame first. Where the edge of the wood doesn't meet the ground, earth and water can trickle out, creating an increasingly large hole at the edge of the bed.

The simplest model is a small rectangle with metal brackets screwed into the inside corners to hold the boards together. Two brackets at each corner, one set several inches above the other, will give far more stability than a single bracket. Once your box is assembled, set it in place, fill it with dirt, and you're done.

A larger bed may need to be built in place, and will be more stable if corner posts are used instead of metal brackets. A shallow trench should be dug for the boards if they will be sunk below ground level. Posts (4x4s work well) should be buried about a foot deep, and should be as high as the wall.

Screw or nail the end boards to the posts, then set them in place. With a board over the post-ends to protect them, use a mallet or sledge hammer to drive the posts partway down into the holes and loosened dirt you've prepared for them. Attach the lowest side boards to the posts and if necessary to each other, using a board or metal bracket on the inside of the structure. Hammer the posts home, sinking the bottom boards to the desired height. Check that the boards are level, then build the walls up to the top of the posts.

Irrigation and Weather Protection
This is the last chance to install irrigation systems before the frames are filled. It is also the perfect time to install additions that protect against moles from below or birds from above.

To deter moles and others who come from below, lay pre-cut wire mesh or screen (aka hardware cloth) in the bottom of the bed, cutting corners to fit around corner posts. To deter birds, extend the growing season, and protect crops from flying pests such as leaf miners, install supports for hoops that can be draped with row covers or bird netting.

To build the supports, secure a 6- to 12-inch length of 1" PVC pipe to the inside of the frame, using pre-formed tube straps. Place the first and last pipes two feet from the ends of the bed, and the others at approximately four-foot intervals, using two straps for each pipe. To cover the bed, bend 1/2-inch PVC into an arch and fit the ends into the secured supports. A 6-foot length of PVC will create nearly a semi-circular arch over a 4-foot wide bed. Visit Sunset magazine on-line for a useful article that includes pictures of this technique.

Soil
Have on hand all the ingredients for your soil mix before you start filling the beds, and pre-mix as much as possible, on a large tarp if necessary, to avoid pockets of clay or fertilizer or any other material. If you're not sure about the quality of your starter soil, or if you know that it's got more sand or clay than is optimal, add extra organic matter in the form of coconut coir, peat moss, or, if you have alkaline soil, pine or spruce duff. Compost -- plenty of it -- will always improve soil, no matter how good it is to start with. You can also add slow-release fertilizers such as blood meal for nitrogen, bone meal for phosphorus, and greensand for potassium. Don't add wood ashes until you two weeks before you plan to plant, because the nutrients in them will leach out.

Put about a shovel's depth of new soil into the planter, and mix it with the loosened soil below. This may seem pointless with a deep planter in which roots are unlikely to reach the original ground-level, but it will encourage the activity of earthworms and micro-organisms on which soil health (and therefore plant health) depends.

Mix the next layer of earth with the previous one, but after that, fill at will, stopping an inch or two short of the top. Since the soil will settle with time, you may need to add more later, but resist the urge to avoid this step by piling dirt into the container above its edges. Overfilling now will mean a royal mess with the first rain. Dips or hollows can become permanent soggy spots, so grade the surface into a slight mound, with the dirt sloping gently away from the center of the planter and away from any structures.

You can plant a shallow bed immediately, though it's best to let any bed settle for a couple of weeks before using it.

Planting and Maintenance

Planting

Several planting techniques help one get the most out of a raised bed.

Given the tight planting found in most raised beds, it can be difficult to spray a nitrogen-rich fertilizer on some plants without getting it on others nearby. The same is true of topdressing or side dressing, so group plants that have similar needs (water, nutrients, sunlight) together for ease of care.

Put plants that need less care near the middle of the bed, saving the easy-to-reach edge for those that require more fussing. In general, plant taller plants on the north side of the bed and smaller ones towards the south, so that all get adequate sunlight. However, if the bed can only be accessed from one side, put the taller plants toward the back and shorter ones toward the front.

Succession planting, which involves planting more than one crop in a season, will let you raise more vegetables in the small area afforded by a raised bed. For instance cold-weather crops such as lettuce or spinach can be planted and harvested before planting melons or tomatoes.

Companion planting, a form of intercropping, involves planting compatible plants together in the same plot. This too lets you grow more in a small space. Carrots and basil can grow below tomatoes, for example, and bush beans can be planted in a strawberry bed. Succession and companion planting also help keep weeds down, because they ensure that there's very little bare ground on which a seed can find purchase.

After seeds have emerged, cover bare soil with an organic mulch such as bark, leaf mold or chipped wood. These materials will discourage weeds while helping soil to retain moisture. Over time, they will break down and be incorporated into the soil, adding organic material and improving soil structure. It may seem counter-intuitive, but mulch should not be mounded around plant stems, as it can also harbor pests and diseases. Pile it thickest, therefore, in the spaces between plants.

Maintenance

If you mixed your soil well, it may retain water better than any soil you've worked with before, but without becoming water-logged or heavy as clay soils do. Don't rush to water, therefore. Once plants are mature, let the top inch of soil dry out before watering, and dig down a full six inches from time to time to see how well the soil is retaining moisture.

Since organic mulches break down and inorganic ones scatter or fray, renew the supply from time to time. The mulch should be three or four inches deep between plants.

The excellent soil in most raised beds makes intensive planting possible, but even the best soil will need rejuvenating over time. If you practice succession planting, it's a good idea to dig slow-release organic fertilizer into the top few inches of soil when you pull one crop and prepare to plant the next one. Use a foliar fertilizer to help ensure that your plants get the nutrients they need without depleting the soil. Rotating vegetable crops over a four year cycle also helps guard against soil depletion, as well as preventing a disease or pest that got a start one year from going full bore the next. Finally, spread a couple of inches of compost on top of the bed each spring and each fall, to renew the supply of organic matter in the soil.

Other Resources

"Raised-Bed Gardening"
Christopher J. Starbuck
Department of Horticulture, U. Missouri Extension, March 2003.
Covers many issues about raised bed gardening, from advantages, to construction out of lumber or stone, a good height for access from a wheel-chair, all the way to maintenance.

"The Perfect Raised Bed"
Jim McCausland
Sunset: Living in the West
Simple instructions with clear photographs on how to build a basic wood-frame raised bed. Look at this to see how easy it can be.

"How to Build a Raised Bed with Retaining Wall Bricks"
Chris Beasley,
Backyard Gardening, How-To Tutorials, May 2006.
A detailed, blow-by-blow account of building a curved raised bed with bricks that interlock at the back, eliminating the need for mortar.

"Gardens that Last for Years - Raised Bed Gardens, a Technique that Works!"
The Samuel Roberts Noble Foundation, 1998.
A different approach, this site explains how to make "rubber boards" out of old tires, and how to build a raised bed from them. The eco-friendly approach is novel and appealing and the explanation clear, but the absence of pictures is a real drawback.

"Building a Raised Bed Garden"
Priscilla J. Files et al.
Texas A&M University, January 2001.
In keeping with Texas A&M's reputation as a premier agriculture school, its site on raised beds is one of the most thorough out there, with separate pages on Planning, Construction, Planting and Mulching, Maintaining, and Further Reading. The later three pages are reassuringly brief, but the first two are quite extensive. They deal with issues not covered by most sites, such as ideal slope for drainage, best emitter spacing for drip irrigation systems, how to work around existing trees, and so on. Thorough, readable, but concise.