How to Build a Greenhouse

By, FreeGreenhousePlans.com

First, why?

Food security, or making sure one has the ability to produce part or all of one's food, is a very important issue in these troubled times. Economic, political, and general global turmoil can easily and quickly affect both the availability and quality of food. For these reasons, it is VERY important to work towards some level of personal food security.

Central to every good food security plan is a greenhouse. This allows earlier starts of plants in Spring, production of many types of food through the Winter, and a protected environment for certain plants throughout the year. The food and plants that a greenhouse can produce by extending the growing

season can quickly pay for the cost of the greenhouse, if done properly and diligently. Therefore, it is wise to have a greenhouse as part of a larger plan for food security.

Hard or expensive?

Building a very solid greenhouse that will last for decades is not complicated nor is it expensive. Our desire is to help you get the most greenhouse for the least cost. Following are free plans using parts you can source at any local hardware store or lumber yard. The only difficult to get item, bent tubes for the hoops, we can provide for a very reasonable cost. If you prefer not to source your own parts, we can assemble and ship you a complete kit, minus a few pieces of lumber and you simply follow this instruction manual and assemble it yourself on your site.

Assembly can be done by one person, though generally it is easier with two people, and it takes about two full days, depending on the size of the greenhouse you build. Our hoops are 20 feet wide and you can make the greenhouse as long as you want, though we recommend a minimum length of 20 feet.

If you source and prepare all parts yourself and buy the hoops from us, your total outlay for a 20' x 35' greenhouse will be about $1500. If we assemble and ship a complete kit to you, the cost will be about $1950. (Prices subject to change.) And, there are a few options you can purchase that are upgrades, or we'll gladly point you to places you can source other supplies. Our goal is to help others with food security. This is about taking care of our brother! Visit FreeGeenhousePlans.com for kits, parts, or questions. We are here to help!!

And, a final introductory note, my photography skills are lacking… 😉

How to do it, the nuts and bolts!!

Site Prep…

The ground does not need to be perfectly flat, free of grass, or any of the other normal considerations for a building. Those qualities may be desired, but can easily be overcome for a great greenhouse, depending on how you will use the interior. What is MOST important is the orientation of the greenhouse relative to the path of the sun. You want the ends of the greenhouse facing roughly east-west so the sun is on the side of the greenhouse all day, particularly in the Winter. This insures capturing maximum warmth.

To prove the site does not need to be perfect, here is the site of a recent build. Lumpy ground and some large weeds, but it faces east (to left) - west (to right) and perfectly fits a space next to this barn and along a fence.

Because we were using ground cloth and raised beds, the grass was best left uncut so it would not grow through our weed cloth. We did fill a few holes and trim the really tall weeds you see, center of photo.

Additional considerations are whether you want water and/or electricity available in your greenhouse. In the case of this greenhouse, both are accessible under the corner of the barn. For daily simplicity, we recommend you plan a way to have both available as dragging a hose in and out, or extension cords stretched out (if you want/need electricity) is not a good idea. This greenhouse will have one GFI outlet and a hose hook up in the west end. A 50’ hose and spray nozzle will reach everywhere in the house once finished.

Locate the Corners

Once the site is selected and prepped, you will need to decide on the exact length of the greenhouse. In the case of the greenhouse in our illustrations, it is 32 feet long and will have five 6’ x 9’ raised beds, 2’ side access paths, a wide center aisle and work area on one end for tables and pots, etc.

Our hoops are made of 1 3/8” x 10’ 6” chainlink top rail tubing which fits nicely inside of the 1 5/8” x 7’ chain link fence posts. Chain link posts are cut in half, on an angle, and driven into the ground as straight as possible until about 28” are above the ground. The top will mushroom, but that part will be cut off so that all posts are the same height with a nearly level line down each side.

Mark your corners first!! Then space your hoops in between as follows: Latitudes with a fair amount of snow, put hoops on 4’ or 5’ centers (four or five feet apart), latitudes with less or no snow can use 6’ or even 7’ centers. For this project, with very little snow, we chose a little more than 5’ centers for ruggedness and illustration. (This 32’ greenhouse has seven hoops.) See the following pics.

Notice the mushroomed tops. The pipes that were not straight (to prove the most basic amateur can do this) were gently pushed/pulled vertical. Also, notice that we went to the trouble of laying the weed cloth and putting the raised beds in place BEFORE putting up the hoops because tractor access with rich soil was easier than a wheelbarrow and shovel…

The width should be exactly 20’. Length will be whatever you decide. You will need two end walls and then a hoop every 5-7’, depending on your plan. We can bend an ship just hoops to you, or we can supply complete kits with all hardware, etc…

Once the corners and side posts are in the ground, trim all mushrooming off with a hacksaw or an angle grinder with a cut off wheel (*much* faster, but wear eye rotection…). Then, locally source some 5/4 decking and use 2” pipe straps to attach it on the *outside* of your posts at the ground level. This will provide a surface you can attach plastic to later on.

Notice the raised beds. These are simply repurposed 2’ x’ 10” boards that we nailed together with some minor corner bracing. Also, notice the weed cloth extends out from under the side boards so that weeds do not grow between the beds and the inside wall.

Butt join, with a supporting board, the 5/4 decking boards. We do *not* recommend placing joints at the metal posts, rather, make your joints between posts. See inset pic.

While we suppose it might be possible to bend your own hoops without a bender, our experience is that people complain of uneven bends that look remarkably like a dog’s hind leg…. Each hoop is assembled using three 10’ 6” chail link fence top rails that have been through our hoop bender for 20’ hoops.

Take three of our hoop sections, lay them out on a flat surface and screw two self tapping TEK screws into each joint. VERY IMPORTANT: Place screws in *SIDE* of the hoop, not in the top. See following pic and inset.

The hoops are now ready to install in the posts you drove into the ground.

Be careful when handling the hoops at this point. Because you have not yet installed the strengthening chord, they can be damaged by bending and flexing. Mark a line on each leg of each hoop 12-15" from the bottom, then *use two people* to move the hoops to the greenhouse and insert the legs, down to the line you marked, in the posts driven into the ground. Here are a couple pics…

At this point, do not panic. The hoops may have a mind of their own as several in the left picture do. They can easily be pulled/pushed into place as the supporting horizontal and longitudinal supports are installed. Some posts may need to be adjusted as a couple in the above pic needed.

See at left, the mark on the hoop that determined how far into the post we inserted it before putting TEK screws on the *inside* surface. Two screws are sufficient to hold the hoop in place. In some cases, you may need considerable down pressure to sink the hoop far enough into the post.

We recommend that you do *not* screw the hoops into place until *all* are installed in the posts in case one will simply not go down far enough… If that happens, just back all others up enough to keep all even. Then, screw them together. A cordless impact driver is priceless for driving these screws…

Each hoop now needs a supporting chord for real strength! We provide these in our full kit, or you can make your own. You will need one for each hoop. Here is how to make your own:

Use a heavy hammer on a very solid surface (like an anvil) to pound the ends of a 10’ 6” section of 1 3/8” top rail flat. Then, drill a 3/8” hole about ¾” from the end.

To mount these, you will need one 1 3/8” fence tension bands on each end and a 5/16” x 1 ¼” carriage bolt, usually found in the chain link fence section of the hardware store.

DO NOT tighten these just yet. Put a level on them and get them close to level, then leave with a little play until the purlins are installed.

It should be starting to look like a greenhouse!!

End walls can be installed at this point. Many people choose to do these different ways. Use our pics for ideas, then adjust to your plan and liking. We chose a 36” door for each end of the greenhouse to promote air flow through. Some will only have doors

on one end but may install a louvered vent that opens and closes with a temperature sensitive piston. We do recommend a post or two on each end to offer base board and horizontal board attachment to affix the greenhouse covering to.

We used 4” x 4” x 12’ treated posts to frame our doorway with a top rail that is a 2” x 6” x 12’ brace. We notched the posts, see pic below, for the brace. Later, we will put an upper brace where the top of the door will be. Bent and drilled pipe straps, as in the pics above, were used in four places to secure the cross brace on the hoop to the 2 x 6. These pics were taken after the purlins were installed

Notice the angled cuts on top of the posts to account for the slope of the hoops. Also, the ends of the 2 x 6 were tapered to fit inside the hoop. The goal, at this point is for all surfaces to be flat with no protruding screw heads or pieces of wood or metal that will rub against the plastic.

Once notched, the end base boards can be installed and screwed into the posts and where they meet at the corners.

As in the pics above, we finished mulching the inside to prevent weed growth and to keep the weed guard from moving while we finished the exterior.

The final structural part to install are the purlins which provide great longitudinal strength. You will need two that are 6” shorter than the total length of the greenhouse. They are made of 10’ 6” sections of top rail tube and the ends are made and shaped exactly like the cross members on the hoops.

An important note: When screwed together with the TEK screws, insure the flat ends are parallel or on the same plane, not twisted. Rather than connecting each together overhead, it is easiest to lay these out on the ground, connect, then run them in the end of the greenhouse, above the hoop brace, one each side inside the angle formed by hoop and brace. See pics.

Notice that these are bound to the hoop by a 3” stainless steel hose clamp. Be careful when tightening this down to ensure the loose end of the strap and the screw clamp itself will not be in contact with the plastic as they can cut or rub a hole in it.

When tightening these into place, attach both ends first. Then check the distance between each hoop as you work your way from one end to the other so that the distance at the purlin/chord intersection is the

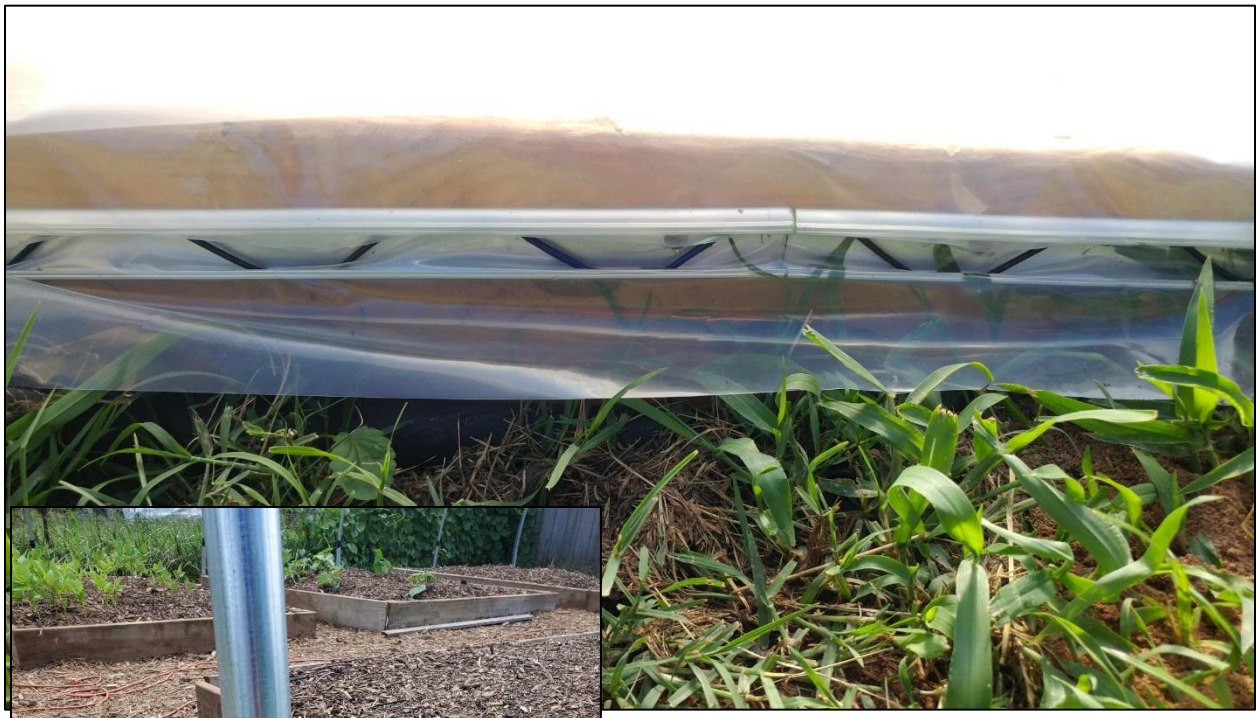
same as at the base. I.e., ensure they remain on center. Also, make sure the brace is level and is also tightened at this time.

Once all connections are tightened, you will find that the structure is very rigid.

Frame the inside of the door openings for the size door you will put in it. The least expensive option in this build was to buy prefab screen doors at Lowe's and simply seal with Thompson's WoodSealer and cover with plastic. These 36" doors were $35 each, off the shelf. Cheaper and nicer than building them ourselves.

Not done at this time, but a near future project is to add a self-opening vent in the top of each end of the greenhouse.

The next step, before covering the greenhouse, was to install Greenhouse U Channel for spring wire. The cheapest option for holding the plastic to the green hoop frame is wood strips tacked along the bottom. However, the long-term best option for tightening plastic, easy removal and



re-install or replacement of plastic is Greenhouse U-channel and Spring wire. Having built multiple greenhouses and replaced plastic on a few, this is the very best option long term. Available from greenhouse supply stores (or through us) I *highly recommend* the extra investment. The channels are aluminum and the wire are coated and will last a decade or two. You will need to drill holes in the channel to screw into the wood sides. The self-tapping Tek Screws work just fine for attaching the channel to the end hoops. [Note: No channel is used on the middle hoops, only the end hoops.]

The final step, before covering, is to put a heavy duct tape anywhere the plastic might rub against a rough spot or uneven match between tubes and bracketry. Any luffing in the wind can wear a hole in the plastic if not properly protected. Here are a few pics of the several places we taped in this install.

Covering

Measure twice! Cut once!! Be sure to order enough plastic and plan carefully how and where you will cut it. For a 20’ wide hoop, you should have a piece of plastic that is about 36’ wide. (Remember, the width at the ground level is actually the diameter of a half circle.) The length should be two to three feet longer than your greenhouse for the main section, then then two pieces for the end walls that are 23’ wide x 13’ or 14’ high.

For the project in the picture, I used a piece of 4 year UV resistant clear greenhouse poly that was 36’ x 60’. We completely unrolled the length in the yard, but did NOT open it up. I measured off 35’ and cut that for a 32’ long greenhouse. Then, I cut a section 22’ long for the end walls and used the center fold as a guide to cut it in half length wise leaving me two 22’x 18’ sections of plastic.

The next portion of instructions require three to four people, several ladders, and a rather calm day.

We laid the end sections along each end and pulled the center (top) section down one side. We began by attaching the one side, then pulling the plastic over the top and simply weighting it on the opposite side.

We then attached the end walls at the bottom then up around the door openings.

Next, working one end at a time, we attached the end walls up over the end hoop. We tucked the plastic for the end wall under the top cover and a helper on the inside of the greenhouse to pull the end wall tight while someone works from the attached side up and over the top attaching the wiggle wire or other plastic attaching method. Work slowly and keep the plastic pulled tight in each direction.

After each end is finished, then the bottom of the remaining long side can be attached.

Here are several pictures to help illustrate the process.

Final Thoughts, Tips, Tricks…

In really warm climates, vents above the doors are almost a *must*! Further, as we will illustrate in an article on our blog, building it so that you can roll up one or both sides is quite easy and very smart. Additional expense is minimal.

Observant readers will notice that I put 16’ cattle panels in the rafters of the greenhouse. These make a very sturdy and nice grid to hang line from for climbing plants such as cucumbers and pole beans as well as supporting tomato vines. The easiest way to use them is to straighten wire coat hangers, bend a loop on one end and a hook on the other. To the loop, tie a string that will nearly reach the ground and weight with a heavy nut or similar item. Then, simply hang it above the plant to train and wrap the string gently around the plant or stem. As the plant grows, just add a wrap or two to train the plant straight up. When not in use, hang all in one area so they remain neat and accessible.

I like a neat entrance, so I repurposed some old treated lumber from a grow bed into a ‘landing’ at each entrance. This helps keep mulch in and grass out.

Water and electrical access in the greenhouse are very convenient, but be sure to have a GFI circuit and don’t place the two too close together.

Materials List

Materials will vary based on how long your greenhouse is. You will need two (2) end walls and then a variable number of hoops, based on a 5’ – 7’ center placement.

End Wall

1 – 1 5/8” x 7’ Chain link fence post, cut in half on an angle for base post.

4 – 1 3/8” x 10’ 6” Chain link fence top rail tube. Three for hoop, one for the cross brace (ends flattened and drilled)

6 – 1 ½” pipe hanging straps hammered into a U shape, or 6 1 3/8” fence tension straps

6 – 5/16” x 1 ½” carriage bolts with nuts

2- 2” pipe strap for base post to board connection.

Lumber for end wall, NOT provided in our hardware kit. We recommend

2 – 4 x 4 x12, treated

1 – 2 x 6 x 12, treated

2 – 5/4 x 6 x 10 decking for base board.

Intermediate Hoop

1 – 1 5/8” x 7’ Chain link fence post, cut in half on an angle for base post.

4 – 1 3/8” x 10’ 6” Chain link fence top rail tube. Three bent for hoop, one for the cross brace (ends flattened and drilled)

2 – 1 ½” pipe hanging straps hammered into a U shape, or 2 - 1 3/8” fence tension straps

2 – 5/16” x 1 ½” carriage bolts with nuts

2 – 3” stainless steel hose clamp

2- 2” pipe strap for base post to board connection.

Purlins

Multiple sections of chain link top rail to make each purlin. You need two purlins, each will be 6” shorter than the total length of the greenhouse, ends flattened and drilled with 3/8” hole for mounting.

Ex. For 32’ greenhouse, we used eight (8) pieces of top rail. With very careful planning on which ends to flatten, we could have saved a single piece of pipe.

Various other materials

Flat head wood screws for end walls.

Short lag screws for attaching base board to posts.

Box of TEK self-tapping metal to metal screws. #10 x ¾”

Roll of heavy duct tape

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