The New Tire Gardener

Novel Raised Bed and Garden Planter Options Using Scrap Tires

Steve Upson, Horticulture Consultant

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Introduction

According to the United States Tire Manufacturers Association (USTMA) during 2017 more than 81 percent of scrap tires were repurposed for use as fuel; for artificial reefs and playground equipment; split tires for floor mats, belts, and dock bumpers; crumb rubber for mudguards, carpet padding, tracks and athletic surfaces; and shredded tires for road embankment or road fill material.

As a horticulturist, I find it interesting that one category was omitted from their report probably because it is not considered to be a commercial enterprise: garden beds and containers. During my tenure with NRI, I have had the opportunity to visit hundreds of gardens; gardens of all types, school gardens, community gardens, backyard gardens and market gardens. During these visits I routinely come across old tractor, truck and automobile tires repurposed as garden beds.

For generations, tires of all shapes and sizes have been used by city dwellers and country folk alike to grow fruit and vegetable crops. What is it about old tires that make them attractive for gardening?

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Introduction (cont'd)

For most folks, cost is the primary consideration. Most tire shops have no problem giving away tires destined for recycling. You will need to load your own but this is worth the work considering the tires are free.

Because tires don't rot or rust they will provide countless years of service when used as rubber lumber, a growing container or as a platform for bed construction. It is estimated that an intact tire can take several hundred years to breakdown. Because of this durability, the annual cost of maintaining a bed or container made from tires is very low.

Repurposing tires to support crop production is environmentally friendly. What can be more rewarding than transforming a waste product into growing systems that foster environmental sustainability, enhance quality of life and generate wealth?

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Introduction (cont'd)

Questions pertaining to the potential adverse health effects caused by heavy metal leachates from tires arise from time to time. While there is no argument that tires contain traces of heavy metals and other organic contaminants, there is no direct evidence that intact tires or tire tread used as borders for raised garden beds leach these contaminants into the soil. If tires were susceptible to leaching they would lose their ability to stay inflated over time. Leaching doesn't occur (or occurs at a miniscule level) because the ingredients are bound up in the rubber matrix during the cooking and curing process. Of course the choice to use or not to use tires in the garden is up to the individual. If you are not comfortable in using tires there are plenty of other materials available for constructing raised bed and container gardens.

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Introduction (cont'd)

This publication represents 25 years of research, development and demonstrating new and novel ways scrap tires can be used to grow specialty crops. Along the way many concepts were researched and many bed/planter designs were evaluated.

The build-your-own construction guides contained in this resource represent the best of the planter and raised bed designs developed at the Noble Research Institute. Each of these guides were originally released as separate publications. The New Tire Gardener is a compilation of the guides, two of which have been extensively revised since first being released.

Our first construction guide "Rubber Lumber Raised Bed" was released in 1997. It documented the use of scrap tires to fabricate rubber lumber for use in raised bed construction. The revised guide offers better graphics and is more detailed compared to the original.

The "Easy Access Raised Garden Bed" construction guide was released in 2015. This particular bed was designed in response to requests by gardeners for a relatively low cost bed with a sufficiently high growing platform to enable gardening in the standing position.

Rubber Lumber Bed under construction

Easy Access Bed

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Introduction (cont'd)

In the past three years, two additional construction guides have been released. The largest of the two new planters looks similar to a bunk livestock feeder, hence the name "Bunk Planter". Due to its novel design, the bunk planter can be easily fitted with a greenhouse cover for extended season growing.

The "Modular Tire Planter" derives its name from a stack of tires, a common practice used to create a planter that has been around a long time. This guide provides instructions on taking the stacking concept to a whole new level.

I trust you will experience much joy, satisfaction and success as you assemble and utilize the planter/bed model(s) of your choice.

Bunk Planter

Modular Tire Planter

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Rubber Lumber Raised Bed

Steve Upson, Horticulture Consultant

Introduction

The ‘Rubber Lumber Raised Garden Bed’ represents our first attempt to incorporate the use of scrap tires in the design and construction of a permanent raised bed. The idea of using tire tread in bed construction came in the early 1990’s, a time when the use of treated lumber was being questioned as a construction material in home gardens. To us, tire tread used as rubber lumber seemed to be a logical alternative to the use of arsenic treated lumber. We appreciated the fact that tire tread offered a longer service life compared to lumber. The biggest selling point, however, was the purchase price; there wasn’t any! All of the scrap tires used in our demonstration projects were obtained from local tire stores at no cost. Three decades later scrap tires are still available at no cost. Your only cost will be the time and fuel required to pick up the tires.

Introduction (cont'd)

These plans provide detailed instructions on constructing the latest version of our rubber lumber raised bed. Many years of trial and error, observation, modification and evaluation under field conditions have gone into the development of this bed. The bed has proven successful in producing a wide variety of vegetable, fruit and floral crops.

While material cost is minimum, a fair amount of time and labor is required to fabricate rubber lumber. If hired help is used for this task, the cost of advantage of using rubber lumber in bed construction is lost.

Now for the good news! Cost of material to construct a scrap tire rubber lumber bed, excluding soil, runs as low as 40 cents per square foot or about $1.20 per running foot.

Tire Selection

The ideal tire for use in rubber lumber fabrication is a well worn, common passenger car, SUV or light truck tire. The lack of tread makes the tire more flexible and easier to work with. The majority of midsize car tires offer a combination of flexibility and acceptable tread length. Avoid high performance, low profile tires with narrow side walls as they are typically built sturdier thus requiring more energy to cut through. Also avoid self-sealing tires as the sealant is not compatible with gardening.

Low profile tire

On left: Avoid scrap tires with excessive tread remaining.
On right: Choose well worn tires with minimal tread remaining.

Tire Selection (cont'd)

When fabricating rubber lumber to construct a raised bed it is important to select tires having the same (or close to the same) width. The sections of tread must overlap each other uniformly in order to fabricate a uniform piece of lumber.

A standard passenger car tire with sidewalls removed and the loop of tread severed produces a section of tread 6-7 feet in length. On average, one tire is required for every 3 running feet of bed.

The use of a matched set of scrap tires enables the fabrication of a uniform piece of rubber lumber.

Rubber Lumber Fabrication

Tool Requirement

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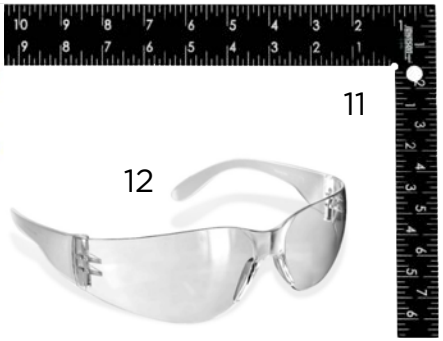

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No	Item
1	Jig saw equipped with hacksaw blades
2	Angle grinder
3	Impact driver (with appropriate bits)
4	Drill (with ¼-inch drill bit)
5	Plastic long tape
6	Retractable tape measure
7	Sharpie paint marker
8	Utility knife with standard and hook blades
9	Ratchet with appropriate size socket
10	Quick release bar clamps (two)
11	Carpenter's square (8-inch x 12-inch)
12	Eye protection
13	Welder's gloves

Parts List (01/20)

Item	Quantity	Unit	Total
Scrap auto/light truck tires*	Variable	N/A	No cost
#9 x 1-½-inch hex-head self tapping roofing screws **	Variable	$0.09/screw	Variable
¼-inch x 1-1/2-inch hot dipped galvanized hex head bolts ***	Variable	$0.35/bolt	Variable
¼-inch galvanized nuts ****	Variable	$0.035/nut	Variable
¼-inch galvanized flat washers *****	Variable	$0.03/washer	Variable

*Number dependent on tire size and bed length. On average one tire is required for every 3 running feet of bed. Two additional tires are required to frame the ends of the bed.

** On average two screws required for each foot of rubber lumber (does not include end pieces). Six screws required for each end piece.

*** Four bolts required for each piece of tread used in rubber lumber fabrication.

**** One nut required for every bolt used.

***** Two washers required for every bolt used.

Rubber Lumber Fabrication

You will need an elevated work surface to fabricate the lumber. For short pieces a large work bench will do. Protruding screw tips can damage your workbench surface, so it's a good idea to cover the surface with a piece of particle board. When fabricating extended lengths of lumber consider using 2-inch x 10-inch X 10-foot long boards supported by saw horses or concrete blocks. The work bench should measure at least two feet longer than the length of lumber you want to fabricate. Mark the boards every 18 inches as shown. The lines identify the location of the pockets that will be attached to the lumber later in the fabrication process.

A simple elevated work surface for fabricating rubber lumber is a back saver!

Rubber Lumber Fabrication (cont'd)

With most tires it is difficult to determine where the side wall ends and the tread begins. This junction (where sidewall and tread meet) will vary slightly between makes of tires. Some tires come equipped with a raised or lowered area at this junction that can be used as a guide when cutting. When selecting tires look for this trait. A paint pen can be used to mark the cut line to assist you in making an accurate cut. Uniform cuts produce sections of tread with straight edges. Straight edges produce straight lumber.

Ready made cutting line

Rubber Lumber Fabrication (cont'd)

Start fabrication process by removing sidewalls from tires. Use a utility knife to cut a small slit in the tire sidewall as shown. The slit should be large enough to insert a jigsaw blade. On smaller tires having thin side walls it is possible to remove the side walls using only a utility knife. This technique is fine for cutting a few tires, however, for larger jobs plan on using a jigsaw. Your wrist and forearm will thank you for it! Cut as close to the tread as possible without cutting into the steel belts. Tread sections with even the smallest amount of sidewall remaining can prove difficult to use during lumber fabrication so be sure and cut close.

Rubber Lumber Fabrication (cont'd)

For removing side walls using a jigsaw, fine-toothed blades are preferred. We have good results using blades with 17-24 teeth per inch (TPI). If you happen to cut into some of the steel belts by accident there is no need to panic. The steel wire exposed on the tread can be removed using an angle grinder. Plan on practicing on a few tires to get a feel for where the steel belting is located. Also practice making a uniform and consistent cut while removing the sidewalls. To reduce the amount of tension on the blade when cutting, insert a piece of tubing between the sidewall and tread as shown.

Rubber Lumber Fabrication (cont'd)

Using a jigsaw, make a single cut through the tread at any point along the loop. We recommend a jigsaw equipped with blades having 11-14 TPI. The larger teeth enable easy cutting through steel belts.

Cutting through a loop of tread can be an awkward experience. To make this procedure easier and safer consider using a cutting jig. An inexpensive jig can be assembled from a few pieces of lumber.

Jig mounted to work table using bar clamps. Note the use of concrete block as a counterweight.

Tool Requirement

Note: Center 2 x 4's on base as shown. Leave 1-inch gap between boards to accommodate saw blade.

Parts List	
Item	**Quantity**
2-inch x 10-inch x 24-inch board	1
2-inch x 4-inch x 32-inch board	2
3-inch deck screws	8

Tool Requirement	
Item	**Quantity**
Quick release bar clamps	2
Spring clamps	2

Rubber Lumber Fabrication (cont'd)

To facilitate cutting through tread in a straight line, use a paint pen and a square to mark the tread as shown.

Loop of tread secured to jig using spring clamps. Ready to cut.

Cutting through tread.

Rubber Lumber Fabrication (cont'd)

After the loop of tread is severed, lay the section of tread on the floor and examine for cupping. In a perfect scenario the section of tread will lay flat on the floor. In reality most sections will exhibit some cupping but on occasion a section of tread will exhibit extreme cupping making it unsuitable for rubber lumber fabrication. In most cases these severely cupped sections can be cut up for pockets or used as end pieces in bed construction.

Section of tread exhibiting severe cupping.

The lower (flat) section of tread is preferred because it presents less issues during lumber fabrication.

Rubber Lumber Fabrication (cont'd)

Designate a separate tire(s) to fabricate pockets for the rubber lumber. In order for the pockets to fit properly on the rubber lumber the tread used in making the pockets should never be wider than the tread used in making the rubber lumber. Prior to cutting, use a paint pen and a square to mark off 6-inch wide pieces of tread as shown.

Rubber Lumber Fabrication (cont'd)

Using a jigsaw equipped with 11-14 TPI blades, cut pocket pieces from the previously marked sections of tread. The use of a pocket cutting jig makes this task much easier. Note: while more awkward, the tire cutting jig can also be used to cut out pockets.

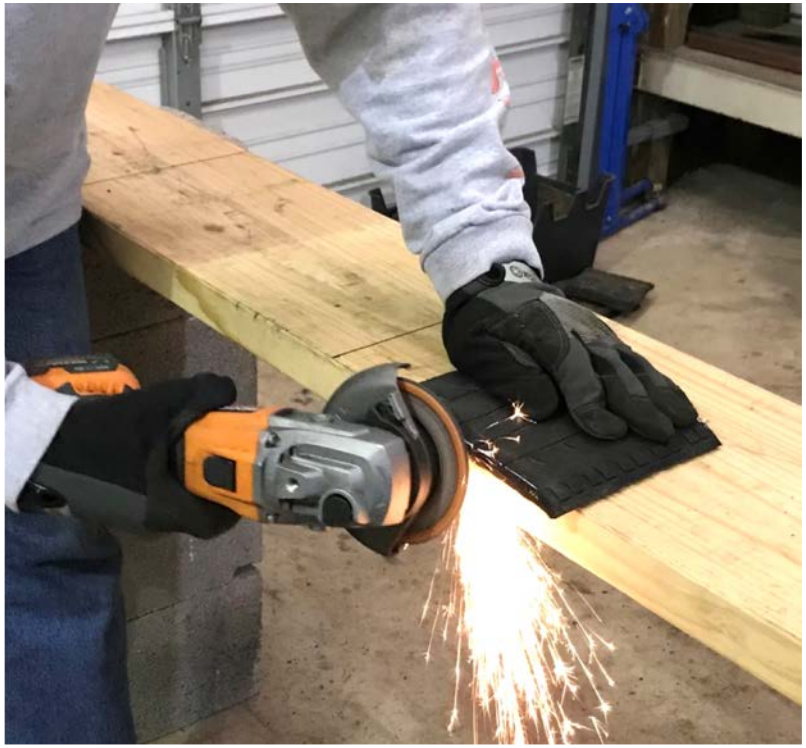
Pocket cutting jig

Rubber Lumber Fabrication (cont'd)

Pocket cutting jig construction using 2-inch x 4-inch and 2-inch x 10-inch boards.

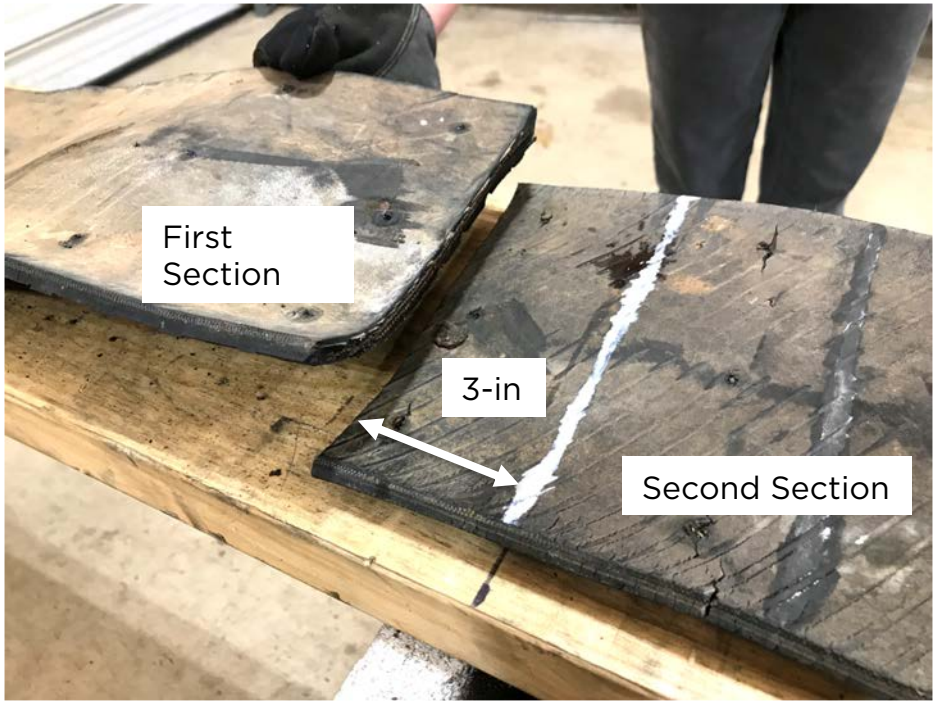
Rubber Lumber Fabrication (cont'd)

Use an angle grinder to remove any wire protruding from the ends and edges of each section of tread and the pocket pieces.



Rubber Lumber Fabrication (cont'd)

Based on the length of the rubber board needed, arrange the appropriate number of tread sections on your work bench end-to-end, making sure tread is facing down. Align the end of the first section of tread with the end of the work bench. Slide the second section of tread under the first a distance of three inches. Continue process with each additional section. When staging the tread sections on the work bench, align the edges to the extent possible. The last section of tread should exceed the planned length of the rubber board by 16 inches. This extra tread is required to form a loop at both ends of the rubber board. Any additional tread should be removed.



Slide second section under first section up to the line.

Rubber Lumber Fabrication (cont'd)

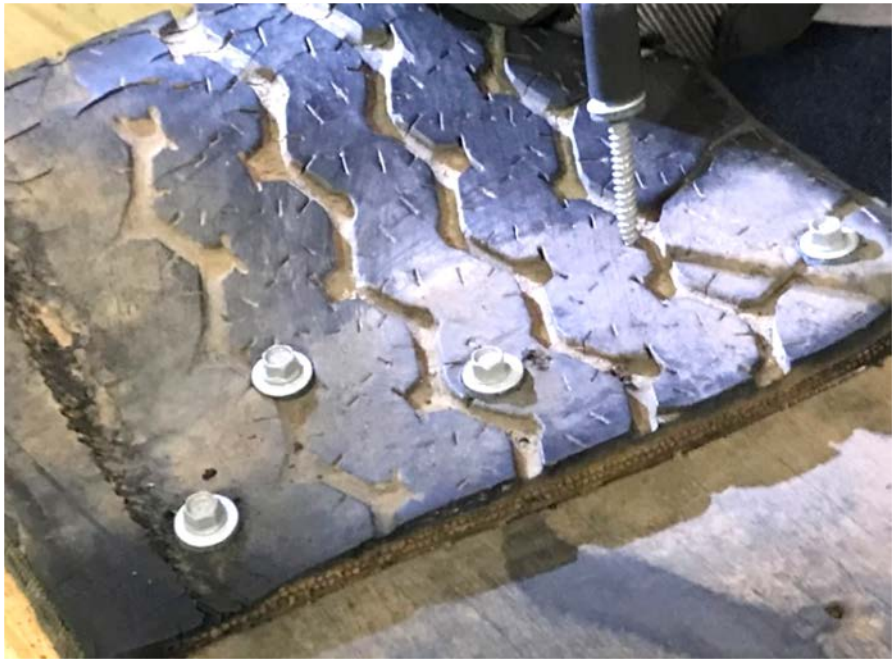
Secure each section of tread to the adjacent section using a combination of hex bolts and roofing screws. Using a paint pen, mark the location of the bolts as shown (one inch from the edge). To prevent the tread sections from slipping while drilling, insert two roofing screws as shown. To obtain a secure connection the screws will by necessity penetrate a short distance into the work bench.

Rubber Lumber Fabrication (cont'd)

Using a ¼-inch drill bit, drill through both sections of tread at each paint mark. The drill bit will need to penetrate into the work bench at least ¼-inch to enable the bolts to pass completely through the rubber. Attach a washer to each hex bolt and insert into the rubber with the assist of an impact driver. When finished inserting the bolts, back out each screw and bolt just enough to detach from the workbench surface.

Rubber Lumber Fabrication (cont'd)

Return to the first section of tread and slide the new rubber board past the edge of the workbench about 8 inches. Bend the end over onto itself to form a loop and secure using five roofing screws as shown. When forming the loops keep them tight but not too tight as the opening needs to be wide enough to accept a 5/8-inch piece of rebar. Use bar clamps to obtain a tight bend. When finished, back out each screw just enough to detach from the workbench surface. Go to the other end of the workbench and repeat the loop making procedure.



Rubber Lumber Fabrication (cont'd)

Return to the first section of tread and align the end of the new board with the end of the work bench. Using the marks on the work bench as a guide, center each pocket on a line and attach using two screws as shown. Also, plan on adding a pocket next to the loop at each end of the rubber board. In the event a bench mark is located where two sections of tread are joined, move the pocket to one side of the union and attach.

bench mark

Locate screws approximately ¾ inch from the edge of the pocket.

Rubber Lumber Fabrication (cont'd)

Back off the pocket screws just enough to detach from the work bench. Starting at one end of the rubber board hold the board up off of the work bench and reinsert every screw and bolt (loop, joint and pocket) using the impact driver. This is the most dangerous task involved with fabricating rubber lumber. To keep from puncturing your fingers wear heavy leather (welder's) gloves and be careful where you place your fingers when lifting the board and reinserting hardware.

Holding board off of work bench while reinserting screws

Rubber Lumber Fabrication (cont'd)

Flip the board over onto the other side.

Attach a washer and nut to each bolt and tighten using a ratchet and socket.

Rubber Lumber Fabrication (cont'd)

Use an angle grinder to remove protruding screw tips. Protruding bolt ends do not pose an injury risk and do not need to be removed. If you do choose to remove the ends, grind them back flush with the nuts. Use eye protection when using grinder.

Rubber Lumber Fabrication (cont'd)

The use of galvanized bolts will slow oxidation. To provide additional protection consider treating the bolt assembly (both sides of rubber lumber) with a rubber coating such as Flex Seal. You can treat the board while still on the workbench or after the lumber is installed prior to filling the bed. In each case allow time for the coating to dry.

Rubber Lumber Fabrication (cont'd)

To transport rubber lumber roll it up and secure the loose end with a couple of roofing screws as shown.

Completed 20-foot piece of rubber lumber

Rubber Lumber Fabrication (cont'd)

Prepare two end pieces using single pieces of tread. With the tread facing up on the workbench locate the center of the tread and mark a line as shown. Make two more lines 18 inches on either side of the center line. Center a pocket on each line and attach using sheet metal screws. Remember to remove protruding screw tips.

Bed Installation

Tool Requirement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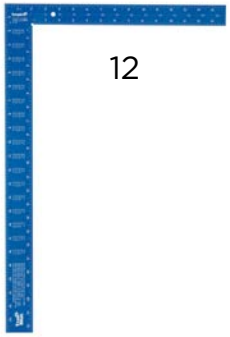
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No	Item
1	Come-Along hand winch
2	Chop saw
3	Impact driver
4	Sledge hammer (4-lb)
5	Plastic long tape
6	Retractable tape measure
7	Carpenter's level (4-foot)
8	Mason's string line
9	Garden rake
10	Shovel
11	Short piece of rope (minimum 3/8-inch diameter) or light duty chain/cable
12	Carpenter's square (16-inch x 24-inch)
13	Line level

13

Parts List (01/20)

Item	Quantity	Unit	Total
3/8-inch x 20-foot rebar	Variable*	$4.25	?
5/8-inch x 10-foot rebar or oil field sucker rod	2	$9.75	$19.50
#9 x 1 ½-inch hex-head self tapping roofing screws	4 screws	$0.09	$0.36
2-inch x 4-inch x 8-foot treated lumber	1	$5.00	$5.00

* Number of joints needed varies with length of bed and length of stake required. Typically one, 20-foot joint is required for every ten running feet of bed (10-ft bed: 1 joint; 20 ft bed: 2 joints; etc.).

Bed Installation (cont'd)

Using a chop saw prepare one, 3/8-inch x 18-inch rebar stake for every pocket on each piece of rubber lumber. The use of stakes on the end pieces is optional. Note: 18-inch stakes are long enough to provide required anchorage in most soil types. If beds will be installed on very coarse (sandy) soils the use of 24-inch long stakes is recommended to insure adequate anchorage. Also prepare two, 3/8-inch x 9-inch rebar 'corner' stakes.

Next prepare six, 5/8-inch x 30-inch rebar stakes. These stakes will be used in combination with string line to establish the location of the bed borders.

Using the treated 2-inch x 4-inch board prepare four, 18-inch long grade stakes. Taper the ends as shown.

Bed Installation (cont'd)

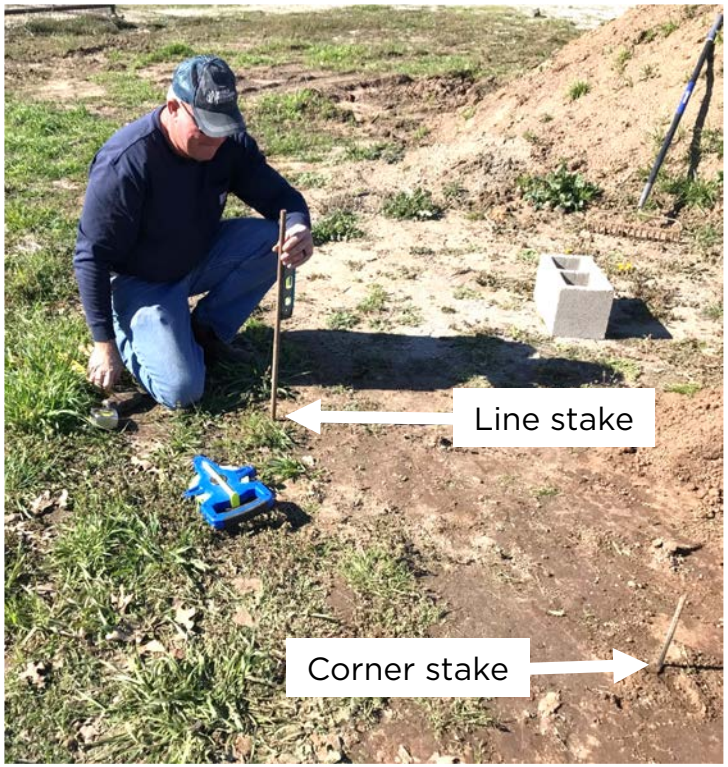
Determine the location of the bed and level the site plus several feet around the periphery of the bed site. Initial leveling can be done by eye. You may need to till the site in order to move the soil around. If the soil is tilled, plan on packing it following leveling in order to limit the amount of settling. The recommended bed width is 40 inches, wide enough to insure plenty of growing area but not so wide as to make it difficult to reach the center of the bed without stepping into it.

Next determine the location of one side (border) of the bed and designate the corners using the 9-inch pieces of rebar. Drive stakes into the ground a couple of inches

Distance between corner stakes is equivalent to the length of the rubber boards.

Bed Installation (cont'd)

Staying in line with the two corner stakes, move out four feet beyond the corner stakes and drive a pair of 5/8-inch stakes (one at each end) about a foot into the ground. Attach a string line between these outer stakes making sure the line is taut. If required, reposition the corner stakes so that they are directly beneath the string line. Use a torpedo level to ensure the corner stakes are installed plumb.



Bed Installation (cont'd)

Designate the location of the opposite border. From each 5/8-inch line stake measure over 40 inches and drive another 5/8-inch x 30-inch stake into the ground. A square can be used to insure the line stakes are installed accurately.

Bed Installation (cont'd)

Install grade stakes on the first border. Locate the grade stakes about a foot inside the line stakes. Center the stakes under the string line. Remove string from one of the line stakes and lay to the side. Drive grade stakes to depth. To make it easier to install the rubber lumber, the elevation of the grade stakes when driven into the soil should be ¼-inch to no more than ½-inch greater than the width of the lumber. If you are installing 8-inch wide lumber, drive the grade stakes to within 8-1/2 inches of the soil surface. It is easier to add soil to fill the gap than it is to remove soil when installing the lumber.

Bed Installation (cont'd)

Reattach the line to the line stake and reposition on top of the grade stakes. Attach a line level between the grade stakes and check the level. Typically one stake is installed at the desired elevation and the second stake is installed to match the first using the line level as a guide. If a stake is driven too deep, pull it out, reposition and reinstall.

Bed Installation (cont'd)

Using a Sharpie mark the location of the string line on both grade stakes as shown. Before marking make sure the string is located directly above the corner stakes. If you need to remove the line for whatever reason prior to completing lumber installation, align the string on the marks when reattaching the string and you are good to go.

Bed Installation (cont'd)

Using the string line and tape measure check the soil level along the border. Remove soil or add where required in order to create a level site.

Target elevation: 8.5 inches.
Remove 1.5 inches of soil.

Target elevation: 8.5 inches.
Add 0.5 inches of soil.

Cut

Fill

Bed Installation (cont'd)

Attach a long tape to one of the corner stakes and extend the length of the bed positioning the tape directly beneath the string line. Install a pair of 3/8-inch stakes every three feet along the tape as shown. The stakes form cradles that keep the rubber lumber upright during installation.

Bed Installation (cont'd)

Remove the measuring tape and string line. Remove one of the corner stakes and replace with a 5/8-inch x 30-inch stake. Drive the stake into the soil to a depth of about 18 inches (one foot exposed above ground) and at a slight angle as shown. Installing the stake at an angle keeps movement to a minimum during the lumber stretching process.

Install stake at a slight angle with the top slanting away from the bed interior.

Bed Installation (cont'd)

Unroll the rubber lumber and position along side the cradles. With the pockets facing out (toward the bed exterior), slide the end (loop) over the angled stake. Working toward the opposite end of the bed drop the lumber into the cradles.

Bed Installation (cont'd)

Remove the corner stake and the grade stake located at the free end of the piece of rubber lumber. The corner stake is no longer needed. When removing the grade stake pull the stake straight up as it will need to be reinstalled.

Tie a loop in a 7-foot long piece of rope to form a sling. Run the sling through the loop on the lumber as shown.

Bed Installation (cont'd)

Attach the fixed end of the Come-Along winch to the line stake and the cable end to the sling as shown. Note: to limit the amount of stake movement when using the winch you may need to drive the line stake deeper. Do not drive too deep or you will not be able to use it when reattaching the string line.

Use the winch to remove slack in the lumber. Be careful not to apply too much tension on the lumber as the sections of tread could separate. When sufficient tension is applied the lumber will stand on edge without assistance from the stake cradles. Your goal when stretching the lumber is to create a straight border by removing as much puckering as possible.

Bed Installation (cont'd)

With the lumber under tension, remove the cradle stakes one at a time and insert into the pockets. Drive the stakes to within a couple of inches of the top of the lumber.

Bed Installation (cont'd)

Release tension on the winch and remove the sling. Insert a 5/8-inch x 30-inch stake into the loop. With the stake resting against the back of the loop drive the stake into the ground a few inches. Continue driving the stake pulling back on it while it is being driven into the ground. Using the stake as a lever keeps tension on the lumber. To avoid skinning your hands when driving the stake be sure and wear gloves. Drive the stake to within a couple of inches of the top of the lumber.

Bed Installation (cont'd)

Reinstall the grade stake as close to its original position as possible.

Bed Installation (cont'd)

Reattach the string line to the line stakes. When attached you will notice the string runs directly above the lumber. The location of the string will need to be adjusted so as not to interfere with the final leveling process. To offset the string line, insert a screw into the top of each grade stake as shown and reposition the line. The line may be offset to either side of the grade stake.

Bed Installation (cont'd)

Reattach line level to the string line. Use the level to insure the reinstalled grade stake is at the proper elevation. If not, make the needed adjustment.

Finish driving stakes using the string line as a gauge.

Bed Installation (cont'd)

If the lumber is not resting on the soil surface it will tend to move downward with the stake when being driven. You can place your hand under the lumber to prevent this movement or use a pry bar to reposition the lumber on the stakes following insertion.

Pry bar used to reposition lumber on stake.

Bed Installation (cont'd)

Fill in gaps along the base of the lumber.

Properly installed rubber lumber. Notice the lumber is level with the string line and there are no stakes protruding above the pockets. The lumber has been installed in a straight line with no indication of puckering or wrinkling.

Bed Installation (cont'd)

Move to the other side and install the second border. Start by attaching a string to the line stakes and installing the grade stakes. Use a carpenter's level as shown to set the elevation of the second set of grade stakes.

At one end of the bed install a 30-inch corner stake directly opposite the adjacent corner stake. For greater accuracy employ the use of a square and carpenter's level when locating the corner stake.

Bed Installation (cont'd)

Continue with the installation of the second border using the same procedure as outlined for the first border. Once installation of the second border is complete check the accuracy of your work using a carpenter's level as shown.

Bed Installation (cont'd)

Install the end pieces. Typically, it is not necessary to attach the end pieces to the bed sides. Once the bed is filled the weight of the soil will prevent the end pieces from moving. To hold the end pieces in position prior to filling, insert two stakes into the soil at the corners of the bed as shown. Once the bed is filled, the stakes can be removed. Not attaching the end pieces to the sides enables easy removal and access to the bed when using a tiller.

Bed Installation (cont'd)

Bed length can be increased slightly by adjusting the overlap of the end pieces with the bed sides.

Squared off configuration with significant side overlap.

Bowed out configuration with minimal side overlap.

Bed Installation (cont'd)

Before filling the bed use a broadfork or spading fork to breakup any soil compaction that can occur during bed construction.

Filling the Bed

The preferred soil type for use in a rubber lumber bed is sandy loam. Amending the soil with compost will improve the water and nutrient holding capacity of the soil. The compost will also serve as a slow release nutrient source.

If you plan on applying plastic mulch film/fabric to the bed surface add sufficient fill to form a crown on the bed. A crowned bed is essential to insuring a tight fit of the film to the soil surface. Soil warming is more pronounced using mulch film when there is continuous film to soil contact.

Crowned bed

Plastic Mulch Application

Standard plastic mulch film or woven weed barrier fabric can be used successfully on a rubber lumber bed. To cover a 40-inch wide bed, we recommend using five foot wide material.

Measure off the required length of film and anchor one end temporarily to the ground using weights (concrete blocks, pavers, bricks, etc.). Cut the other end making sure the film extends a couple of feet beyond the end of the bed.

Stretch the film length wise and temporarily anchor to the ground with weights.

Plastic Mulch Application (cont'd)

Pick a side and beginning with the first pocket, wrap the edge of the film immediately above the pocket several times around a 6-inch wide piece of treated wood lath. As you wrap the film around the lath, pull the film to the side of the bed. Pull back the top of the pocket and insert the lath. Proceed to the next pocket and continue the process. When finished, switch to the other side and continue the process. When you have finished with lath installation, all of the slack (wrinkles in the film) should be removed. If not, restretch the film where wrinkles exist, wrap and reinsert the lath.

Plastic Mulch Application (cont'd)

Conclude mulch application by stretching the film towards each end of the bed, wrapping and installing the lath in the end wall pockets.

Plastic Mulch Application (cont'd)

In most cases the pocket creates a tight fit sufficient to keep the lath from rotating or popping out. If this happens, secure the flap using sheet metal screws as shown.

A final note on using plastic mulch film. Standard mulch film isn't permeable to water. As such, drip irrigation emitter line must be installed in the bed prior to film application. If this presents a problem consider installing weed barrier fabric. It is permeable to water permitting the use of dripper line on top of the fabric.

Mulch film (water impermeable)

Woven weed barrier fabric (water permeable)

Mini Tunnel Bed Cover

Rubber lumber beds can be easily outfitted with greenhouse poly film and floating crop covers. An inexpensive hoop frame to support the covers can be erected using 3/8-inch x 18-inch rebar stakes and ½-inch (125psi) x 7-foot long poly pipe hoops. The cover is attached to the hoop frame at the base using 2-inch binder clips.

Easy Access Raised Garden Bed

Steve Upson, Horticulture Consultant

Introduction

The Easy Access Raised Garden Bed was developed in response to requests by gardeners for a relatively low cost bed with a sufficiently high growing platform to enable gardening in the standing position. It is my hope that this design will assist senior and physically challenged gardeners to more fully engage and enjoy their gardening experience.

The use of discarded truck (tractor-trailer) tires to create an elevated base for the bed is what makes this design unique and reduces construction costs. The tire base is arranged in such a way as to permit the gardener to place one foot under the bed while standing at the side of the bed, effectively reducing stress on the lower back.

Introduction (cont'd)

This design can be used to construct a bed of any length and up to 35 inches in height. The height can be lowered to accommodate shorter (younger) gardeners by simply reducing the length of the framing material.

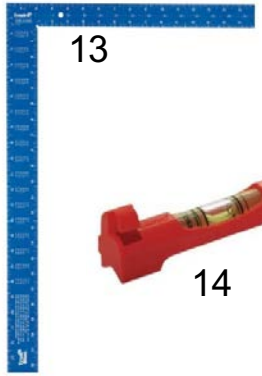
The plans outlined in this publication are specific for construction of a 10-foot long by 40-inch wide by 35-inch high bed. Six tires are needed for the construction of this bed.

Parts List (bed length: 10 feet) (11/20)

Item	Quantity	Unit	Total
Corrugated metal roof sheeting (galvanized) 26-inch x 8-foot	2	$ 16.00	$ 32.00
Truck tires (295/75R22.5) or (275/80R22.5)	6	no cost	no cost
2-inch x 4-inch x 8-foot pressure treated lumber	16	$ 5.00	$80.00
Deck screws (3-inch)	Three, 1-lb boxes	$ 9.50	$ 28.50
Sharp point self tapping sheet metal roofing screws (1.5-inch)	one box (35 count)	$ 6.00	$ 6.00
Wood screws (no. 8 x 1-inch)	one box (100 count)	$ 5.50	$ 5.50
Hanger brackets (2-inch by 4-inch lumber)	8	$ 0.70	$ 5.60
Spray-on truck bed coating	Two, 15-oz cans	$ 7.00	$ 14.00
Silicon caulking (clear)	4 tubes	$ 5.50	$ 22.00
Foam sealant (spray)	2 cans	$ 6.50	$ 13.00
Fill soil (for base)	1.5 cubic yards	$40.00	$60.00
Growing medium (amended topsoil)*	2 cubic yards	$ 50.00	$ 100.00
Total			**$366.60**

* Cost of growing medium will vary dependent on composition (% sand, compost, bark, other amendments) and trucking expense.

Tool Requirement



No	Item
1	Cordless drill
2	Cordless circular saw
3	Impact driver
4	Cordless jig saw
5	Plastic long tape
6	Retractable tape measure
7	Carpenter's level (4-foot)
8	Torpedo level
9	Mason's string line
10	Garden rake
11	Shovel
12	Sledge hammer (4 lb)
13	Carpenter's square (16-inch x 24-inch)
14	Line level
15	Pocket knife
16	Sharpie
17	Sharpie paint marker
18	Carpenter's pencil
19	Tin snips
20	Rebar stakes (two, ½-inch x 48-inch)

Tire Specifications

As with automobile tires, there are several different sizes of truck tires. This publication calls for the use of 295/75R22.5 or 275/80R22.5 size tires. These similar sized tires are very common and should be readily available.

Tire Selection and Preparation

Obtain six scrap truck tires. Check local truck tire stores for availability. Many truck stops offer tire repair services and will have used tires. While the tires are free, they are also heavy so plan on taking a friend to load the tires. To reduce the possibility of injuring your back, use a ramp to roll the tires onto a trailer. One person can roll a tire while it may take two to tote the tire. Also, select only intact tires. Avoid tires that are shredded or that have exposed steel belts. On a safety note, always wear gloves when working with tires.

Tire Selection and Preparation (cont'd)

To simplify construction, select tires that are the same diameter. The same classification of tire can vary by as much as an inch in diameter due to tread wear. No two used tires will have the exact same diameter, so be realistic when making your selection. For best results, the tires should not vary more than ¼-inch in diameter.

The most accurate method you can use to determine tire size involves the use a tape measure to measure circumference. Tires having the same circumference are identical in diameter. Use a paint pen to note the diameter of each tire. Diameter can be calculated by dividing the circumference by 3.14.

Tire Selection and Preparation (cont'd)

While not absolutely necessary, the use of a circular alignment guide during construction greatly simplifies the task of aligning the tires to form a straight bed. The guide also enables accurate positioning of the bed frame members. Our circular guide is made from ¼-inch plywood and is 23-3/8 inches wide. Use a jig saw to prepare the alignment guide. Use a framing square and marker to cross mark the guide. The guide is used to designate four equidistant corners on each tire.

With the alignment guide centered on the tire, use a white paint pen and straight edge to designate four corners on all six tires.

A tape measure can also be used to accurately locate all four corners but this method requires measuring all six tires.

Site Preparation

Prepare the site for the bed. The bed requires a level surface so it may be necessary to till the soil in order to level the site. If a perennial sod is established on the site, consider eliminating it with the use of a herbicide such as glyphosate (Roundup) prior to leveling. Designate the ends of the bed by driving two rebar stakes into the ground 10 feet apart. The stakes should extend out of the soil 24 inches. Use a torpedo level when driving the stakes to insure they are installed plumb. Attach a string line between the stakes making sure the line is taut. This line represents the central axis of the bed. With the line positioned six inches above the soil, attach a line level. Adjust one end of the line until it is level.

Next, use the line to gauge if the ground is level. Using a rake, move the soil around until the site is level 20 inches to either side of the string. In situations requiring deep tillage to level the site or when a large quantity of fill is required to form a pad for the bed, make sure to pack or roll the soil (site) prior to bed construction to prevent settling of the bed. A good rain or sprinkle irrigation on the site will also aid in settling the soil. Remove the string line following site leveling.

Line (string) level

Base Construction

Form the base of the bed by aligning the tires in a row between the stakes. It is much easier to move tires by rolling as opposed to dragging. If the tires you have chosen for the bed vary slightly in diameter, designate the larger ones for use on this row.

Depending on the diameter of the tires, the tires may or may not touch each other when aligned in a row. When setting the tires into place, the paint marks on adjacent tires should be directly across from one another. Reattach the string line and position just above the tires. To insure the tires are positioned in a straight row, the paint marks on the tires must be aligned with the string line.

Base Construction (cont'd)

The use of the paint mark and string technique to align the tires is especially helpful when constructing long beds because the longer the bed, the more difficult it becomes using line of site to center objects like tires that do not have straight edges.

A carpenter's level may be used to insure the base is level side to side. A long section of square tubing or angle iron can be used to check the level of the bed end to end. If you did a good job of leveling the site, the base row of tires should be fairly level. If not, lift the tires where needed and remove or add soil until the base is level.

Tires perfectly aligned in a row

Base Construction (cont'd)

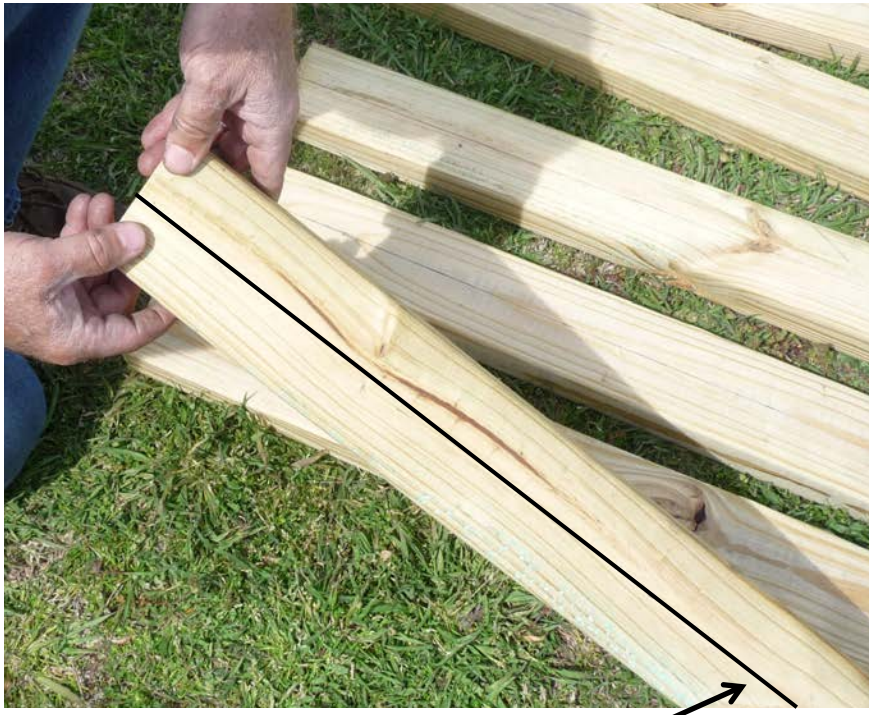
With the string line removed, install the top row of tires making sure the paint marks on adjacent tires are directly across from one another. Reattach the string line and position just above the top row of tires. Once again, align the paint marks on the tires with the string line. Be sure each tire in the top row is centered on the tire below it. Remove rebar stakes and string line.

With the tire base in place, fill the tires with soil. You can choose to fill the first tier of tires before adding the second or fill both tiers at the same time. Work the soil towards the outer edges of the tires to fill as much of the available space as possible. Because plants will root down into the tires, choose a loam or sandy loam as fill. There is no need to amend the soil used in this step of bed construction.

Frame Construction

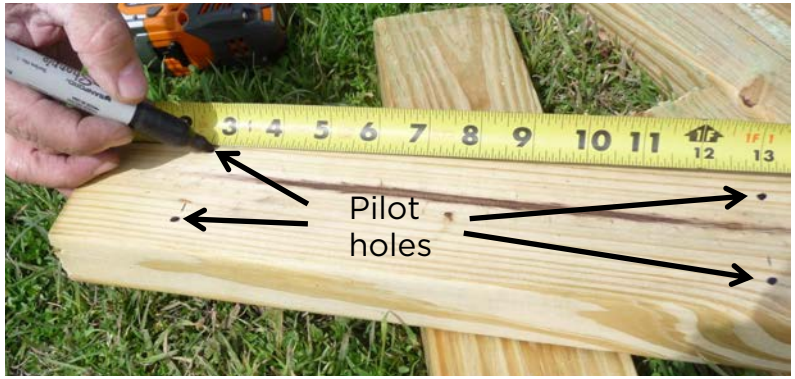
Using 2-inch by 4-inch treated lumber, prepare the vertical frame members. Three, 32-inch long frame members can be cut from one, 8-foot board. The number of frame members will vary depending on bed length. A 10-foot long bed will require 40 members.

Select six of the members for installation on the bed sides. Mark a line down the center of these six vertical frame members as shown. The lines will serve as reference points during installation.



Frame Construction (cont'd)

To avoid splitting the frame members when attaching to the tire base, pre drill pilot holes for the 3-inch deck screws. Locate a set of two pilot holes 2-½ inches from one end of the wood member and another set 13 inches from the same end. All holes should be ¾ inch from the edge of the member. Preinstall screws to make installation easier. On the six members that received a reference line be sure and install the screws on the side opposite the reference line.



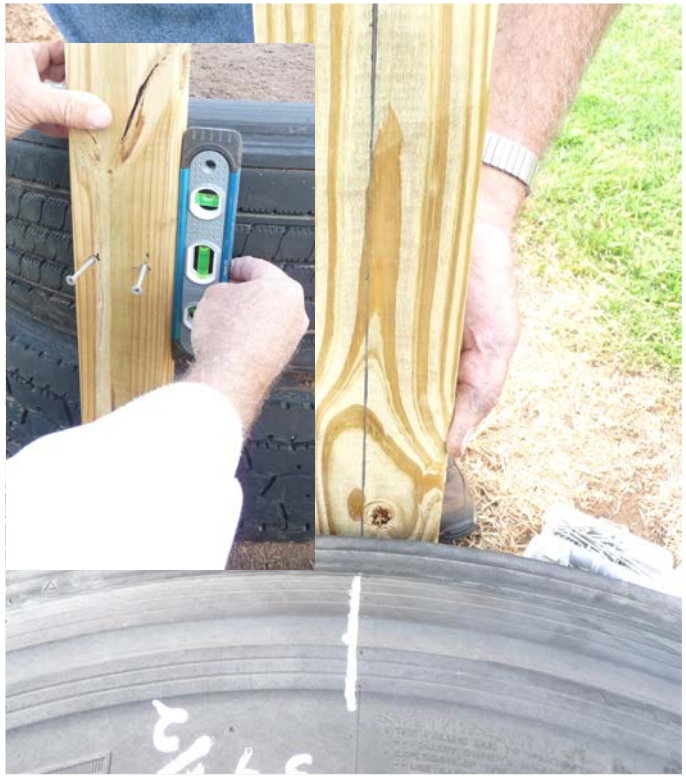
Frame Construction (cont'd)

Prior to installing vertical frame members, decide on the height of the bed. A bed height of 35 inches can be achieved using 32-inch long vertical members and a couple of 2-inch by 4-inch blocks to elevate the frame members. To lower the height of the bed, simply shorten the length of the frame members. To prevent rotting, never install the wood frame members with the base resting on the ground.

Frame Construction (cont'd)

Before fastening the six vertical frame members to the sides of the tire base, align the reference line on the back of the vertical members with the mark on the tires. Use a torpedo level to make sure the members are plumb.

Use a 4-foot level to insure the top of each vertical frame member is level with the opposite and adjacent members.



Frame Construction (cont'd)

If the top tire in a particular stack is smaller in diameter than the base tire, you may need to use a shim in order to plumb the vertical member. To avoid the need for shims, select tires with similar diameters.

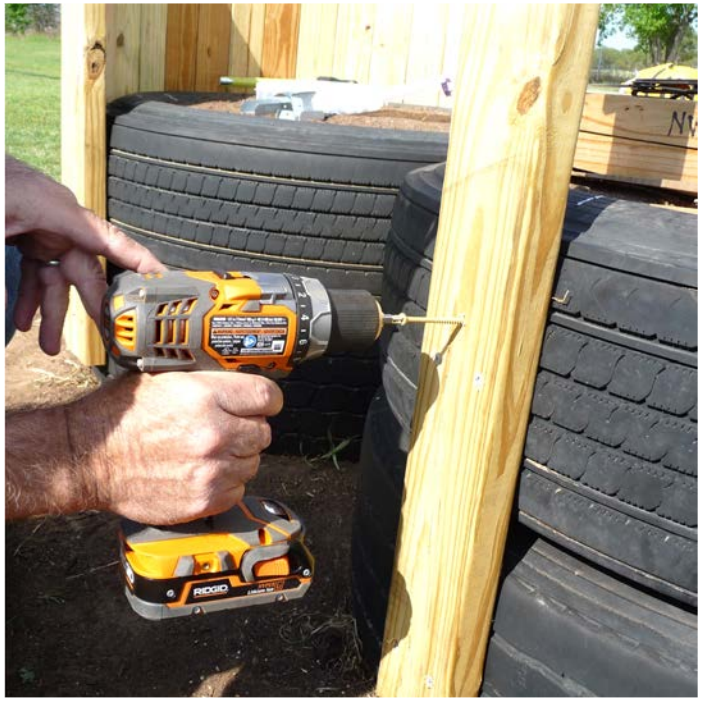
Once the installation of the six vertical frame side members is completed, frame in the ends of the bed using additional vertical members. Check the level of each frame member before attaching. Cut to fit the last vertical frame member installed on each end of the bed.

Custom cut frame member

Frame Construction (cont'd)

Fortify the frame at each end of the bed by connecting the individual vertical members along the top of the frame. Start at one side and work your way to the other side connecting the members using 3-inch deck screws. Be sure and drill pilot holes to reduce the chance of splitting.

By design, the center vertical frame member on each side of the bed is required to handle a greater portion of the soil load in the bed. To make sure it doesn't pull lose from the tire, insert a third, 3-inch deck screw just above the other screws.

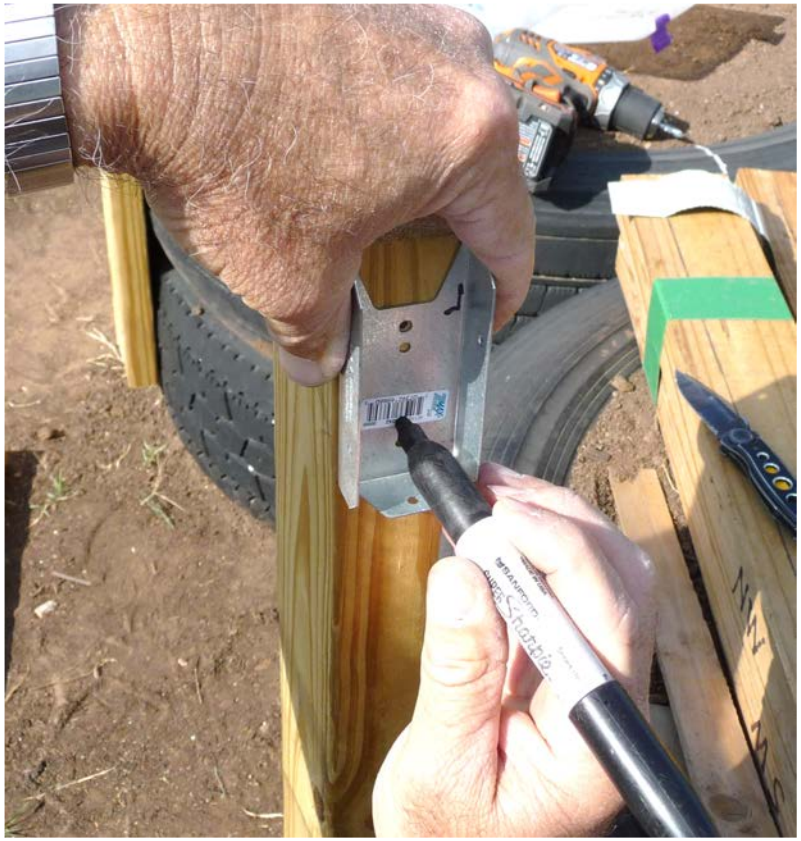


Frame Construction (cont'd)

Completed installation of vertical frame members. A total of 40 vertical members are needed when constructing a 10-foot long bed.

Frame Construction (cont'd)

Next, attach the 2-inch by 4-inch hanger brackets to the six vertical frame side members as shown. Position the base of each bracket 3-½ inches below the top of the frame member. With the bracket correctly positioned on the side of the member, mark the locations for the screws.



Frame Construction (cont'd)

Drill pilot holes prior to attaching the bracket. Use 1-inch wood screws to attach the bracket to the frame member.

Complete construction of the frame by installing the cross members. Cut each member to fit. Install using 1-inch wood screws. Remember to drill pilot holes before inserting screws. Frame construction is now complete.

Liner Installation

Two pieces of corrugated sheeting are required to make a liner for the bed, each piece lining one half of the bed.

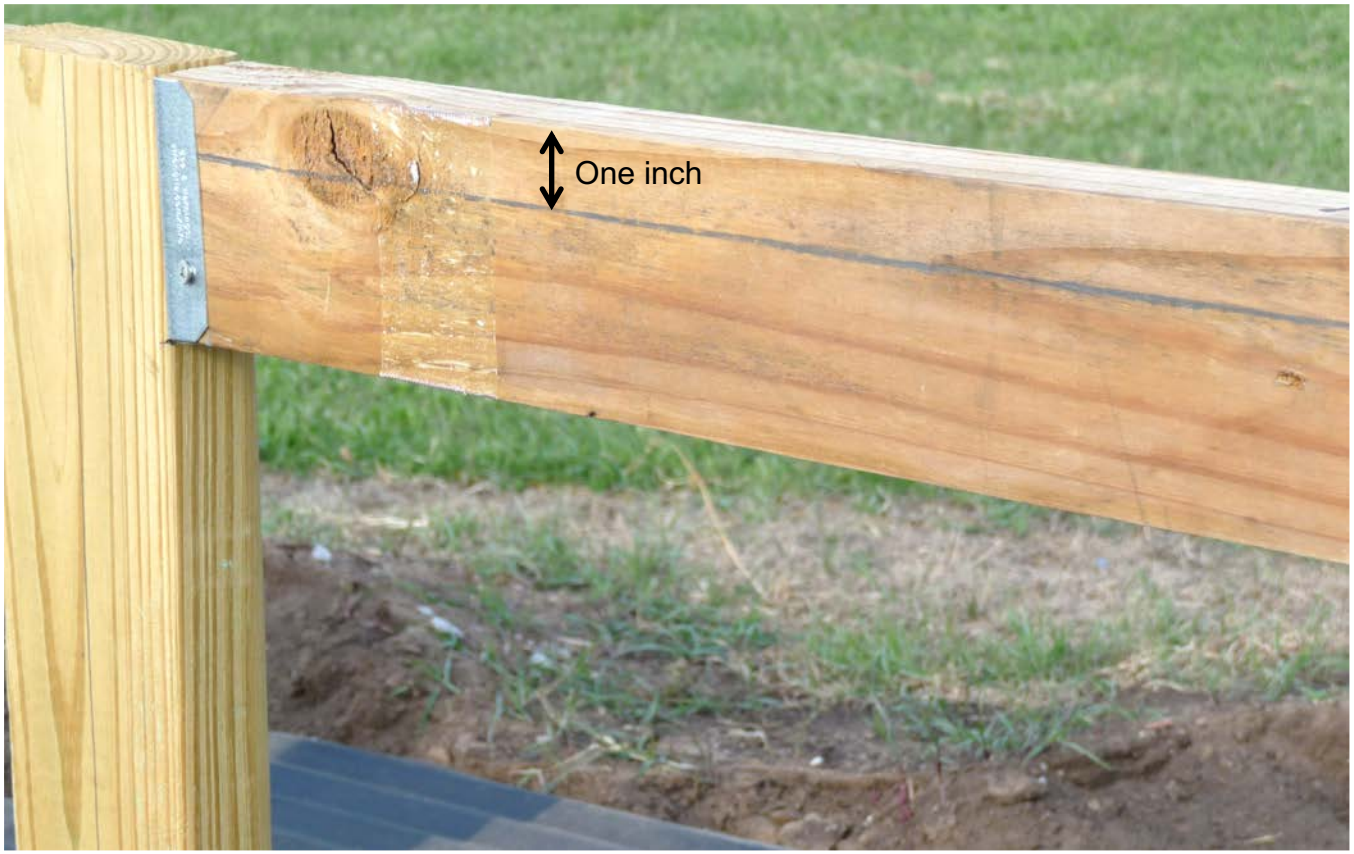
Begin preparation of liner by applying a spray-on truck bed coating or a rubber based coating such as "'Flex Seal" to the corrugated metal sheeting. The galvanization imparts rust protection to the metal; however, because the corrugated sheeting is designed for use on roofs and not as a liner for garden beds, it is highly recommended you apply a coating. One coat is good; two is better.

Liner Installation (cont'd)

Using tin snips, cut both pieces of sheeting to fit your bed. When constructing a 10-foot long bed, the liner should measure between 79 and 80 inches in length. Before cutting, measure the bed to make sure each piece is long enough to attach to the vertical frame side members on each end of the bed.

Liner Installation (cont'd)

To assist with the installation of the liner, mark a line on the inner surface of the cross members one inch from the top.



Liner Installation (cont'd)

Center a sheet on one side of the bed and align the top with the line on the cross members. Attach the top of the sheet to the frame using a minimum of five, 1-½ inch self tapping roofing screws. Repeat process on the opposite side of the bed using the other metal sheet.

Liner Installation (cont'd)

Bend the sheets to conform to the shape of the bed. Holding each sheet in position, attach the free edge to the tire base using roofing screws.

Using the remaining pieces of sheeting, cut two pieces to cover the gaps in the tire base and fasten with roofing screws.

Liner Installation (cont'd)

Finish the liner installation by inserting three roofing screws in the middle of each sheet along the fold.

Seal Gaps

Seal the gaps between the vertical frame members using clear silicon caulking. Seal the gaps at all four corners of the bed using foam sealant. After the foam cures, use a knife to remove excess.

Seal Gaps (cont'd)

Use foam sealant to seal the gap between vertical frame members and tires on each end of the bed.

Completed bed ready to fill with growing medium.

Growing Media Options

The bed base and the frame are strong enough to permit filling with topsoil. To insure adequate drainage, we recommend using a coarse textured soil such as fine sandy loam. Although more expensive, excellent results can be expected using a commercial potting soil or nursery mix as fill.

One of many container options using the Easy Access Bed.

Easy Access Raised Bed Mini Tunnel Crop Cover

Now that you've constructed an Easy Access Bed, consider taking your gardening experience to a new level. A mini tunnel cover will enable you to extend the growing season and protect plants from inclement weather. The mini tunnel can be assembled in less than a day using materials available at any home improvement store. While construction grade poly film may be used as a covering for the tunnel, it will need to be replaced on an annual basis due to sunlight degradation. For extended life, choose a greenhouse grade poly film available from greenhouse (horticulture) supply stores, local or online.

Mini Tunnel Crop Cover Parts List

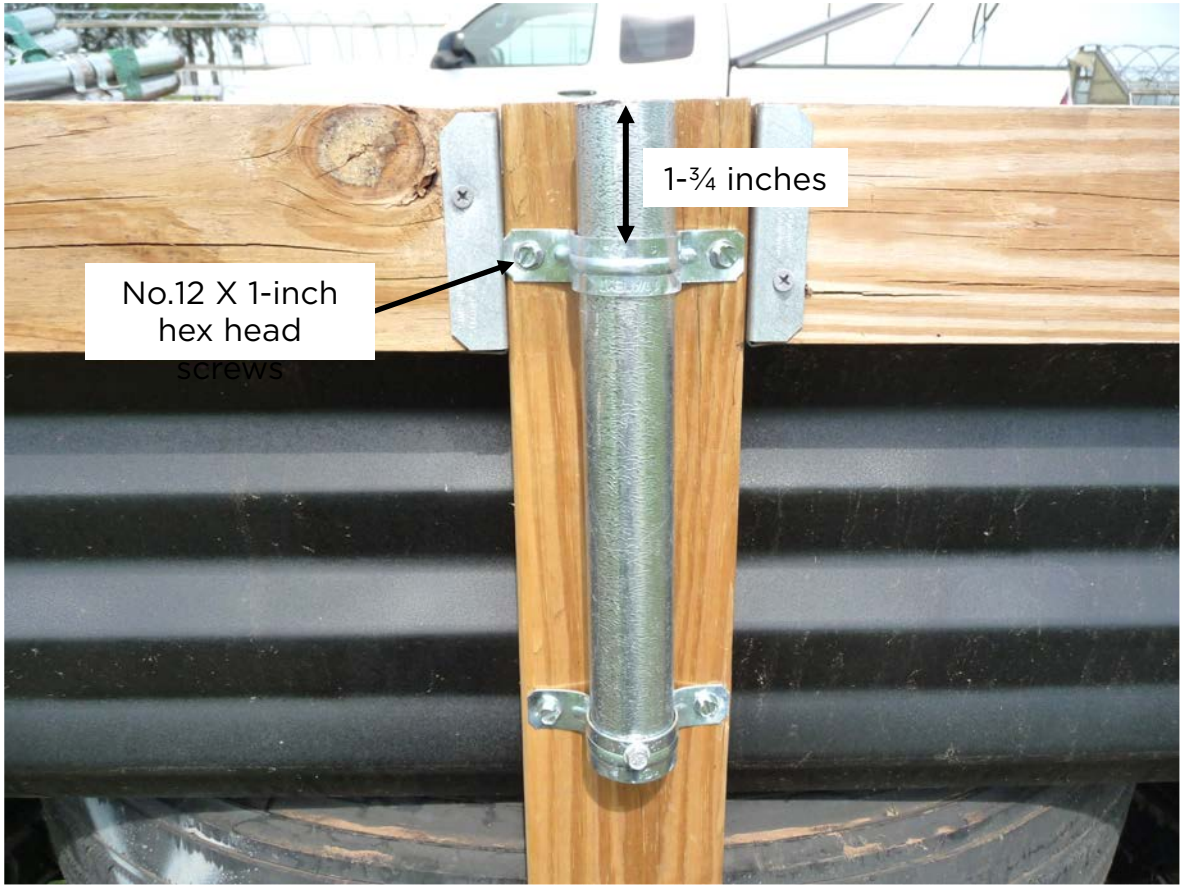
(bed length: 10 feet)

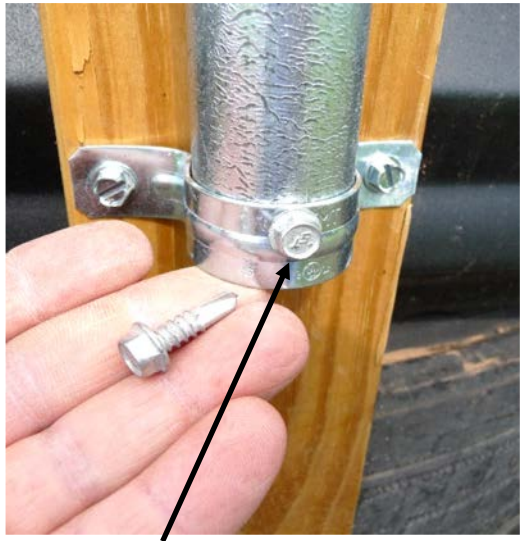
Item	Quantity	Unit	Total
Pipe hanger (1-¼-inch EMT)	20	$ 0.40	$8.00
'Top rail' chain link fence tubing (1-3/8-inch x 10-foot)	1	$11.00	$11.00
Hex head screw (No. 12 x 1-inch)	One box (50 count)	$5.50	$5.50
Self-drilling Tek screw (No. 10 x ¾-inch)	One box (50 count)	$6.00	$6.00
PVC conduit (¾- inch x 10-foot) gray	5	$3.00	$15.00
Eye Screw (No. 10 x 1-3/8-inch)	Two packs (4 count)	$1.30	$2.60
Braided nylon rope (3/16-inch x 50-foot)	1	$6.50	$6.50
Ball bungee	One container (8 count)	$6.50	$6.50
Hook screw (1-¼-inch)	1 pack (4 count)	$1.30	$1.30
Bungee cord (4-foot)	2	$2.70	$5.40
Tennis balls (used)	2	No cost	No cost
Greenhouse poly film (8-foot x 18-foot x 6 mil)*	1	$30.00	$30.00
Total			**$97.80**

* Eight-foot and 18-foot film widths are not standard. Expect to purchase either a 10-foot or 20-foot wide section of film and cutting it to size. An 8-foot X 18-foot section of film is recommended for covering a 3-foot high mini tunnel. Custom cut sizes of greenhouse film are available from FarmTek https://www.farmtek.com/farm/supplies/prod1;ft_ag_growing_supplies-ft_greenhouse_equipment-ft_greenhouse_covering-ft_greenhouse_plastic_covering;pg108654.html

Crop Cover

Start by installing the hoop receptacles. Attach a 10-inch long hoop receptacle to the sides of the initial six side frame members as shown using 1-¼ inch pipe EMT hangers and wood screws. Fabricate hoop receptacles from 1-3/8 inch diameter 'top rail' chain link fence tubing. Insert a Tek screw into the bottom hanger as shown.

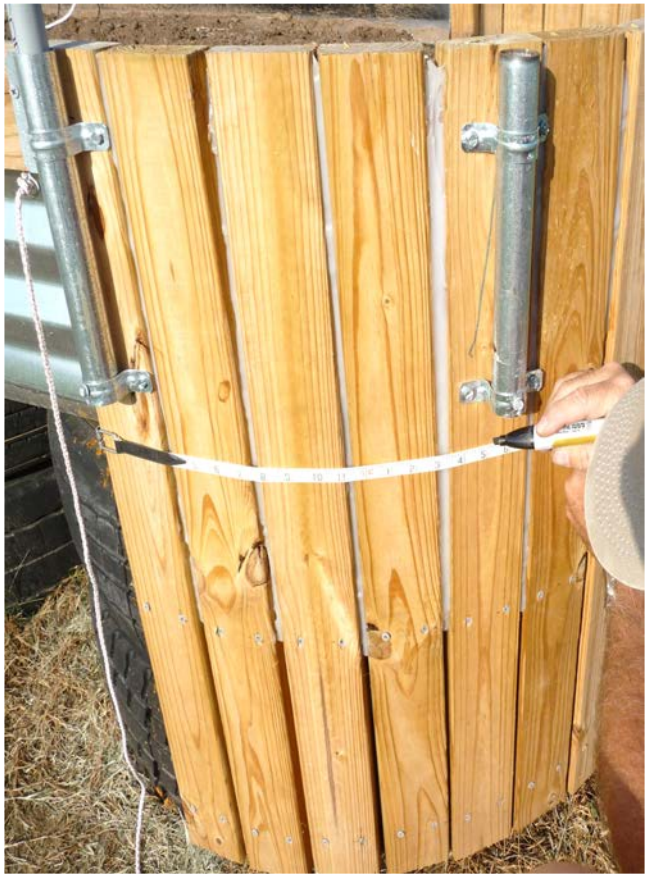




Self-drilling Tek screw (No.10 X ¾-inch)

Crop Cover (cont'd)

Install the remaining four hoop receptacles on the ends of the bed, two on each end. Using a tape measure as shown, mark the location of the remaining hoop receptacles approximately 18 inches from the adjacent corner receptacle.



Crop Cover (cont'd)

Fabricate hoops from ¾-inch gray PVC conduit. You can adjust the height of the tunnel by varying hoop length. A 3-foot high tunnel requires three, 9-foot hoops and two, 7-foot hoops.

Install hoops making sure the short hoops are installed at both ends of the bed. Hoop ends should rest on the Tek screw at the base of each receptacle.

Crop Cover (cont'd)

Install eight eye screws on the underside of the cross members. Locate two screws to either side of the center vertical frame member and one screw at the opposite end of each cross member.

To accommodate a 3-foot high tunnel, cut a set of four ropes, 4-feet long and a set of four ropes, 7-feet long. Attach one end of the 4-foot ropes to the eye screws on one side of the bed and one end of the 7-foot ropes to the eye screws on the other side.

eye screw (No.10 X 1-3/8-inch)

3/16-inch braided nylon rope

Crop Cover (cont'd)

Install the poly cover. To accommodate a 10-foot long bed, prepare an 8-foot by 18-foot piece of poly film. Center the cover on the bed. Many greenhouse supply companies offer custom cut sizes of greenhouse poly film. Choose construction grade poly film as your last option.

Crop Cover (cont'd)

Secure the poly cover to the hoop frame by connecting the rope straps on opposite sides of the bed. Tie a loop at the end of each 7-foot rope strap. Draw the free end of the 4-foot strap through the loop and tie off using a half hitch knot. Do not pull the rope straps taut at this time.

half hitch

Crop Cover (cont'd)

Attach the ends of the poly cover to the bed frame. Place a tennis ball in the center of the cover at one end and roll the film around the ball several times as shown.

Crop Cover (cont'd)

While holding the wrapped tennis ball, pull the film towards you and twist the film clockwise creating an ever tightening role of film.

Crop Cover (cont'd)

Attach a ball bungee cord to the poly film 'tail' just ahead of the covered tennis ball. The tennis ball is needed to prevent the ball bungee cord from slipping off the end of the 'tail'.

Place the 'tail' against the side of the bed and insert a hook screw into the wood frame adjacent to the ball bungee as shown. Use the hook screw to secure the poly cover to the frame. You may need to wrap the bungee cord around the 'tail' several times to remove any slack. Repeat process at the other end of the bed.

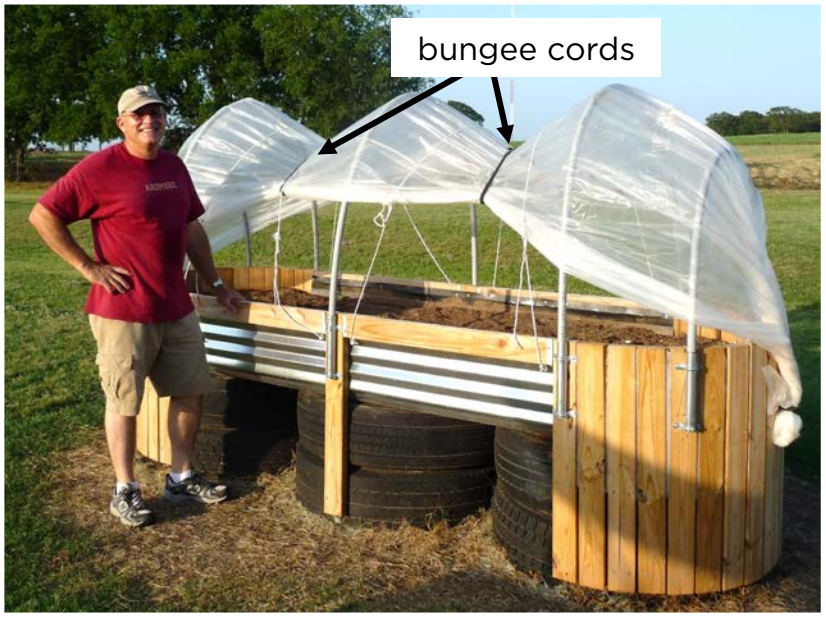
Crop Cover (cont'd)

To prevent flapping of the cover in the wind, use the rope straps to apply tension. To increase the amount of tension, loosen the knot, pull down on the free end of the strap and retie the knot. The use of a half hitch allows you to quickly untie the knot, readjust the tension and retie.

A properly tensioned crop cover.

Crop Cover (cont'd)

To vent the mini tunnel, pull the edges of the cover upward. Depending on the height you raise the cover, you may find it necessary to loosen the ball bungees to provide the needed slack.



The use of 4-foot bungee cords to maintain the cover in a fully vented position.

Bunk Planter

Steve Upson, Horticulture Consultant

NOBLE RESEARCH INSTITUTE

Introduction

The Noble ‘Bunk’ planter uses two, erect standing semi-truck tires to form the planter frame. The planter measures approximately 8-feet in length, 40-inches wide and 20-inches deep. Dimensional lumber or sheet metal can be used to clad the structure. Based on early reviews, most folks prefer wood cladding over sheet metal. Due to its novel design, the bunk bed can be easily fitted with a low tunnel crop cover for extended season growing.

Parts List (11/19)

Item	Quantity	Unit	Total
Truck tires 295/75R22.5 or 275/80R22.5*	2		No cost
2-inch x 4-inch x 8-foot pressure treated lumber	14	5.00	70.00
2-foot x 4-foot x 15/32-inch treated plywood	1	10.00	10.00
1-1/4-inch x 10-foot EMT steel tubing (14-gauge)	2	18.20	36.40
8-inch x 16-inch x 2-inch concrete paver (optional)	2	1.50	3.00
Steel strap (24-inch)	6	2.10	12.60
Nail plate (5-inch)	8	0.65	5.20
Deck screws (3-inch)	Three, 1-lb boxes	9.50	28.50
Self tapping sheet metal screws (no.9 x 1-inch)	One box (120 count)	11.00	11.00
Self tapping sheet metal screws (no.10 x 1-1/2-inch)	One box (35 count)	6.00	6.00
Self tapping lath screws (no. 8 x ½-inch)	One box (100 count)	6.00	6.00
Pipe hangers (1-1/4-inch EMT)	8	0.65	5.20
'Flex Seal' spray sealant	4 spray cans	13.00	52.00
Wood stain/sealant	1 gallon	25.00	25.00
Commercial nursery growing mix	Fifteen, 2-cu ft. bags **	10.00	150.00
Total			**$420.90**

*Tires should be the same size and have similar tread wear (same diameter)
** Volume of growing mix required dependent on amount of filler material used in bottom of bed

Tool Requirement

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16

17

No.	Item
1	Jig saw
2	Cut off saw
3	Impact driver
4	Circular saw
5	Plastic long tape
6	Retractable tape measure
7	Chalk line
8	Garden rake
9	Shovel
10	Small sledge hammer
11	Pipe driver
12	Carpenter's square
13	Torpedo level
14	Carpenter's pencil
15	Sharpie paint marker
16	Large nail
17	Carpenter's level: 4-foot

Tire Preparation

Select two semi truck tires of identical size (same tread wear and diameter). Tires sharing the same circumference will have identical diameters. Recommended truck tire size: 295/75R22.5 or 275/80R22.5

Tire Preparation (cont'd)

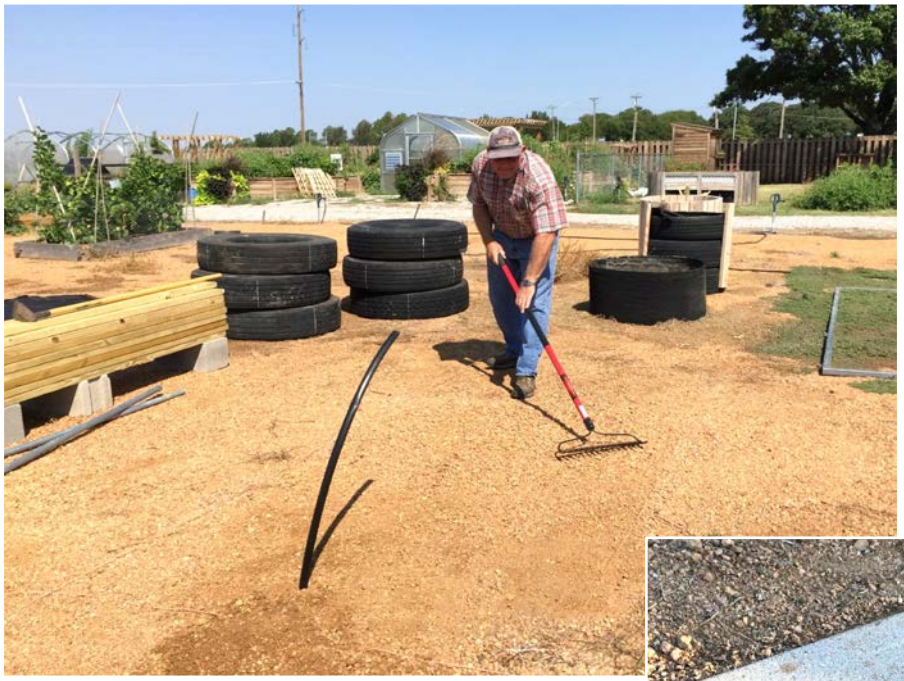
Using a tape measure and a white marker, make four, evenly spaced vertical lines on both tires as shown. For ease of calculation, use a tape measure that measures in tenths of inches. Inserting a screw into the tire to hold the end of the tape measure frees up a hand for marking. A carpenter's square or torpedo level can be used to ensure lines are plumb. If a torpedo level is used, make sure the tire is positioned on a level surface prior to marking. The four lines represent the top elevation, bottom elevation and midpoint elevation of the bed.

Tire Preparation (cont'd)

In order to accurately position tires on the ground posts, you will need to extend the white lines designating the top and bottom of the bed from the tread onto the sidewalls. Pick any set of lines opposite each other to serve as the top and bottom points. You can free-hand the mark or use a level or chalk line for increased accuracy.

Site Preparation

Level a 4-foot by 10-foot area. Initial leveling can be done by eye. You may need to till the site in order to move the soil around. If the soil is tilled, plan on packing it following leveling in order to limit the amount of settling. You may need to install pavers (shown below) under the tires in order to prevent settling. A carpenter's level used in conjunction with a jig (see section on jig construction) can be used to perform final leveling.



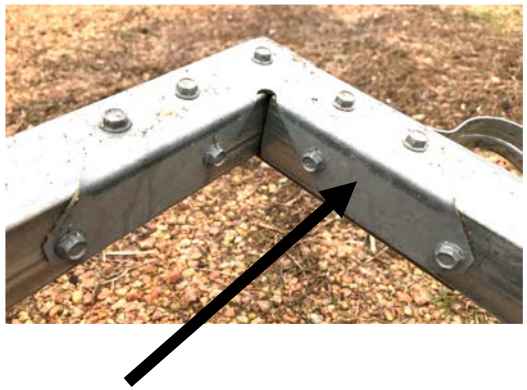
8-inch x 16-inch x 2-inch concrete paver

Jig Utilization

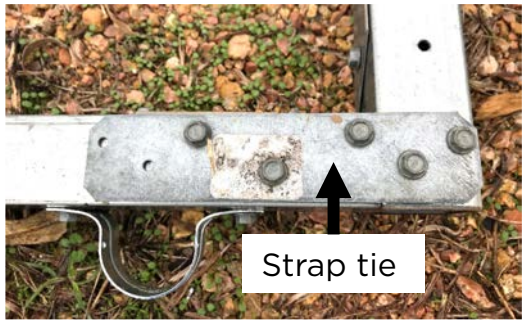
When installing ground posts, use a jig to insure posts are installed accurately. Improperly placed ground posts will all but insure the bed will be out of square. Another advantage of using a jig is greater uniformity and consistency when installing multiple beds. If you anticipate installing multiple beds of your own or assisting a friend construct their own, the small investment spent on fabricating a jig will save you time and frustration. DYI jigs can be fabricated using square steel tubing or PVC pipe. Consider applying a weight on top of the jig to prevent it from moving during post insertion.

Jig Construction: Steel Tubing

The jig pictured below is fabricated using 1-1/2-inch square tubing, angle braces, strap ties and pipe hangers. The dimensions given are recommended when using 295/75R22.5 or 275/80R22.5 truck tires and 2-inch x 4-inch x 8-foot lumber for planter construction.



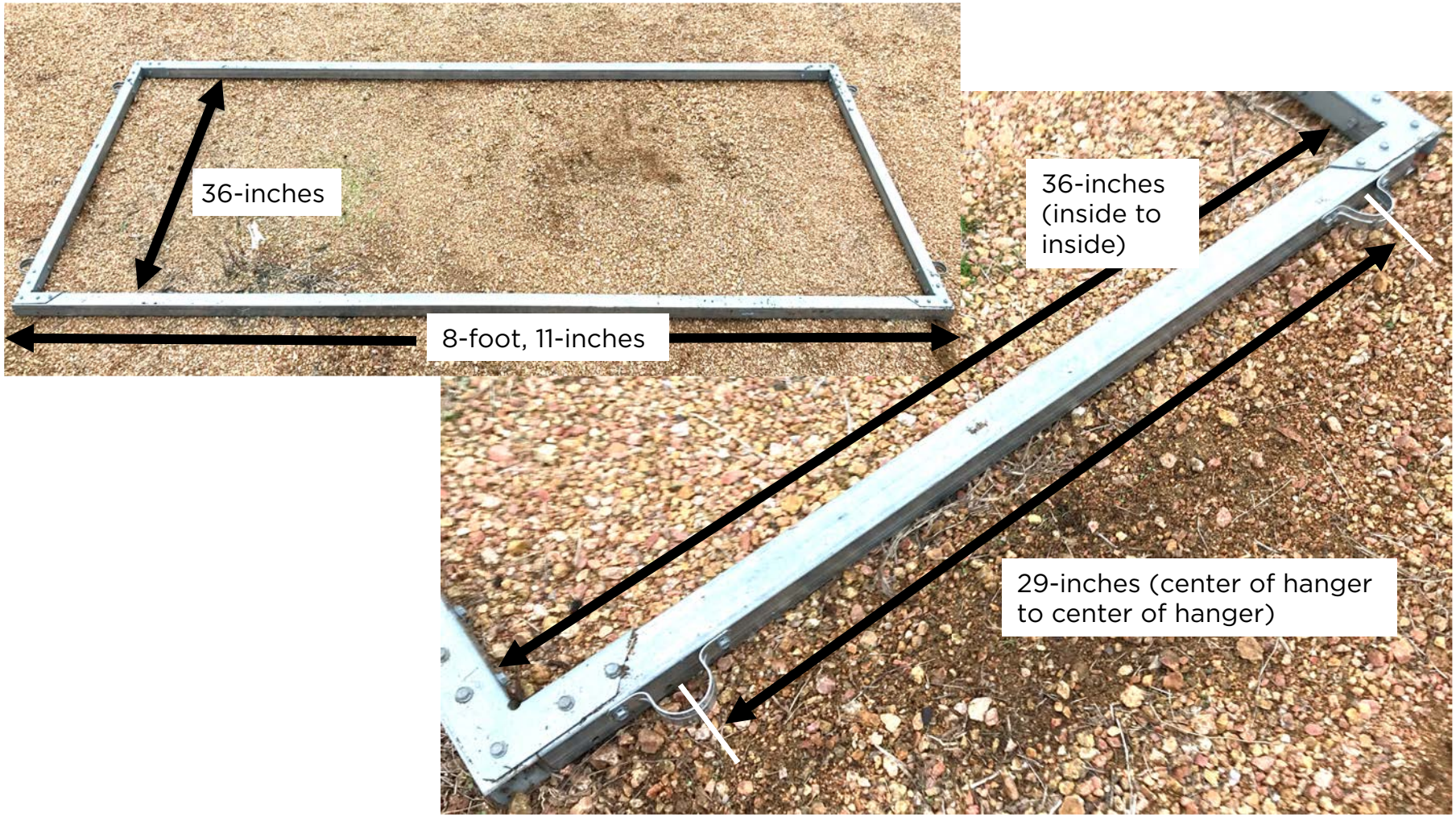
Angle braces on top surface of frame and strap ties on bottom to insure a rigid frame.



Square Tubing Jig Parts List	
Item	No.
1-1/2-inch x 8-foot, 11-inch square tubing	2
1-1/2-inch x 36-inch square tubing	2
1-1/2-inch angle brace	4
1-3/8-inch x 6-inch strap tie	4
1-1/2-inch pipe hangers	4
Tek screws (no.10 x 1-inch)	60

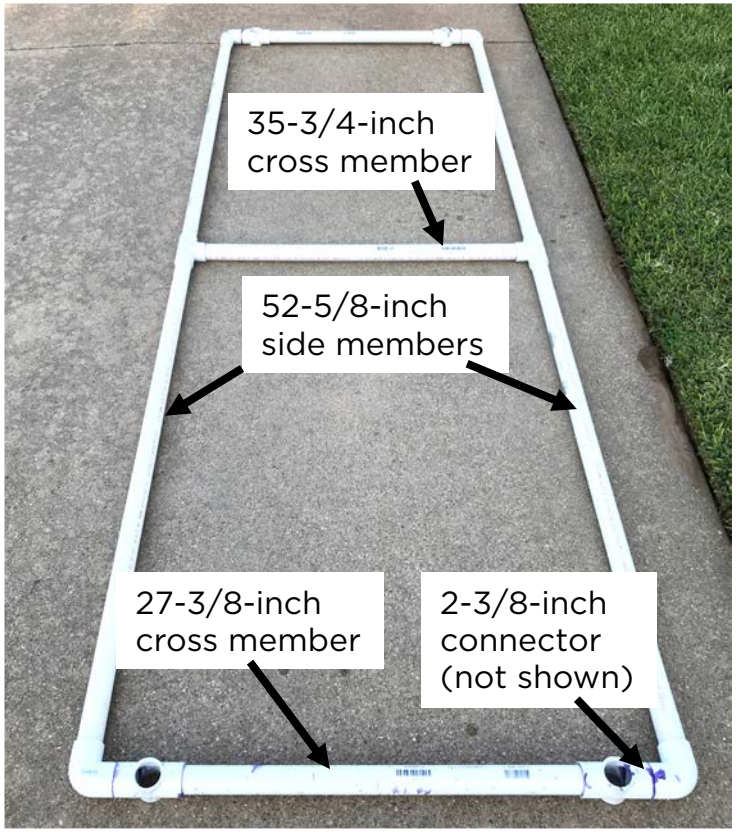
1.5-inch pipe hangers (designate location of ground posts)

Jig Construction (cont'd)



Jig Construction: PVC Tubing

The jig pictured below is fabricated using 1-1/4-inch Sch 40 PVC pipe and assorted fittings. It is designed to be disassembled for portability. The dimensions given are recommended when using 295/75R22.5 or 275/80R22.5 truck tires and 2-inch x 4-inch x 8-foot lumber for planter construction.



Bunk Bed PVC Jig Parts List	
Item	No.
1-1/4-inch x 52-5/8-inch Sch 40 pipe	4
1-1/4-inch x 35-3/4-inch Sch 40 pipe	1
1-1/4-inch x 27-3/8-inch Sch 40 pipe	2
1-1/4-inch x 2-3/8-inch Sch 40 pipe	4
1-1/4-inch Sch 40 Cross	4
1-1/4-inch Sch 40 Ell	4
1-1/4-inch Sch 40 Tee	2
PVC primer and cement	1
Total price (approximate)	**$51.00**

Note: Three, 10-foot joints of 1-1/4-inch Sch 40 PVC pipe is sufficient to fabricate all of the jig members and connectors.

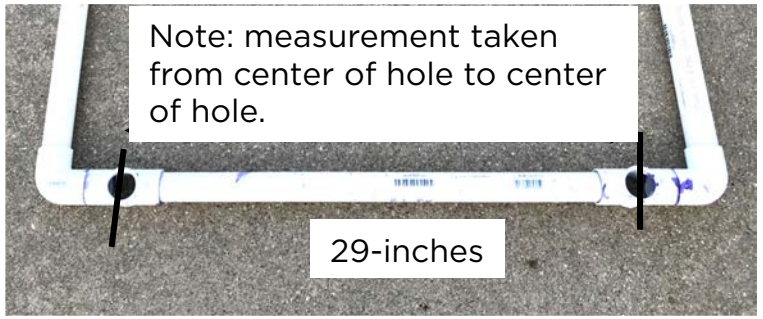
Jig Construction (cont'd)

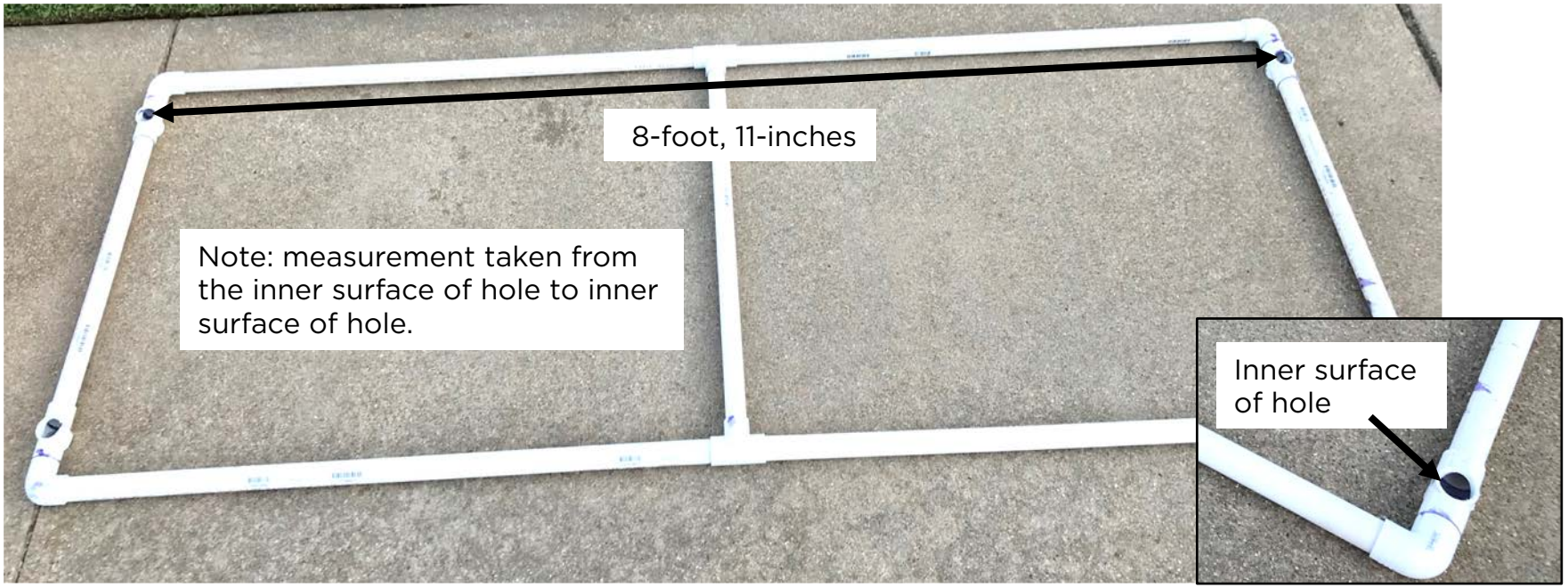
To enable the jig to lay flat when in position, remove a set of opposite arms on each of the crosses prior to assembly. This is best accomplished using a cut-off saw. To make the job easier and safer, insert a piece of pipe into the fitting prior to sawing. Caution: Use eye protection when using power tools.

When fabricating the jig, cement the fittings to the cross members as shown. The side members need to be free to slip in and out of the fittings to assemble and disassemble the jig. To enable the side members to slip in and out of the fittings with the proper amount of resistance, you will need to slightly reduce the diameter of the pipe at both ends using sandpaper. Be careful not to remove too much as you do not want the frame to pull apart during use. Preferably, the side members should fit a little tight than too loose.

Jig Construction (cont'd)

Check final jig measurements prior to use. The critical measurements include the distance between ground post holes at each end and between ends.





Post Installation

Using a cut-off saw, prepare four, 4-foot long posts using the 1-¼-inch EMT tubing. Insert posts into the jig and drive into the ground. To prevent flaring of ground posts when inserting, use a pipe driver or a driver made from a large bolt or hitch pin. Do not drive posts to their final depth at this time. Inserting them to a depth of 14 inches is sufficient at this stage. Use a torpedo level when driving posts to ensure they are installed plumb.

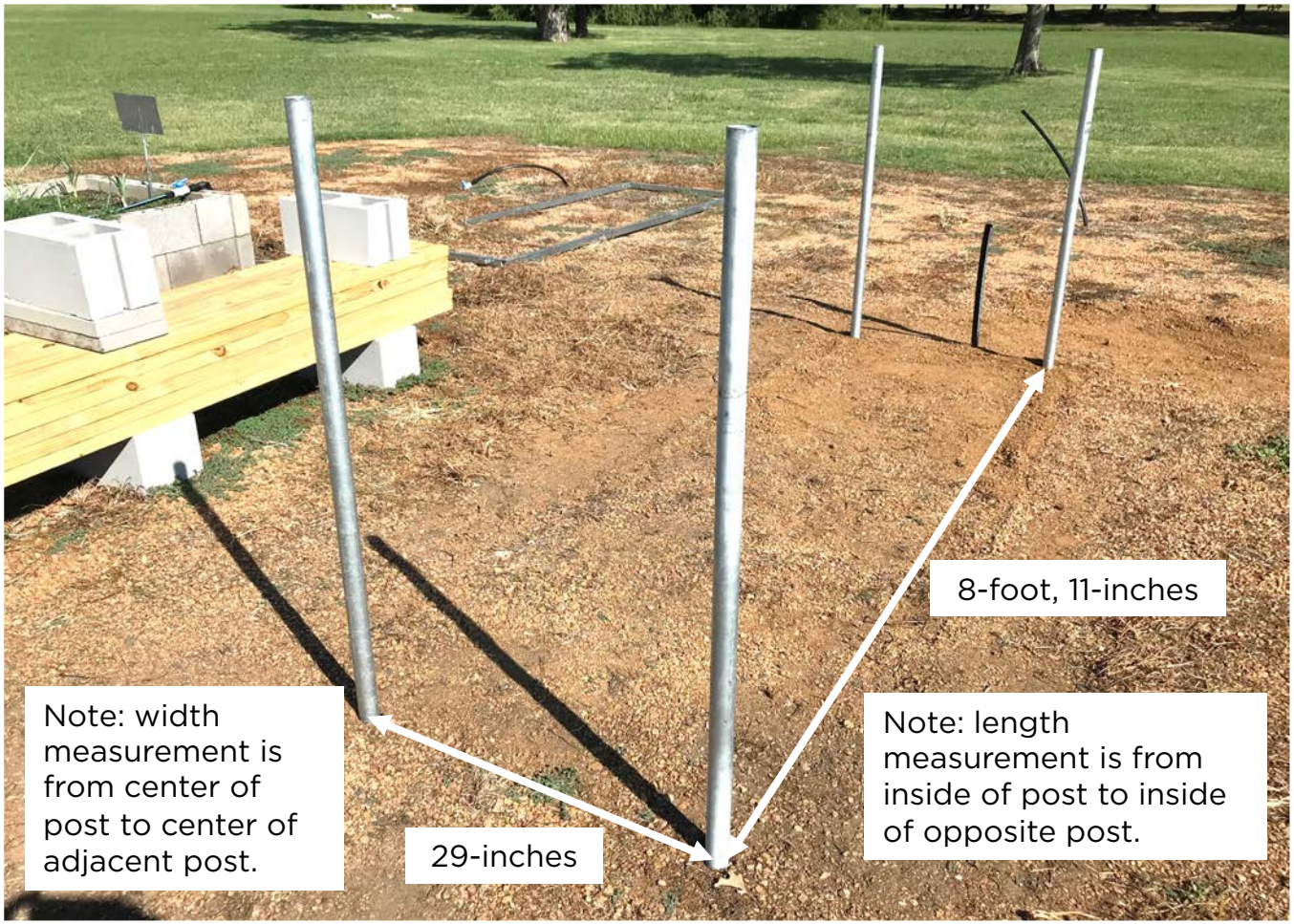
Post Installation (cont'd)

Once posts are securely in place the jig may be removed. The easiest method of removing the jig is to lift simultaneously from both ends. Lifting from one end causes the jig to bind against the posts greatly complicating the process. This is one activity where the use of two people is strongly encouraged.

Breaking down the PVC jig following post installation.

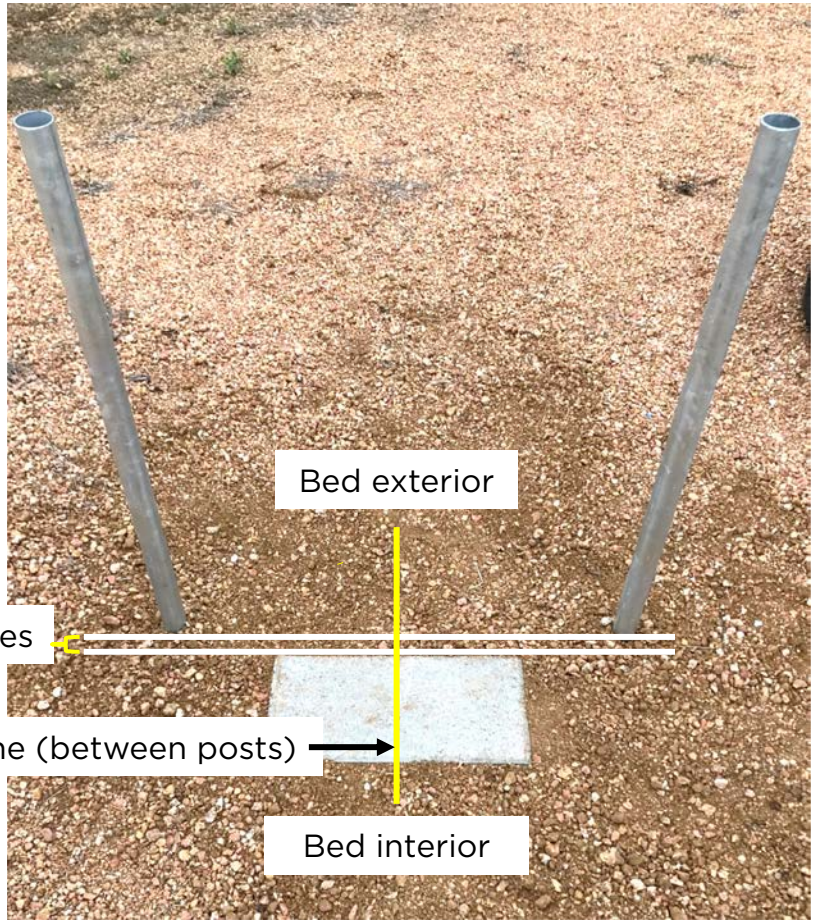
Post Installation (cont'd)

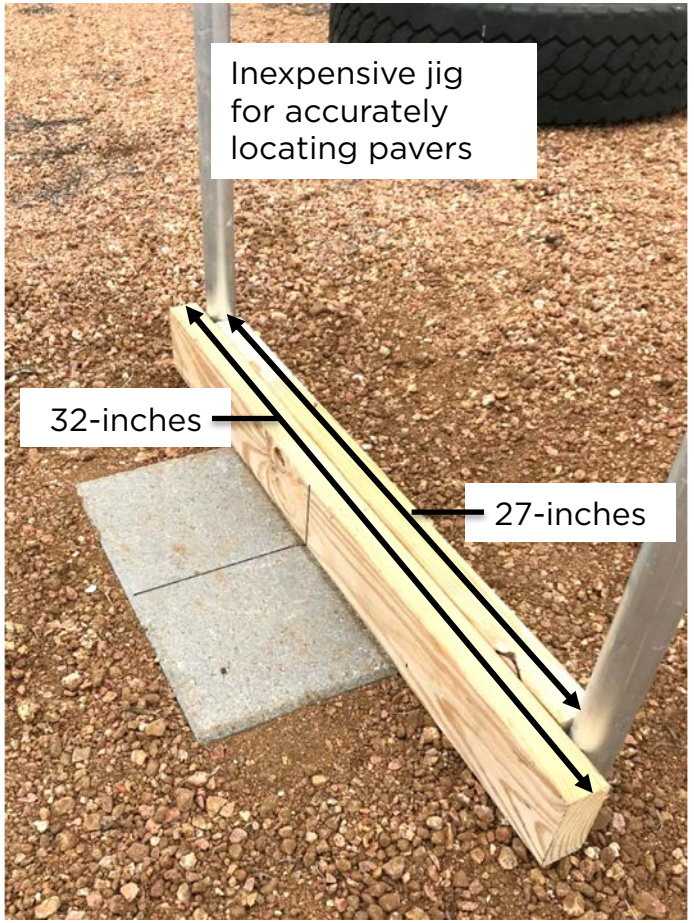
Accurately placed ground posts made possible with use of a jig.



Paver Installation

If you choose to install pavers to support the tires, center the pavers between the posts and offset by 1-1/2 inches as shown. Consider constructing a jig to simplify locating pavers.





Note: Dimensions listed for jig are specific for use with 1-1/4-inch EMT conduit posts.

Paver Installation (cont'd)

Use an 8-foot section of angle iron, steel tubing or 2-inch x 4-inch board positioned as shown to ensure both pavers are level, one with the other. Make sure the pavers are well seated prior to checking the level. Standing on the pavers will help seat them. If you did a good job leveling the site prior to installing the pavers, only slight adjustments will be required during the installation process.

Use a torpedo level to level individual pavers.

Tire Attachment

If pavers have been installed, no additional leveling will be required. If pavers are not used, the elevation of one of the tires may need to be adjusted in order to ensure both are on the same level. Typically, if you did a good job leveling the site only a small adjustment will be required when leveling. All things being equal, it is easier to lower a tire by removing soil than it is to raise a tire by adding soil.

To accomplish leveling, the tires must be centered on the posts. Use a tape measure or a jig to locate the midpoint between both sets of posts and designate using a large nail.

Position the tires against the inner surface of the posts and center on the posts as shown making sure the bottom paint mark on the sidewall lines up with the nail. This technique is useful for centering tires when placed on the soil surface or on pavers.

Tire Attachment (cont'd)

Use the white marks at the top of the tires as a point of reference to assist with centering. A 2-inch x 4-inch x 4-foot board can be used as a temporary brace to keep the tires pinned against the posts to ensure they stay centered.

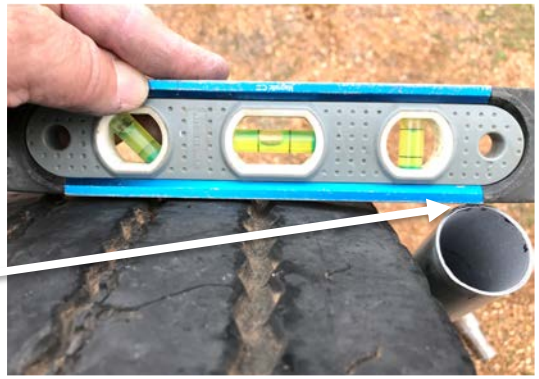
Position an 8-foot section of angle iron, steel tubing or 2-inch x 4-inch board as shown to check the level. Make elevation adjustments to one of the tires as needed.

Tire Attachment (cont'd)

With the leveling process completed (and tires centered on posts), drive posts to their final depth. When driven to the proper depth the top of each post should be even with the tread at its closet point. The posts should not protrude above the tread. A 4-foot carpenter's level can be used to ensure the post tops are level one with the other.

The tire will be centered on the posts if the distance from the top paint mark to both posts is the same. This assumes the location of the paint mark is accurate and the posts are installed plumb. With the tire centered on the posts, attach using pipe hangers and 1-1/2-inch sheet metal screws as shown. Position pipe hangers at the same location on each post before fastening.

Post top even with tread surface.

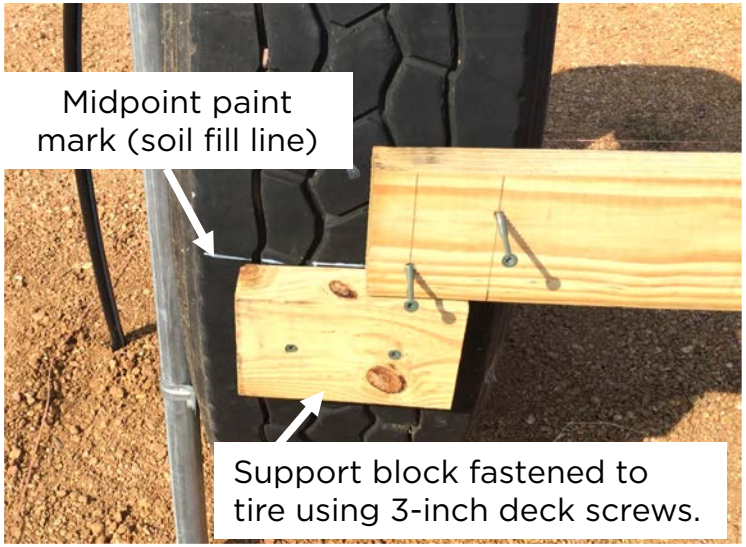


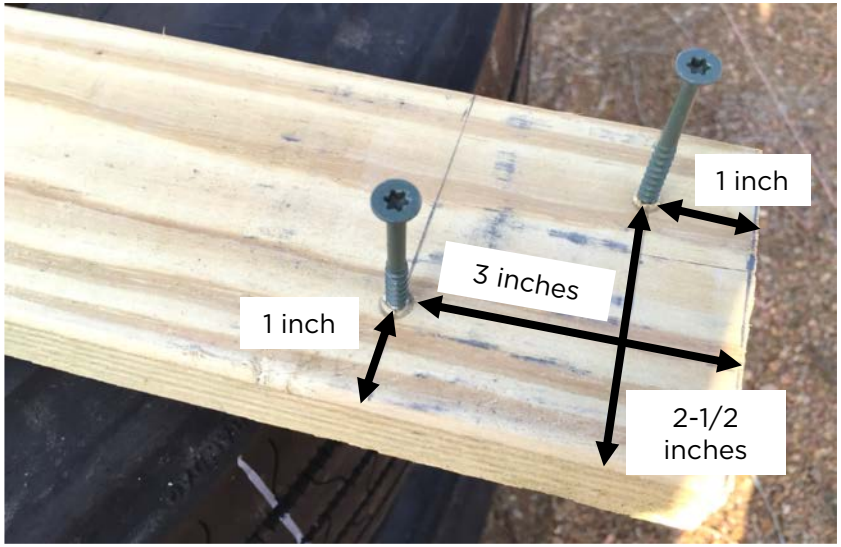
Siding Installation

As mentioned in the introduction, several material options are available to construct the sides of the planter. This section details the use of 2-inch x 4-inch x 8-foot treated lumber to construct the planter. When selecting boards, avoid bent or misshapen ones. The use of straight boards makes assembly easier and creates a better looking bed. Also, most lumber is not cut precisely to length at the mill, so be sure and measure each board and cut to size prior to fastening.

Starting on one side of the planter, locate the midpoint paint mark on both tires. Attach a support block to one of the tires as shown using 3-inch deck screws.

Before attaching, partially insert 3-inch deck screws on each end of the boards. To ensure a tight, uniform connection, use a minimum of two screws and position screws on a diagonal as shown. Partially inserting screws into the boards makes attachment much easier.





Siding Installation (cont'd)

With a board centered on the tires and one end resting on the support block (or held in place by an extra set of hands), align the bottom of the board at the opposite end with the paint mark on the tire. Before attaching, check the level using a 4-foot level. In the event the board location as determined by the paint mark and the carpenter's level do not agree, go with the location as determined by the level. You will need to apply pressure to the board while inserting the screws to insure a tight fit.

Siding Installation (cont'd)

Continue to attach boards to the tire frame as shown. Using two people makes the process go much quicker. A total of seven boards are required to complete each side of the planter.

In order to access lower boards using an impact driver, plan on removing soil from around the base of the tire as shown.

Remove soil to allow tool access.

Siding Installation (cont'd)

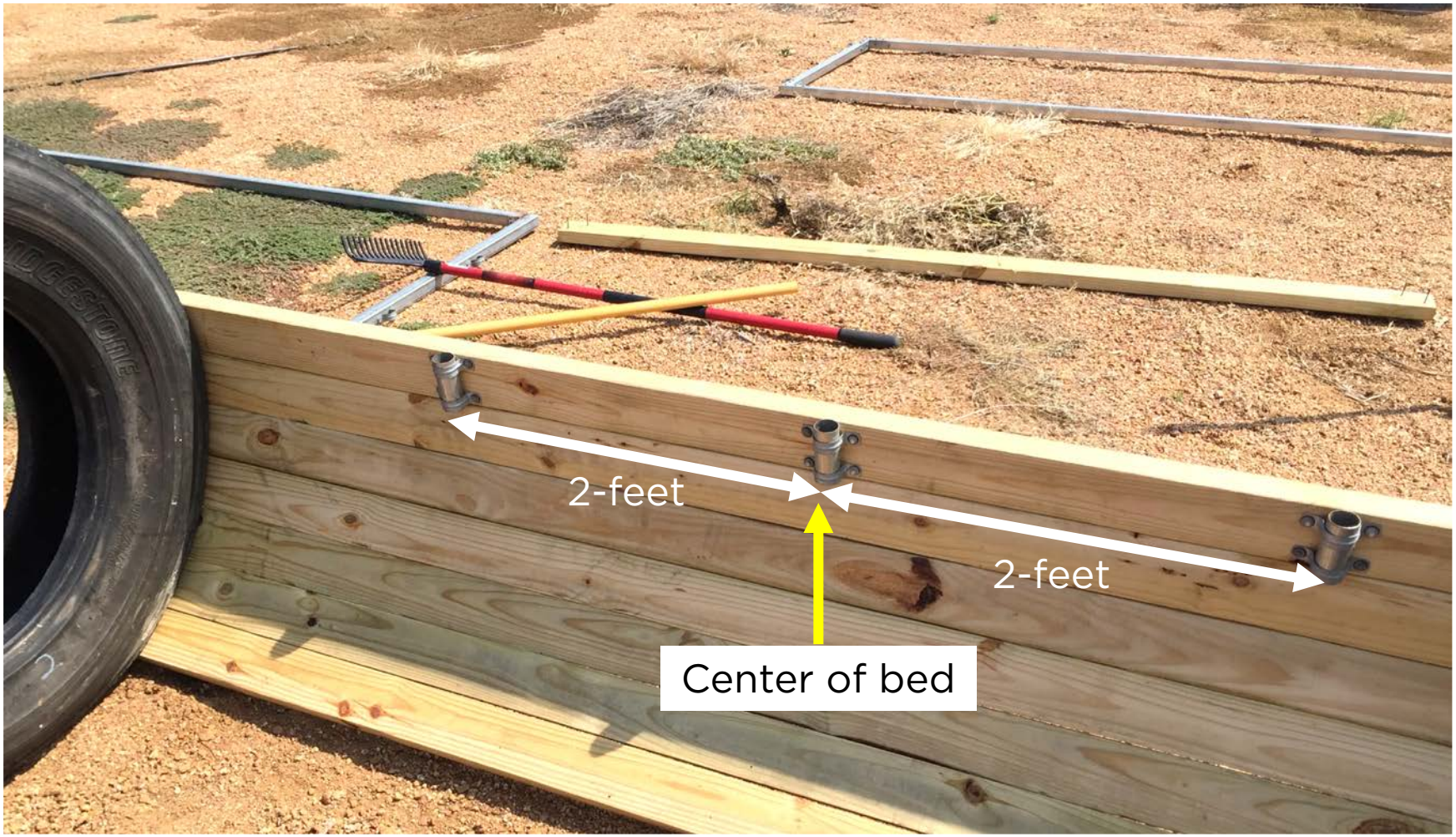
One side of planter installed.

Siding Installation (cont'd)

If you plan on equipping your planter with a crop cover, now is the best time to install the hoop receptacles. Using a chop saw, cut six, 3-1/2-inch hoop receptacles using the 1-inch EMT tubing. Use a file to remove burrs (See Bunk Planter Crop Cover parts list).

Attach receptacles to the bunk bed using pipe hangers and 1-inch sheet metal screws. Position the lower pipe hanger close to the bottom edge of the receptacle.

Siding Installation (cont'd)



Evenly space receptacles along the inner surface of each side as shown.

Siding Installation (cont'd)

Install 24-inch long steel straps to strengthen the bed sides. Use 1-inch sheet metal screws to attach the strapping.

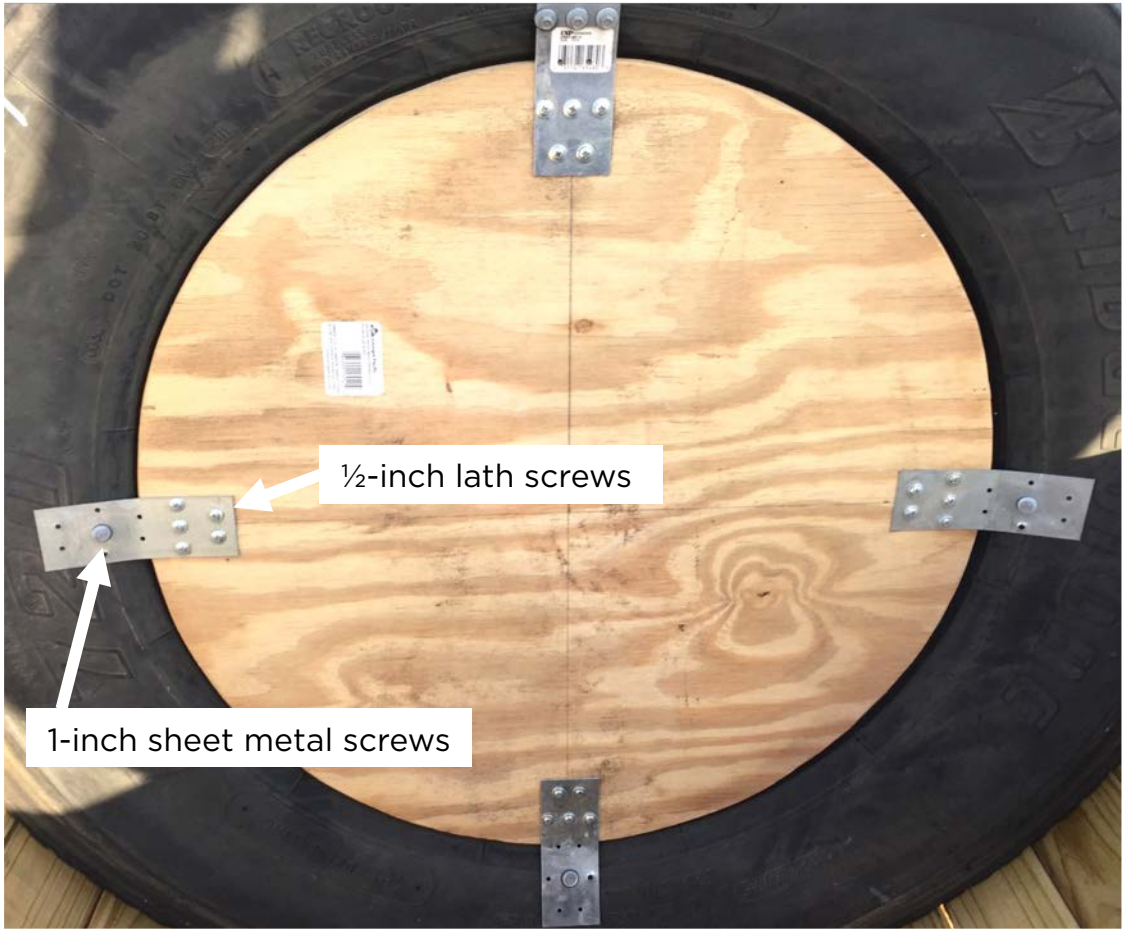
Plan on installing three straps on each side. Locate straps next to the hoop receptacles.

Siding Installation (cont'd)

Jump to the opposite side of the planter and repeat the process. Use the paint mark on the tire as the starting point. Before installing the first board, place a 4-foot level across the top of the planter (one side to the other) to ensure the board is installed level. Complete installation of remaining boards, hoop receptacles and steel straps.

End Cap Installation

Use a jig saw to cut two disks from a 15/32-inch piece of pressure treated plywood. The disks should measure 23-1/4-inches in diameter, large enough to overlap the 22-inch wheel diameter. Attach the disks to the interior surface of tires as shown using 5-inch nail plates, 1-inch sheet metal screws and ½-inch lath screws.



Sealant Application

To increase the service life of the planter, apply Flex Seal to the inner surface of the planter and to the end caps to create a water barrier. Apply a combination stain/sealer to all exterior wood surfaces.

Add Growing Medium

To decease the volume of soil/growing mix required, consider filling the bottom half of the planter with shredded tree trimmings, bricks, etc.

Sticks used as filler material

Loam soil over fill

Planter filled with commercial nursery mix

Bunk Planter Crop Cover

Assembly and Installation Plans

Bunk Planter Crop Cover Parts List

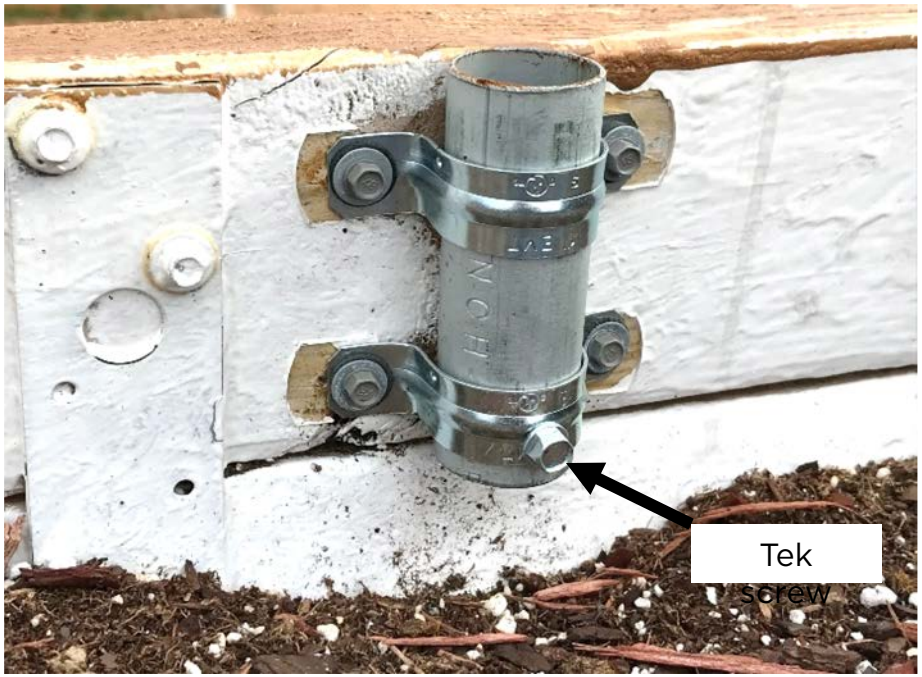
Item	Quantity	Unit	Total
Greenhouse poly film (6-mil clear) 4-foot X 9-foot	2	$5.00	10.00
EMT steel tubing (1-inch X 10-foot)	1	10.50	10.50
EMT steel tubing (3/4-inch X 10-foot)	4	6.00	24.00
Bungee cord (4-foot)	2	2.50	5.00
24 inch Horizontal Plastic Closure Strips for corrugated roofing (6-Pack)	1	6.00	6.00
Eye screws (#106 X 1-13/16-inch) 2-pack	1	1.30	1.30
PVC snap clamps (1/2-inch X 48-inch)* 10-pack	1	27.00	27.00
Self tapping sheet metal screws (no.9 X 1-inch)	One box (120 count)	11.00	11.00
Deck (wood) screws (no.8 X 1-1/4-inch)	One box (30 count)	2.60	2.60
ADS 100-PSI Poly Coil Pipe (3/4-inch x 100-foot)	One roll	25.00	25.00
White Braided Nylon Rope (3/16-inch x 50-foot)	One roll	9.00	9.00
Pipe hangers (1-inch EMT)	12	0.50	6.00
Hex drive Tek screws (no.10 X ¾-inch)	One box (50 count)	6.00	6.00
Pipe hangers (1/2-inch EMT)	4	0.30	1.20
Plastic barbed tee fitting (3/4-inch)	4	1.00	4.00
Rebar (3/8-inch X 10-foot)	2 joints	5.00	10.00
Total			**$158.60**

*Available at Greenhouse Megastore **https://www.greenhousemegastore.com/snap-clamps-sn--sc**. Note: Clamp size that fits ½-inch sch 40 PVC pipe is recommended for use on ¾-inch EMT steel conduit.

Bunk Planter Crop Cover (cont'd)

(See page 27 in section on Siding Installation for instructions on installing hoop receptacles)

Insert a single ¾-inch Tek screw into the base of each hoop receptacle as shown. The screw serves as a stop for the hoop when inserted into the receptacle.



Prepare hoops. Cut three pieces of tubing from the roll of ¾-inch poly pipe. Each piece should measure approximately 61 inches.

Bunk Planter Crop Cover (cont'd)

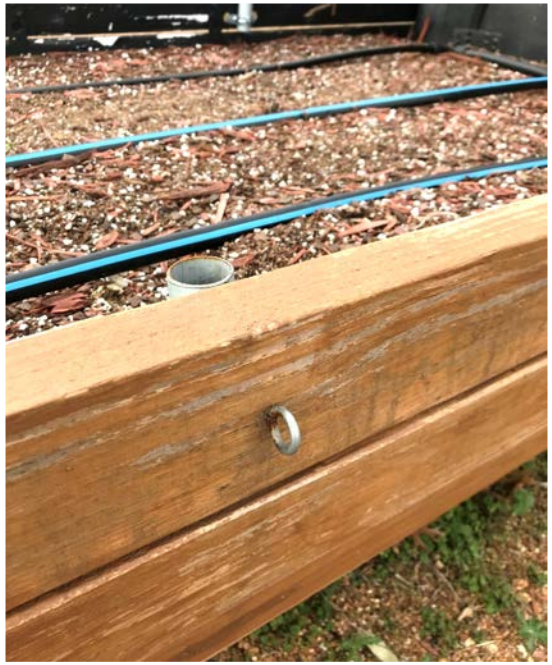
Insert hoops into the receptacles and check for fit. Use a joint of the ¾-inch conduit to ensure the hoops match the height of the tires. If a hoop is too long, cut down to fit; if too short, cut another piece to fit.

Bunk Planter Crop Cover (cont'd)

Attach plastic closure strips to each tire. The slots in the strips prevent the cover from sliding on the frame. The closure strips shown in the photo come in 24-inch sections that snap together. Connect two sections together, center on the tire as shown and secure using 1-1/4-inch deck screws. Note: the use of closure strips is optional. Being diligent in keeping the bungee cords and straps tight will reduce sliding. The choice is yours.

Bunk Planter Crop Cover (cont'd)

Install eyes screws. The eye screws work in combination with the rope to restrain the cover at the center of the planter. Install one screw in the fourth board from the top and at the center of the planter. Install the other eye screw in the top board on the opposite side and in the center of the planter.



Bunk Planter Crop Cover (cont'd)

Attach a ½-inch pipe hanger to both sides of each tire as shown using 1-inch sheet metal screws. The pipe hangers are used to attach the bungee cords to the frame.

Assemble the planter cover. The cover consists of two sections. Each section is composed of two pipe reels, a 4-foot x 9-foot piece of greenhouse poly film and 20 snap clamps.

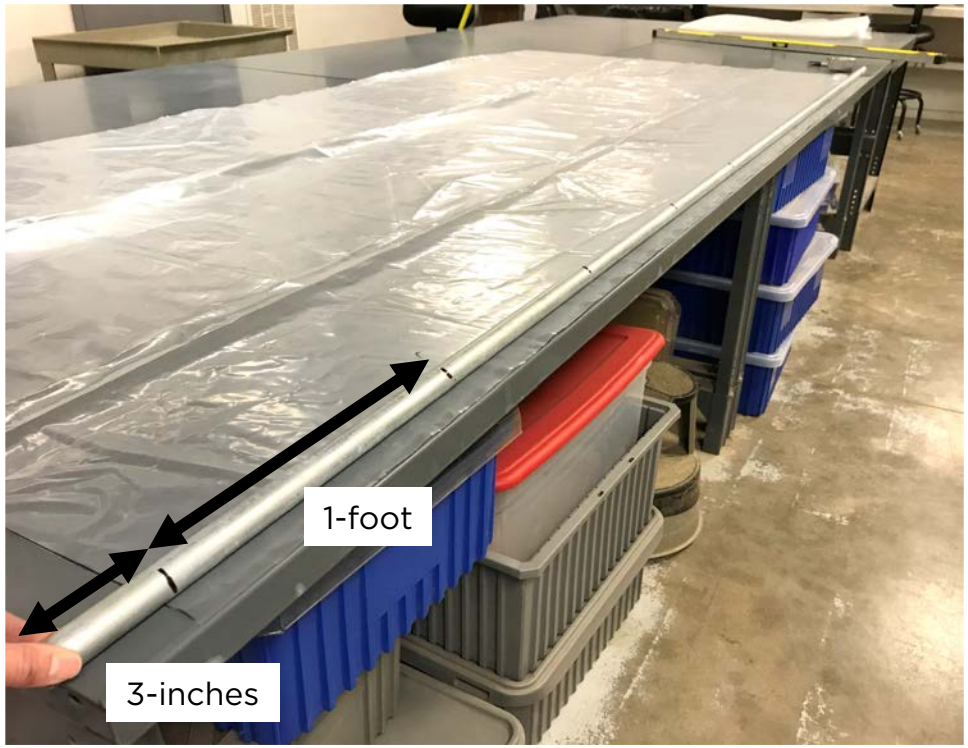
Fabricate the reels. Using a chop saw, cut each ¾-inch conduit to a length of 9-1/2-feet. Use a file to remove burrs.

Prepare two, 4-foot by 9-foot pieces of poly film. A large work table makes a great surface to measure and cut the film to size.

Bunk Planter Crop Cover (cont'd)

Use a chop saw to cut the snap clamp strip into individual clamps measuring 1-1/2-inch.

Designate snap clamp location on the pipe reels. Using a permanent marker, make a mark on each reel three inches from both ends and on one-foot centers between the outer marks.



Bunk Planter Crop Cover (cont'd)

Move one of the poly film pieces to the edge of the table. Orient a pipe reel along one of the long edges as shown. The end mark on the reel should be aligned with the edge of the poly film. Starting at one end, roll the edge of the film around the reel until it contacts the film. Attach the film to the reel as shown using a snap clamp.

Bunk Planter Crop Cover (cont'd)

Repeat process on each reel until both pieces of poly film are attached. With both edges of the poly film attached, roll up the cover from both sides evenly distributing the plastic on both reels.

One side of poly film attached to reel.

This section of the cover is ready to install on the planter.

Bunk Planter Crop Cover (cont'd)

Install bungee cords. Place each section of the cover under the bungees and on the closure strips as shown. The cover can be installed two ways; with the film rolled over the top of the reels or under the reels.

Bunk Planter Crop Cover (cont'd)

Standing on one side of the bed, grab the top reel with both hands and slowly unroll the poly film moving the reel upward one section on the closure strips at a time. Continue unrolling the film until you reach the first valley past the paint mark (top of bed). While unrolling the film, keep tension on the reel to maintain a tight roll. The tension provided by the bungee cords will prevent excess unreeling of the film. Next, unroll the poly film on the bottom reel using the same basic procedure until the reel comes to rest on the side of the planter. Move to the opposite side of the bed and repeat procedure with the second cover section. To create a rain proof seal, the top reel of the second section must overlap the top reel of the first section as shown.

Cover installed with the film rolled over the top of the reel. Notice how one section of the cover overlaps the other to create a water tight seal.

Closed configuration

Bunk Planter Crop Cover (cont'd)

To more fully secure cover and limit flapping of the poly film, install a rope strap. Secure the strap to the frame using the previously installed eye screws. Tie a loop in one end of a 14-foot long section of rope. Run the other end through both eye screws and over the top of the cover. Position the rope on either side of the center hoop. Tie off the free end by running it through the loop and securing with a half hitch. To increase tension on the cover, loosen the knot, pull down on the rope and tie off with a half hitch.

Bunk Planter Crop Cover (cont'd)

During high wind conditions the poly film has a tendency to unwind on the reels resulting in a loose fitting cover. To prevent the reels from turning, install 'tee' handles on one end of each reel. A 3/8-inch rebar stake placed through the handle effectively locks the reels in place. A ¾-inch plastic barbed tee fitting makes a great handle. In order for the fitting to slip inside the pipe reel the diameter of the perpendicular arm will need to be reduced. Use a grinder to remove just enough plastic to achieve a secure fit.

Bunk Planter Crop Cover (cont'd)

With the cover in the closed position and with as much slack in the poly film removed as possible, install two tees to reels on one end of the bed as shown and two tees to reels at the opposite end as shown. Install the tees in an upright position on the reels as shown.

North end

South end

Bunk Planter Crop Cover (cont'd)

Secure the tees to the reels using ¾-inch Tek screws.

Using a chop saw, cut four pieces of 3/8-inch rebar long enough to protrude above the tee handles when installed. Bend each rebar as shown to create a handle.

Reels locked in place using rebar stakes.

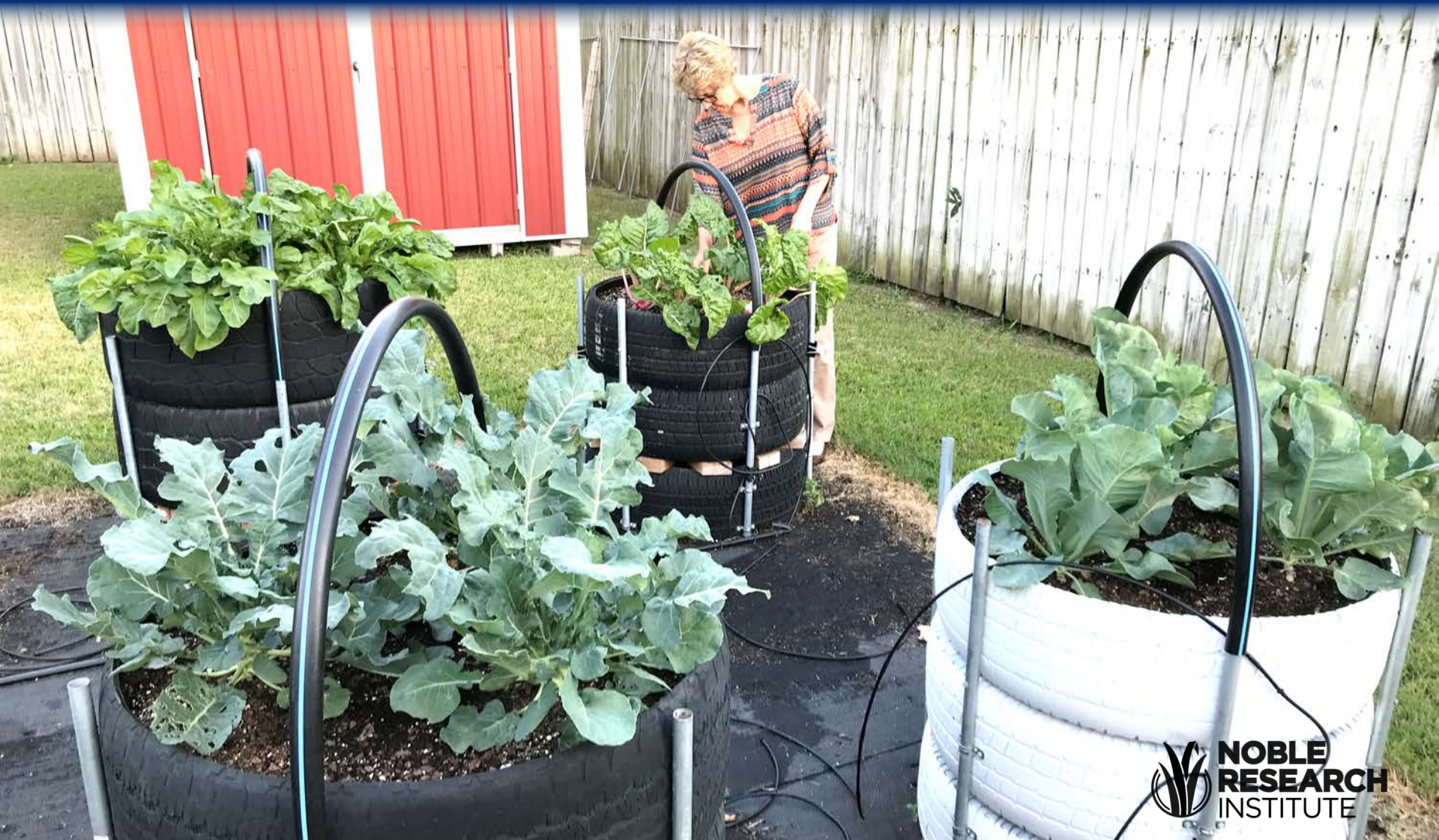
Bunk Planter Crop Cover (cont'd)

To vent the crop cover, remove stakes, move reels to the desired position and reinstall stakes.

Closed crop cover for maximum protection.

Modular Tire Planter

Steve Upson, Horticulture Consultant



Introduction

For over 25 years, the Noble Research Institute has been researching the use of discarded tires to support the production of specialty crops, more particularly in the creation of raised bed and container growing systems. The NRI Modular Tire Planter represents our latest effort in developing an adjustable height, environmentally friendly, sustainable growing platform that is inexpensive to construct and maintain.

The Modular Tire Planter derives its name from a stack of tires. Each tire in the stack serves as either a base module or a growing module. Depending on configuration, a planter can consist of one or more base or growing modules.

A module can range in depth from six inches to twelve inches depending on the size (width) of tires chosen. The average depth of the modules used in our modular planters is about eight inches. A growing module with an 8-inch rooting depth is sufficient to grow most vegetable and floral crops if close attention is given to irrigation scheduling. However, based on our experience, we recommend using two growing modules for best results. Not only does the increased volume of growing medium increase rooting area, water and nutrient holding capacity, it acts as a buffer against the increase in soil temperature, thus reducing temperature related stress on crops during the summer.

The planter is equipped with a frame which ensures the integrity of the structure and which serves as a point of attachment for accessories such as a mini greenhouse, shade structure and crop trellis

The planter can be assembled with or without an elevated floor. The addition of an elevated floor (bottom) reduces the amount of growing medium required to fill the planter. As an added benefit, the floor component serves as a natural vent that aids in the dispersal of hot air that can build up during hot, summer days.

Planters equipped with elevated floors have both growing modules and base modules. The base modules support the elevated floor and as such contain no growing medium. Planters equipped with elevated floors are technically classified as containers. To ensure adequate drainage, they should only be filled with a soilless growing medium.

The bottom module of a planter that does not utilize an elevated floor serves as both a base module and a growing module. To avoid confusion, the bottom module of a floorless planter will be referred to as a base module.

Depending on the desired height, two, three or four tires are required to construct a planter. A set of four identical, used automobile or light truck tires is recommended for construction. While it is possible to construct a planter using different brand tires of similar size, it is not recommended due to the requirement for shims. A set of four identical, used automobile or light truck tires is typically available at most tire shops.

Two module planter with elevated floor, 1 base module, 1 growing module. Recommended post length: 20 inches.

Three module planter with elevated floor, 1 base module, 2 growing modules. Recommended post length: 30 inches.

Four module planter with elevated floor, 2 base modules, 2 growing modules. Recommended post length: 40 inches.

Three, 3 module planters without elevated floors.

Parts List for a Three Module Planter (equipped with an elevated floor) (11/20)

Item	Quantity	Unit	Total
Auto/light truck tires *	3		no cost
EMT conduit tubing (3/4-inch X 10-foot)	2	$6.50	$13.00
Goat panel (16-foot X 4-foot X 4-inch mesh) Note: makes up to seven floor panels	1 panel	45.00	$45.00
Sharp point, self tapping sheet metal roofing screws (no.10 X 1-inch)	One box (40 count)	$6.00	$6.00
Hex-drive Tek screws (no.10 X ¾-inch)	One box (50 count)	$6.00	$6.00
Deck screws (no. 10 X 2 ½-inch)	One box (40 count)	$6.00	$6.00
Pipe hangers (3/4-inch EMT)	One bag (20 count)	$4.50	$4.50
Treated lumber (2-inch X 4-inch X 8-foot)	1	$5.00	$5.00
Weed barrier fabric (3-foot X 50-foot roll, 5 oz) Note: enough fabric to equip 16 planters	1	$31.00	$31.00
Duct (Gorilla) tape	1 roll	$9.00	$9.00
Potting soil (2-cubic foot bag) **	3	$10.00	$30.00
Total			**$155.50**

* Tires should be identical in size and preferably at least 30 inches in diameter. Note: 4 tires required for a 4-module planter.
** Volume of soil required dependent on size of tires selected.

Tool Requirement

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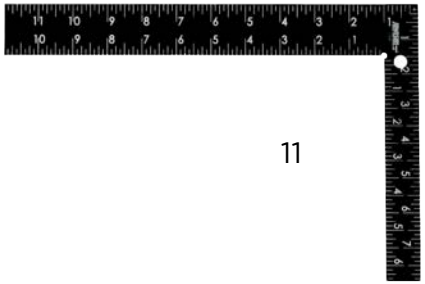
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No.	Item
1	Jig saw
2	Cut off saw
3	Angle grinder
4	Impact driver
5	Circular saw
6	Plastic long tape
7	Retractable tape measure
8	Carpenter's pencil
9	Sharpie paint marker
10	Utility knife-hook & standard blades
11	Carpenter's square
12	Bolt cutters
13	Torpedo level
14	Carpenter's level: 4-foot

Construct Planter Base

Step 1: Choose one tire to be the base module.

Step 2: Designate post location on the base. Using a tape measure and a white marker, make six evenly spaced vertical lines on the tire as shown. For ease of calculation, use a tape measure that measures in tenths of inches. A carpenter's square or level can be used to ensure lines are plumb. If a level is used, make sure the tire is positioned on a level surface.

Construct Planter Base (cont'd)

Step 3: Using conduit, cut six posts to the desired length. Remove burrs on the tubing. Note: 30-inch posts are sufficient for a stack of three tires. 40-inch posts may be required for a stack of four tires.

Step 4: Install pipe hangers. Align the center of the hangers over the lines as shown and attach one side using sheet metal screws.

Step 5: Install conduit posts. Insert posts into the hangers. Prior to attaching the other end of hangers, place a short piece of 2x4-inch lumber under the post to ensure all posts are installed uniformly.

Note: If you choose to utilize two base modules in order to construct a taller planter, place a second tire on top of the first. Secure posts using pipe hangers and sheet metal screws. When using a second tire, one pipe hanger per post is sufficient. There is no need to mark the second tire, however, use a torpedo level to ensure the posts are plumb before attaching to the tire.

Caution: Use eye protection when using power tools!

Move Planter Base

Move planter base to desired location and level. It is best to level the site before locating the planter, however, if this is not possible, use shims to level the planter. Pieces of rubber pavers make excellent rot and rust proof shims.

Install Elevated Floor Cross Supports

Step 1: Install two, 2-inch x 4-inch cross supports on the upper surface of the base module as shown. Cut boards to size being sure to angle the ends to match the curvature of the tire. The boards should be five inches apart plus or minus an inch depending on tire (rim) size. To prevent slipping, attach the boards to the sidewall using 2-½-inch deck screws.

Step 2: Prepare eight, 2-inch x 4-inch x 4-inch support blocks for installation at a later stage.

Prepare Growing Modules

Step 1: Choose one tire to create the lower growing module. On one side of the tire use a paint marker and tape measure to mark the side wall along the midpoint (crown) as shown. Using a utility knife, cut along the line to remove the side wall. This section of side wall may be discarded.

Prepare Growing Modules (cont'd)

Step 2: Flip the tire over and remove the side wall. Use a utility knife to prepare a slit large enough to insert a jigsaw blade. Cut as close to the tread as possible without exposing the steel belting. Choose a fine toothed hacksaw blade (17-24 teeth per inch) for best results. If you happen to cut into some of the steel belts by accident there is no need to panic. The steel wire exposed on the tread can be removed using an angle grinder. Save the side wall.

Step 3: If desired, choose another tire to create an upper growing module. When fabricating an upper growing module, completely remove both sidewalls. Discard the sidewalls. Note: for best results, choose two (upper and lower) growing modules.

Lower growing module

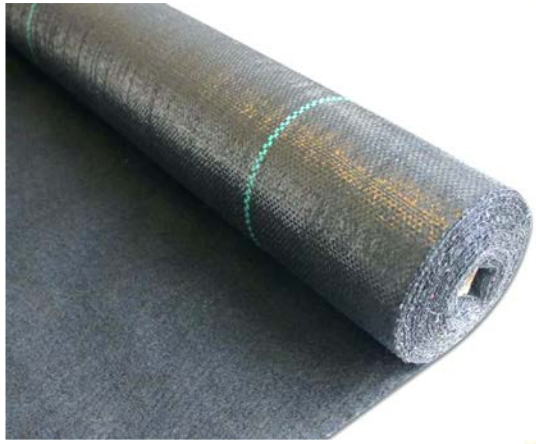
Upper growing module

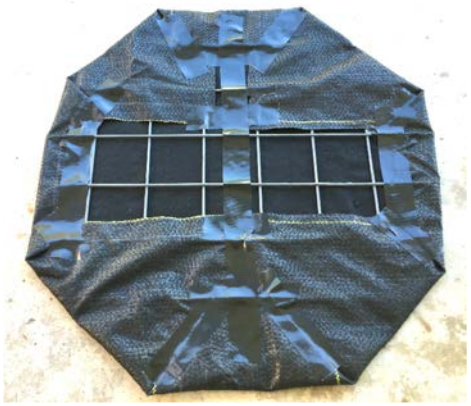
Fabricate Floor Panel

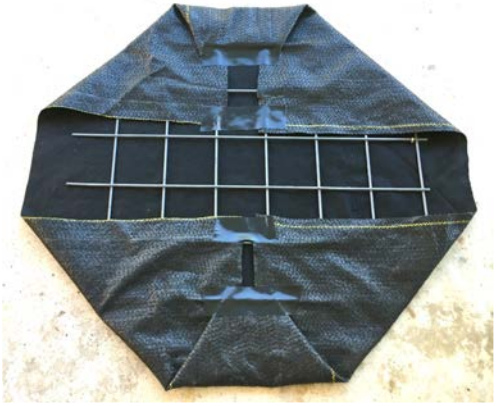
Step 1: Fabricate a floor panel for the lower growing module using a piece of goat panel. Using the saved sidewall as a template, mark off the panel as shown. Use a pair of bolt cutters to cut the panel. Trim edges of panel to lay flat on the bottom of the module.

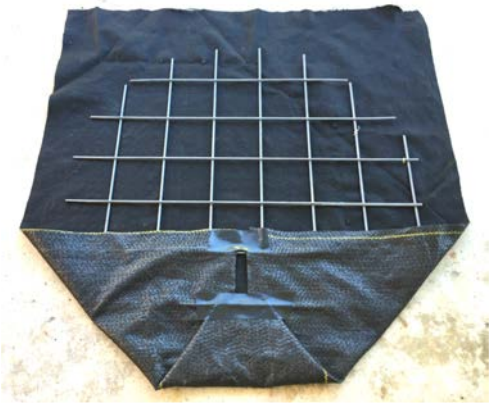
Fabricate Floor Panel (cont'd)

Step 2: Prepare a liner for the floor panel using a piece of heavy weight weed barrier fabric such as Dewitt Pro 5. Gather the fabric on the back side as shown and secure using duct tape. If a lighter weight fabric is chosen, several layers may be needed to prevent liner failure.









Install Growing Modules

Step 1: Wash the interior surface of the growing module(s) prior to installation.

Step 2: Insert the lower growing module into the frame and position on top of the cross supports.

Step 3: Insert the 2-inch x 4-inch x 4-inch support blocks as shown.




Install Growing Modules (cont'd)

Step 4: Attach the lower growing module to the frame as shown using pipe hangers and sheet metal screws. Prior to attaching, adjust each post as necessary using a level to ensure they are plumb. One pipe hanger per post is sufficient.

Step 5: Use an angle grinder to remove protruding screw tips. Sweep out filings.

Install Growing Modules (cont'd)

Step 6: Install the floor panel.

Step 7: If used, insert the upper growing module into the frame and position on top of the lower growing panel.

Step 8: To prevent slippage, secure each post to its corresponding pipe hanger on the base module using a self tapping 'Tek' screw.

Fill Planter

Fill planter using a soilless growing mix high in organic materials such as peat moss and composted pine bark.

To reduce the volume of growing mix required for modular planters not equipped with elevated floors, the base module(s) can be filled with chunks of wood, bricks, etc. If support blocks are used to create a vent, additional fill material will be required to prevent loss of the growing mix. A fill composed of small sticks serves as an excellent screen for retaining growing medium. To be effective, the screening material needs to be added to a depth several inches above the vent.

Floorless planter equipped with perimeter venting.

Perimeter vent covered with screening. Ready for growing mix.

A Word of Caution

The vent openings present in planters equipped with elevated floors create an ideal habitat for black widow spiders. Web covering the vent openings is a sign that spiders have taken up residence in the vent openings and possibly the base modules. Spiders are easily controlled by injecting an insecticide labeled for controlling spiders into the vent openings. The use of an insecticide in such a manner will not harm the crop nor make it unfit for consumption.

Accessorize Your Planter

Drip irrigation

Reflective wrap

To reduce soil temperature during the summer months, consider installing a reflective insulation wrap on the south and west sides of your planters. Use binder clips to attach the wrap to the frame.

Accessorize Your Planter

Butterfly crop cover

(See back of publication for construction plans.)

Basic crop shelter

(See back of publication for construction plans.)

Jumbo crop shelter

(See back of publication for construction plans.)

Trellis possibilities

Results

Butterfly Crop Cover

The butterfly cover is designed to be used in conjunction with a modular planter. The cover derives its name by the way it pivots in the middle. When placed on top of a modular planter it creates an ideal environment for seed germination and seedling development during cool weather. Ventilation is achieved by raising one or both of the “wings”, the degree of ventilation attained determined by the position of the wings. The cover can also be used to protect young transplants when used in combination with an additional tire module placed on top of the planter. These construction plans provide details for constructing a cover sufficient in size to accommodate a wide range of modular planters. Custom sized covers can be made by making a few modifications to the individual components.

Butterfly Crop Cover Parts List

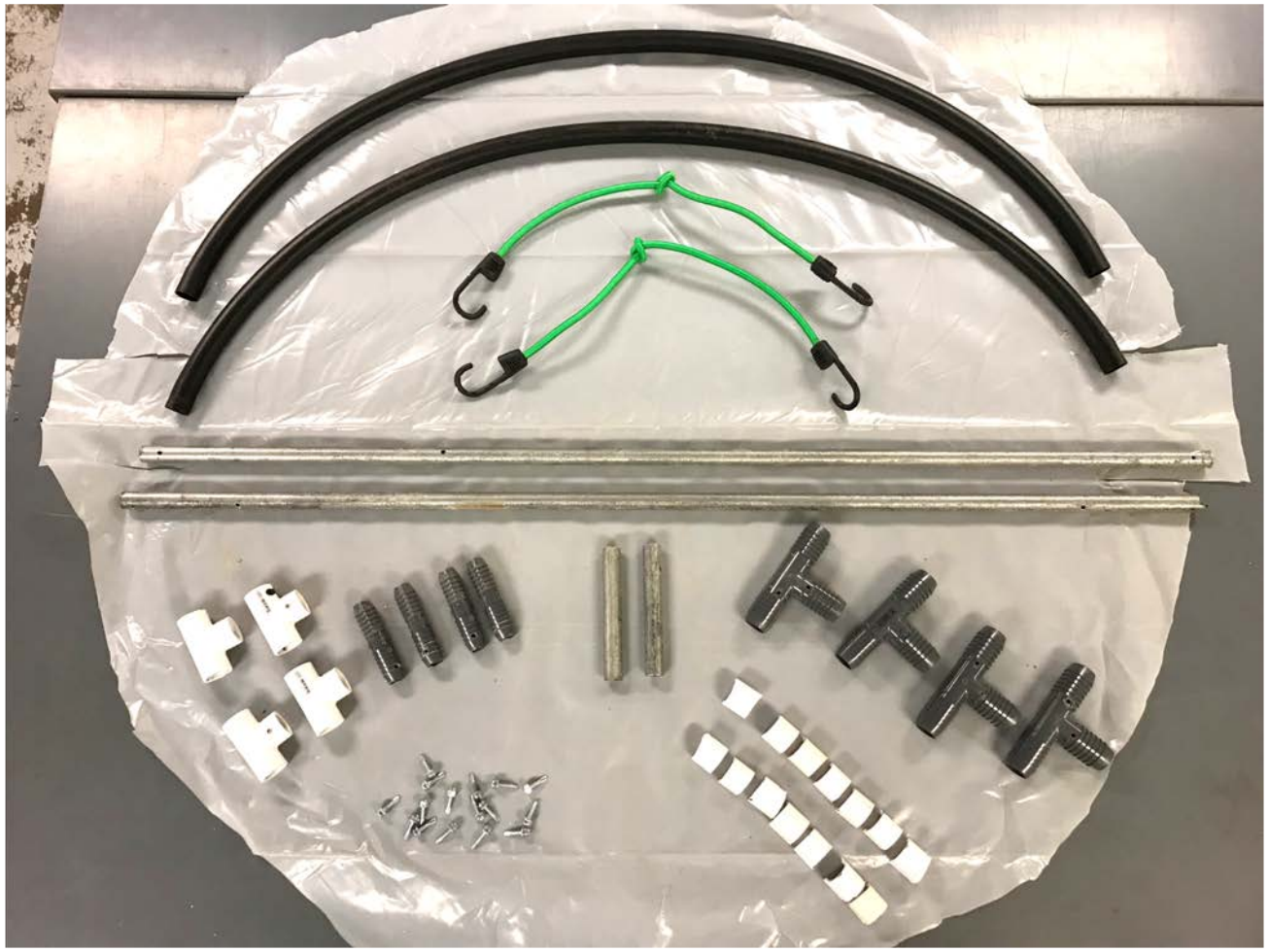
Item	Quantity	Unit	Total
Polyethylene sheeting (clear) 10-foot X 25-foot, 6-mil*	1	25.00	25.00
EMT steel conduit (1/2-inch X 10-foot)	1	3.60	3.60
Bungee cord (2-foot)	2	2.00	4.00
PVC Tee fitting (1/2-inch slip)	4	0.65	2.60
PVC snap clamp 1/2-inch X 4-inch)**	10 pack	0.45	4.50
ADS 100-PSI Poly Coil Pipe (3/4-inch x 100-foot)***	One roll	25.00	25.00
Hex drive Tek screws (no.10 X ¾-inch)	One box (50 count)	6.00	6.00
Plastic barbed coupling (3/4-inch)	4	0.90	3.60
Plastic barbed Tee fitting (1-inch)	4	1.00	4.00
Total			**$78.30**

* Construction grade film. Greenhouse film preferred but more expensive. A 10-foot X 25-foot roll will equip 12 butterfly crop covers.

Available at Greenhouse Megastore **https://www.greenhousemegastore.com/snap-clamps-sn--sc.
Note: Clamp size that fits ½-inch sch 40 PVC pipe is recommended for use on ¾-inch EMT steel conduit.

***A 100-foot roll of poly pipe will equip 12 butterfly crop covers.

Butterfly Crop Cover Components



Butterfly Crop Cover

Prepare spindles. Use a chop saw or angle grinder to cut two, 42-inch long spindles from the ½-inch metal conduit. Remove burrs on the ends of the spindles.

Assemble hinges. Use an angle grinder to reduce the barb size (coupler diameter) on one end of all four plastic barbed couplers. Remove just enough plastic to allow a snug fit when the couplers are inserted into the poly pipe.

Butterfly Crop Cover

Assemble hinges (cont.) Insert a spindle through a PVC tee as shown. Insert the non-scuffed end of a coupler into the PVC tee until it comes to rest on the spindle. Insert a Tek screw to lock the coupler into place. Remove the PVC tee hinge from the spindle and repeat the procedure for the remaining tees.

Butterfly Crop Cover

Assemble wings. Cut two, 48-inch pieces of poly pipe. Insert the free (scuffed) end of a barbed coupler into both ends of a piece of poly pipe as shown. Slide two of the PVC Tee hinges with attached poly pipe onto a spindle as shown. Center the assembly on the spindle. Repeat process using the second piece of poly pipe and spindle.

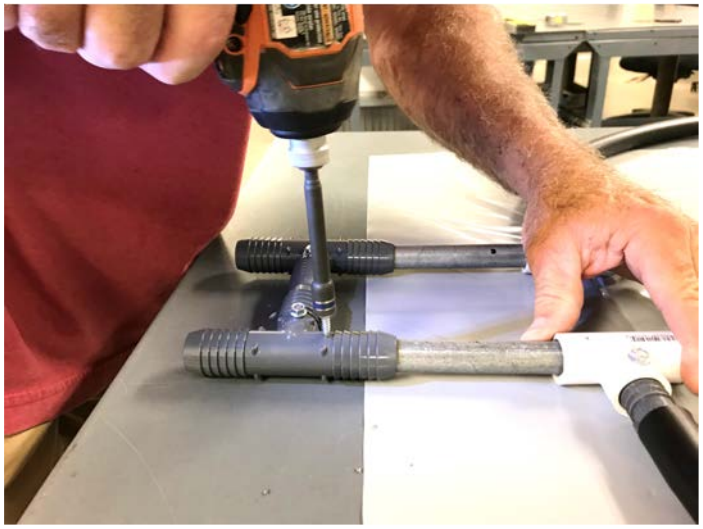
Inserting free end of coupler into poly pipe.

Butterfly Crop Cover

Assemble wing connectors. From the remaining piece of metal conduit, cut two pieces and insert into the plastic (barbed) tees as shown. When cut to the proper length, the conduit will fit snug inside the tees and not be visible. The pieces of conduit used in our cover are 5-inches in length. Use Tek screws to secure the tees to the conduit.

Butterfly Crop Cover

Connect wings. Slide a set of wing connectors onto each end of the spindles as shown and connect using Tek screws. Make sure the spindles are seated against the conduit inside each wing connector before inserting screw. Also, make sure the screws are all inserted on the same side of the frame.



Move each PVC hinge along the spindle until it comes to rest against the corresponding wing connector (barbed tee). To keep the hinges from sliding on the conduit, insert a Tek screw into the conduit next to the tee as shown. Do not insert the screw too deep or it will interfere with the movement of the hinge on the spindle.

Butterfly Crop Cover

Check movement of wings. Raise and lower the wings to make sure they move freely without binding. There should be just enough tension on the hinges to keep the wings in place once released.

Prepare plastic clips. Use a chop saw to cut the PVC clamps into 14, 1-inch wide clips. Attaching the clamps to a two-foot section of ½-inch PVC pipe while cutting will make the job easier and safer.

Butterfly Crop Cover

Prepare poly film. From a roll of plastic film cut a 4-foot X 4-foot piece.

Butterfly Crop Cover

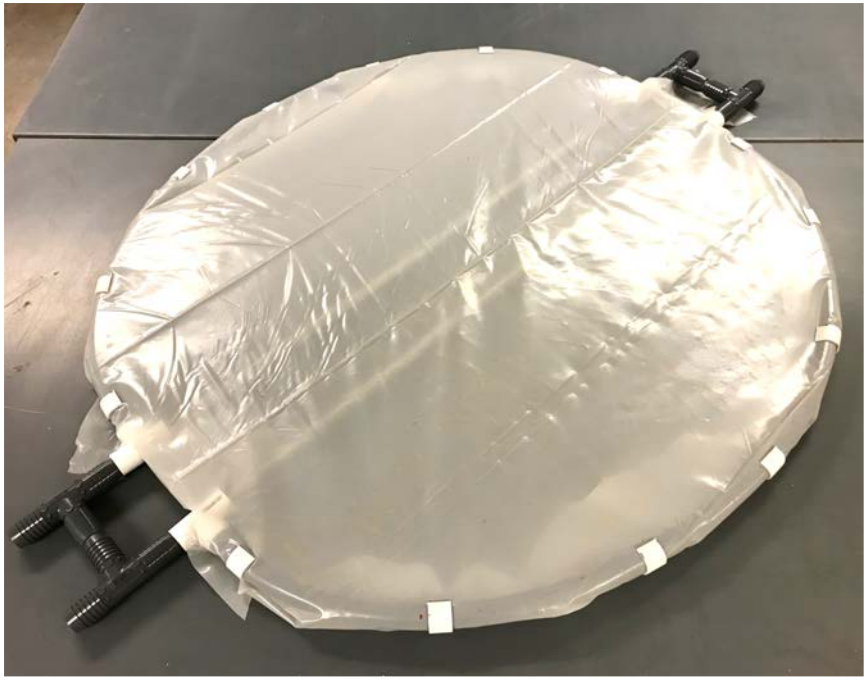
Attach film to frame. Center the frame on top of the plastic cover with screw heads facing up. Attach film to frame using the clips as shown. Evenly space the clips on the pipe. Install every clip with the exception of the four clips that are to be located at the ends of the tubing next to the hinges. The recommended minimum number of clips to use is 14. The use of additional clips will ensure a more secure fit.

Butterfly Crop Cover

Attach film to frame (cont.). Flip the frame over. To enable the use of clips close to the hinges, make a few cuts in the film located on top of the connectors as shown. You should now be able to attach the remainder of the film to the poly pipe. Use scissors to trim excess film from the cover.

Butterfly Crop Cover

Finished butterfly crop cover ready to install on planter.



Butterfly Crop Cover

Installation. Center the crop cover on the top of the planter with the wing connectors centered on and directly above a set of planter posts. Attach using two bungee cords as shown. If necessary, tie a knot in the bungees to increase tension.

Butterfly Crop Cover

Utilization

Maximum protection

Partial ventilation

Maximum ventilation

Use of a butterfly cover in combination with an extra module to protect pepper transplants.

Basic Crop Shelter

The Basic crop shelter is designed to be used in conjunction with a modular planter. The shelter consists of a frame and a cover of some type. The shelter can be used for season extension when equipped with a poly film cover or to shelter crops from high wind, hail, intense solar radiation and many pest insects when equipped with a shade fabric cover.

Because of its low profile, the shelter is best suited for protecting low growing crops and crops that do not require trellising such as strawberry, leafy greens, cole and root crops. Growers needing to protect tall and/or trellised crops grown in a modular planter should install a ‘Jumbo’ Crop shelter. See ‘Jumbo Crop Shelter’ section for assembly instructions.

The Basic shelter’s unique design enables it to be vented at the top while remaining in a closed position. Whether equipped with poly film or shade fabric, the shelter enables access to the crop for pruning, spraying and harvesting without removing the cover from the frame.

Basic Crop Shelter Parts List (2020)

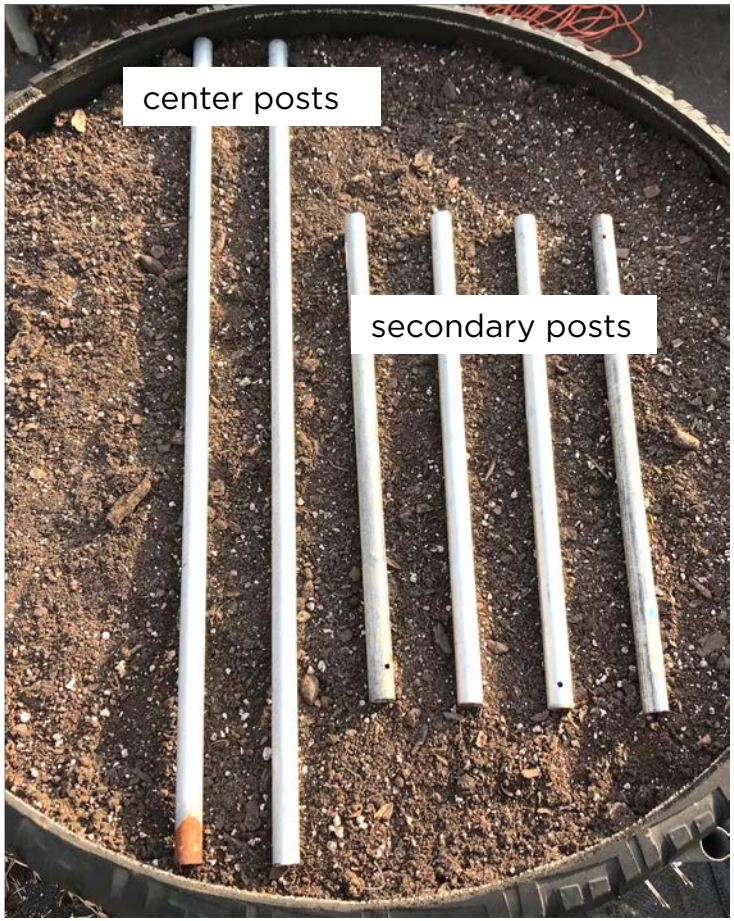
Item	Quantity	Unit	Total
Polyethylene sheeting (clear) 10-foot X 25-foot, 6-mil*	1	25.00	25.00
EMT steel tubing (1/2-inch X 10-foot)	2	3.60	7.20
PVC Schedule 40 slip elbow (1/2-inch)	2	0.40	0.80
ADS 100-PSI poly coil pipe (3/4-inch x 100-foot)**	One roll	25.00	25.00
Hex drive Tek screws (no.10 X ¾-inch)	One box (50 count)	6.00	6.00
Binder clips (2-inch)	Two, 12 packs	6.00	12.00
Total			**$76.00**

* Construction grade film. Greenhouse film preferred but more expensive. A 10-foot X 25-foot roll will equip eight Basic crop shelters.

** A 100-foot roll of poly pipe will equip 10 Basic crop shelters.

Basic Crop Shelter

Prepare frame posts. Use a chop saw, angle grinder or jigsaw to cut four, 16-inch posts and two, 28-inch posts from the ½-inch metal conduit. Remove burrs on the ends of the posts. The two longer posts will serve as the center posts and the other four are designated as secondary posts.



Basic Crop Shelter

Install frame posts. From the top of each planter post, measure down six inches and install a Tek screw. Designate a set of opposing posts on the planter to receive the center posts. Insert the secondary cover posts into the four remaining planter posts.

Basic Crop Shelter

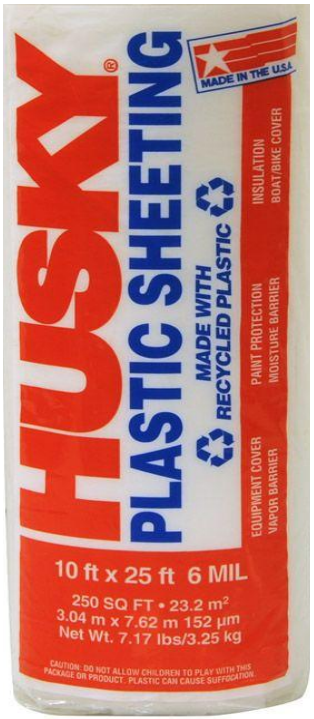
Install spacer bar. Measure distance between center posts (inside surface to inside surface). Take measurement at the base of the posts. Cut a piece of ½-inch EMT conduit to serve as a spacer bar. To calculate the length of the spacer bar, add one inch to the center post to center post measurement. Attach the ells to each end of the spacer bar using Tek screws as shown. Be sure the bar is inserted all the way into the ells before fastening. Attach the spacer bar to the center posts.

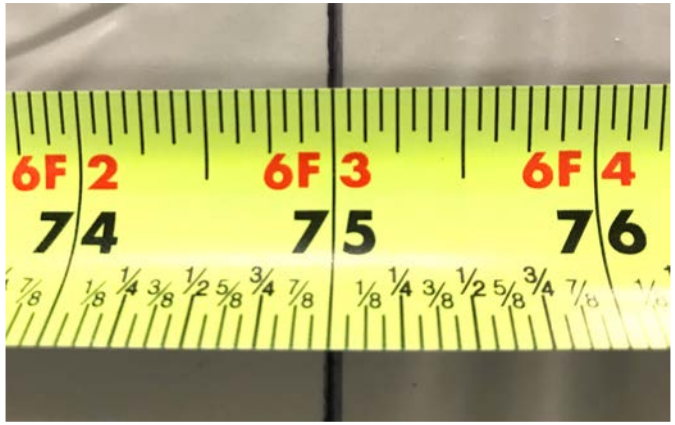
Basic Crop Shelter

Install poly pipe hoops. Cut to fit, two pieces of ¾-inch poly pipe and place each end over a set of secondary posts as shown. When installed, the hoops should contact the spacer bar at the top of the frame at their midpoints. For ease of installation, consider designating the midpoint on each hoop using a piece of tape or a paint pen. The hoops should fit snug on the posts but not excessively so. Depending on the diameter of the planter, the length of the hoops can vary from 52-56 inches in length.

Basic Crop Shelter

Prepare poly film cover. Unroll film on the floor or better yet an elevated work surface. From a 10-foot wide roll of plastic film, cut off a 6.25-foot (75 inch) piece. A total of eight covers can be cut from a 10-foot by 25-foot roll of film by making the 75–inch cut first.





Basic Crop Shelter

Prepare poly film cover (cont.). Unfold the film and cut the 10-foot sheet at the midpoint (60 inches) creating two, 60-inch by 75-inch pieces. Note: Expect the film to measure a few inches wider than the listed 10 feet. You may remove the excess film or leave it, the choice is yours. To ensure a straight cut use a straight edge and a permanent marker to designate the cut line.

Basic Crop Shelter

Prepare poly film cover (cont.). Locate the midpoint (37.5 inches) of one of the 75-inch long cover pieces and use the straight edge and marker to designate the center line. The center line makes the job of centering the film on the frame much easier. Repeat process on the other piece if a second cover is needed.

Basic Crop Shelter

Install cover on frame. Attach a minimum of three binder clips to each planter post for easy access. Drape the cover over the frame and center.

Basic Crop Shelter

Install cover on frame (cont.). When installed properly, the center line will be aligned with the spacer bar and the cover will hang over both ends of the spacer bar evenly.

Basic Crop Shelter

Install cover on frame (cont.) Using binder clips, attach the base of the cover to the four planter posts housing the secondary frame posts. To achieve a tight fit, remove any wrinkles in the film prior to clipping.

Basic Crop Shelter

Install cover on frame (cont.). To close the cover, pull each flap over the adjacent center post one on top of the other and attach to the post using binder clips as shown.

Basic Crop Shelter

Install cover on frame (cont.). To vent the cover at the top, separate the flaps at the top of the frame and roll the film back on itself as shown. Secure opening using binder clips.

Basic Crop Shelter

Install cover on frame (cont.). To close the top vents, remove the clips and unroll the film. Pull the film up at the top (center line) with one hand and use the other hand to fold one flap over the other at the center line. Fold the gathered film over the center post as shown and secure with a clip.

Basic Crop Shelter

Install cover on frame (cont.). To vent one side of the shelter, remove all clips on the center post. Roll/fold back both flaps as shown and secure to the adjacent secondary post and hoop as shown. Repeat process on the other side to create a fully vented shelter.

Basic Crop Shelter

Optional cover. If you only need one or two covers, consider using a clear shower curtain (liner). Most curtains are large enough to be used in conjunction with a basic shelter frame. You may pay a little more for a shower curtain cover but when you consider it can be used straight out of the package, it's worth the price.

Jumbo Crop Shelter

The Jumbo crop shelter is designed to be used in conjunction with a modular planter. When outfitted with a poly film/insulated protective fabric cover, the shelter can be used to protect large plants in the event of a late cold spell or extend the production of frost sensitive plants late into the season. Shelter from high wind, hail, intense solar radiation and many insect pests can be achieved by replacing the poly film with shade fabric.

The frame is dual purpose. Not only does it support the cover, it can be used to support a trellis when growing crops such as tomato and pepper. Its unique design enables it to be vented at the top while remaining in a closed position. Whether equipped with poly film or shade fabric, the shelter allows access to the crop for pruning, spraying and harvesting without removing the cover from the frame.

Jumbo Crop Shelter Parts List (2020)

Item	Quantity	Unit	Total
Polyethylene sheeting (clear) 10-foot X 25-foot, 6-mil*	1	25.00	25.00
EMT steel tubing (1/2-inch X 10-foot)	4	3.60	14.40
PVC Sch 40 slip elbow (1/2-inch)	2	0.40	0.80
PVC Tee fitting (1/2-inch slip)	4	0.65	2.60
ADS 100-PSI poly coil pipe (3/4-inch x 100-ft)**	One roll	25.00	25.00
Hex drive Tek screws (no.10 X ¾-inch	One box (50 count)	6.00	6.00
Binder clips (2-in)	Two, 12 packs	6.00	12.00
Total			**$85.80**

* Construction grade film. Greenhouse film preferred but more expensive. A 10-foot X 25-foot roll will equip 4-5 Jumbo crop covers.

** A 100-foot roll of poly pipe will equip 10 Jumbo crop covers.

Jumbo Crop Shelter

Prepare frame posts. Use a chop saw, angle grinder or jig saw to cut two, 50–inch and four, 40-inch long posts from the ½-inch metal conduit. Remove burrs on the ends of the posts. The two longer posts will serve as the center posts and the other four will serve as secondary posts.

The frame posts serve a dual purpose. Not only do the posts support an array of covers, they also serve as supports for the various types of trellising you may choose to install. All of the posts are equipped with self tapping (Tek) screws that serve as points of attachment when using twine. The screws make twine installation much easier and prevent the twine from slipping on the posts.

Jumbo Crop Shelter

Prepare frame posts (cont.) Starting 12 inches from one end of each of the shelter posts, install Tek screws in a line every six inches. Install a total of seven screws on the 50-inch posts and a total of four screws on the 40-inch posts. Do not insert screws to depth but leave about ¼-inch of the stem exposed. For ease of installation, use a workbench for this task.

Jumbo Crop Shelter

Install shelter posts. From the top of each planter post, measure down six inches and install a Tek screw. Designate a set of opposing posts on the planter to receive the center posts and insert posts. Insert the secondary posts into the remaining four planter posts.

Jumbo Crop Shelter

Install center post spacer bar. Measure distance between center posts (inside surface to inside surface). Take measurement at the base of the posts. Cut to fit a piece of ½-inch metal conduit to serve as a spacer bar. To calculate the length of the spacer bar, add one inch to the center post to center post measurement. Attach a PVC ell to each end of the spacer bar using Tek screws as shown. Be sure the bar is inserted all the way into the ells before fastening. Slide the spacer bar assembly over the center posts as shown. The spacer bar is required to keep the center posts plumb when attaching a trellis.

Jumbo Crop Shelter

Assemble secondary post spacer bars. The secondary post spacer bar consists of two, ½-inch PVC tees fitted to a section of ½-inch EMT conduit at each end. You will need to assemble two spacer bars, one for each set of opposing secondary posts. The spacer bars are required to keep the secondary posts plumb.

Jumbo Crop Shelter

Assemble secondary post spacer bars (cont.) Select two secondary posts located to either side of one of the center posts and measure the distance between the two secondary posts. Cut a piece of ½-inch metal conduit to match the secondary posts measurement. Slide a PVC tee over each end of the conduit as shown. To enable the spacer bar to slide up and down on the posts, do not insert the conduit all the way into the tees. To set the depth of the conduit, insert a short piece of conduit through the open end of the tee as shown. With the spacer bar set at the proper depth (both pieces of conduit touching inside the tees), attach the spacer bar conduit to the tees using Tek screws. Remove the short piece of conduit. Repeat process to assemble the second spacer bar.

Jumbo Crop Shelter

Install secondary posts spacer bars. Slide each spacer bar assembly over a set of secondary posts until they come to rest on the Tek screws. Spacer bar installation is now complete.

Jumbo Crop Shelter

Install poly pipe hoops. Cut to fit, two pieces of ¾-inch poly pipe and place each end over a set of secondary posts as shown. When installed, the hoops should contact the spacer bar at the top of the frame at their midpoints. For ease of installation, consider designating the midpoint on each hoop using a piece of tape or a paint pen. The hoops should fit snug on the posts but not excessively so. Depending on the diameter of the planter, the length of the hoops can vary from 52-56 inches in length.

Jumbo Crop Shelter

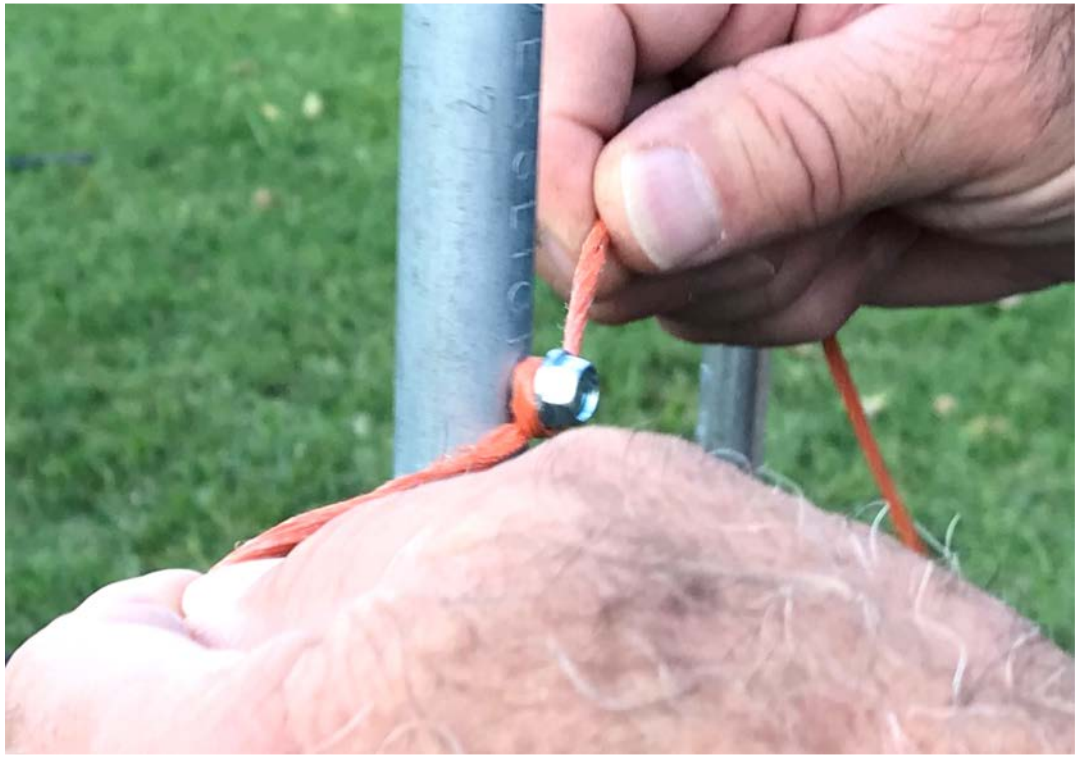
Trellis installation. A quick and inexpensive crop trellis can be installed on the shelter frame using baler twine. The ‘narrow cage’ trellis configuration used on modular planters is very flexible, making easy work when guiding plant growth through and up the trellis.

Jumbo Crop Shelter

Trellis installation (cont.). A complete trellis may be installed prior to or just after a crop is planted or in phases as the crop grows. A trellis may be installed between the two center posts or between a set of opposing secondary posts. Notice all of the shelter posts are oriented with screw heads facing away from the center of the bed.

Jumbo Crop Shelter

Trellis installation (cont.) Install the trellis one run (level) at a time. Each run consists of a separate piece of baler twine. The length of twine required to complete a run will vary depending on the width of the planter. An 8-foot piece of twine should be sufficient to complete one run of a center post trellis. There are several techniques one can use to attach twine to the frame. Depending on the technique you choose, the shelter posts may have a tendency to spin in the planter posts when installing twine. To prevent spinning, use Tek screws to connect the two. Regardless of the technique you choose, the twine should be wrapped around the protruding screw shanks on the posts to ensure it doesn't slide downward when supporting the weight of the crop. To form a 'cage', the twine must be positioned on both sides of the posts.



Jumbo Crop Shelter

Trellis installation (cont.)

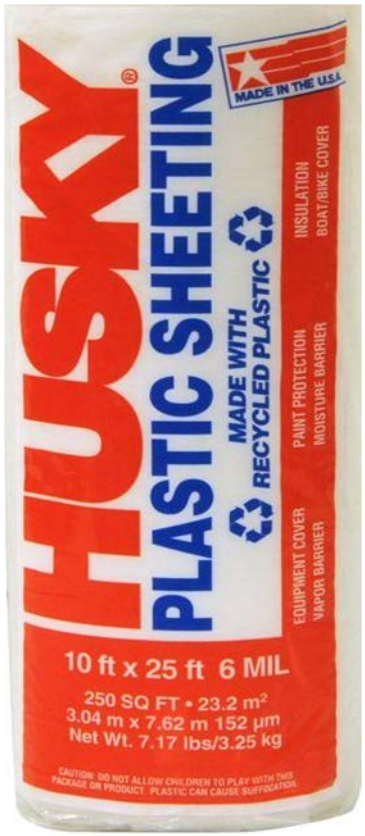
Jumbo Crop Shelter

In this modified version of a secondary post trellis, the 40-inch posts have been replaced by 50-inch posts and a terminal spacer bar has been added to each trellis. Each trellis supports two pepper plants.

A center post trellis supporting two determinate tomato plants. The secondary posts and hoops have been removed to provide easier access to the crop.

Jumbo Crop Shelter

Prepare poly film cover. From a 10-foot wide roll of plastic film, cut off a 5-foot X 10-foot piece. This width of film will accommodate a modular tire planter with a 32-inch diameter. For smaller diameter planters, a smaller width will suffice. Better to have an oversize cover than one too small. Keep in mind it is easier to trim a little off one edge than to prepare another piece.



Jumbo Crop Shelter

Prepare poly film cover (cont.). Spread film on the floor or better yet an elevated work surface. Locate the mid point (60 inches) on the 10-foot piece of film. Using a straight edge and a permanent maker, designate the center line of the cover as shown. The center line makes the job of centering the film on the frame much easier. Note: Expect the film to measure a few inches wider than the listed 10 feet. Be sure to take a measurement before marking the film.

Jumbo Crop Shelter

Install cover on frame. Attach three binder clips to each planter post for easy access. Drape cover over frame and center. When installed properly the center line will be aligned with the center post spacer bar and the cover will hang over both ends of the spacer bar evenly.

Jumbo Crop Shelter

Install cover on frame (cont.). Using binder clips, attach the base of the cover to the four planter posts housing the secondary frame posts. To achieve a tight fit, remove any wrinkles in the film prior to clipping.

Jumbo Crop Shelter

Install cover on frame (cont.). To close cover, pull each flap over the corresponding center post, one on top of the other and attach to the post using binder clips as shown.

Jumbo Crop Shelter

Install cover on frame (cont.). To vent the cover at the top while still closed, separate the flaps at the top of the frame and roll the film back on itself as shown. Secure opening using binder clips.

Jumbo Crop Shelter

Install cover on frame (cont.). To close the top vents, remove the clips and unroll the film. Pull the film up at the top (center line) with one hand and use the other hand to fold one flap over the other under the crown as shown. Fold the gathered film over the center post as shown and secure with a clip.

Jumbo Crop Shelter

Install cover on frame (cont.). To vent one side of the cover, remove all clips on the center post. Roll back both flaps as shown and secure to the adjacent secondary post as shown. Repeat process on the other side to create a fully vented cover.