Hoop House Construction for New Mexico:

12-ft. x 40-ft. Hoop House

COLLEGE OF
AGRICULTURE AND
HOME ECONOMICS

BRINGING
SCIENCE
TO YOUR
LIFE

Cooperative Extension Service • Circular 606

Hoop House Construction for New Mexico: **12-ft. x 40-ft. Hoop House**

Del Jimenez, Ron Walser, Reynaldo Torres[1]

HOOP HOUSE

The hoop house, cold frame and high tunnel can be basically the same structure with minor changes to the design. The hoop house gets its name from its shape, although houses can be constructed with straight lines using elbows to get the desired shape for a building. The shape of a hoop house causes water and snow to be shed from its exterior while permitting sunrays to provide heat.

Houses of this category are made with aluminum pipes or plastic PVC pipes as hoops that are covered with a single layer of polymer plastic covering. A second layer may be added for better insulation.

REASONS TO BUILD A HOOP HOUSE

Hoop houses are ecosystems all in themselves, and the environment inside can be manipulated to a crop's need.

Hoop houses can extend the growing season, since you may plant early, the collection of heat units with the plant is higher resulting in earlier harvesting. Planting in late summer and early fall allows you to produce and harvest into the winter months.

Planting in a protected environment guards the crop from Mother Nature's whims and control the crop's quality.

Using the hoop house for season extension increases income over a longer period of the year and allows the use of different marketing strategies.

FACTORS TO CONSIDER BEFORE BUILDING A HOOP HOUSE

Hoop houses are relatively inexpensive to construct, costing around $1 per square foot, with low maintenance once constructed. They are easy to build and adapt to small land units to meet the needs of gardeners and farmers.

Since plants need sunlight to grow, light penetration should be a concern in structure design. Grow lights can be used but require an electrical source. In an area where wind and snow are part of nature, consider the load limitations the structure must have to endure stress.

The height of the hoop house can be adjusted so that one can walk and work inside comfortably, therefore, one must think about height before construction starts.

SELECTING A SITE FOR A HOOP HOUSE

Select a site that is moderately level with good drainage and good soil for planting. A site can be modified by soil fill so that construction is on a pad. Select a site in an open area where trees and other obstacles will not affect sun penetration.

Consider the surrounding area so the structure will be protected against high winds and heavy snows, thus providing longer life. Water and electricity may be needed for the hoop house, so a source nearby should be considered.

[1] Agriculture Specialist, Rural Agricultural Improvement and Public Affairs Project (RAIPAP), Fruit Specialist, RAIPAP, and Agriculture Agent, Taos County Extension Service, respectively, New Mexico State University, Las Cruces, New Mexico.

Security and protection against vandalism of the hoop house and crop may also be a factor to consider when selecting a site.

ORIENTATION OF THE HOOP HOUSE

Preferably, position the hoop house in a north ⟷ south direction. Air currents come from a south, southwest direction and will help ventilate the hot air buildup within the hoop house on hot days. The north ⟷ south orientation also favors sun penetration, since the sun tracks from east to west going directly over the hoop house for maximum light penetration.

LAYING OUT THE HOOP HOUSE

Begin by choosing the size of a hoop house that meets your needs. Then square off the corners of the hoop house using the Pythagorean Theorem.

$$A^2 + B^2 = C^2$$

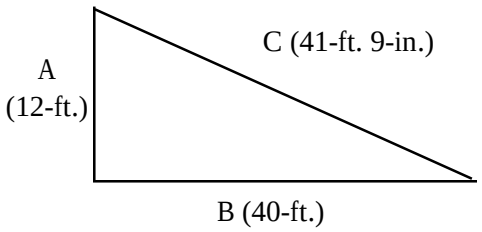
$$(\text{Length of Building})^2 + (\text{Width of Building})^2 = (\text{Hypotenuse of Building})^2$$

Example: $A\ (12\text{-ft.})^2 + B\ (40\text{-ft.})^2 = C^2$

$144\text{-ft.}^2 + 1{,}600\text{-ft.}^2 = 1{,}744\text{-ft.}^2$

$\sqrt{1{,}744} = 41.76\text{-ft.}$

$C = 41.76\text{-ft.}$



Squaring the building is critical so that the rest of the structure proceeds normally in construction.

SETTING STAKES

After squaring the corners of the hoop house, set four stakes in the ground using 1/2-in. rebar 24-ins. long. Drive these stakes 12-ins. into the ground at a 30-degree angle from vertical pointing inward. Half the stake will now be underground and half the stake above the soil.

Place a string around the four corners to outline the hoop house's foundation.

Along both lengths of the hoop house and inside the string, drive 24-in. rebar stakes every 4-ft. apart, 12-ins. deep, at a 30-degree angle, until you reach the desired length.

SETTING THE PLASTIC PIPE HOOPS

The standard length for PVC pipe is 20-ft. With a 12-ft. wide hoop house, the height in the center is approximately 6 1/2-ft. On a 16-ft. wide hoop house, the height is approximately 5 1/2-ft. Adding extra lengths of pipe will increase the height and width of a hoop house. It is recommended that you add the extra length to the ends of a 20-ft. pipe because, when the pipe is bent, the stress is not as severe on the glued joint.

There are various size PVC pipes that can be used for the hoops: 1-in, 1 1/4-ins., 1 1/2-ins., 2-ins. are the most common. The desired height, length and the local environmental conditions will determine what size is best.

We recommend the use of 2-in. PVC, because it holds up well to winds blowing 50 mph and the occasional snow 8-ins. thick on the plastic. Use new plastic pipe for construction because weathered pipe will be brittle and break when bending. Once the pipes for the hoops have been bent and weathered, the pipe will retain its bent shape and can be reused for another hoop house project.

When the rebar stakes are set, it's time to place the PVC pipe. This is accomplished by placing one end of the PVC pipe over one of the stakes, then bending the pipe by pulling on it; place the opposite end of the pipe on the lateral stake on the opposite side. If the rebar stakes are perpendicular to the ground, it is very difficult to place the pipe on the

spike. That is why stakes should be placed at a 30-degree angle (figs. 1-3).

PLACING THE WOOD BASEBOARDS

Baseboards are installed to give the hoop house stability, and are where the plastic covering is attached. On the outside of the hoops along the base of the hoop house, place the baseboard using 2-in. drywall screws fastened to the 2-in. PVC pipes.

The baseboards should be 1-in. x 4-ins. x 10-ft. long boards, butted and fastened together by short brace pieces. You may also use 2 x 4s. Make sure the screws and brace pieces are faced toward the inside when installing the baseboard.

When both sides are in place, drive two 24-in. rebar stakes bent in a "J" design, 10 ft. from each end along each side (figs. 4-5). These are hooked over the baseboard. This will help keep the hoop house anchored during high velocity windstorms.

INSTALLING TUBULAR BRACES

There are three (3) tubular braces running the length of the inside of the hoop house that will be used for stability and also for irrigation. The tubular braces will be made from 3/4-in. PVC pipe. PVC pipe comes in 10 or 20-ft. lengths. Mark the 2-in. pipes where the tubular braces will be attached. The mark will be 72-ins. from the end of the pipe, and also down the middle of the pipe. Marking the two end hoops and running a string can easily achieve this.

Glue the 3/4-in. PVC pipe together and mark every 48-ins. This marking will correspond with the distance between each of the 2-in. hoops.

Start attaching the tubular braces from the front of the hoop house. Make sure the brace is flush with the outside of the first hoop, and that the markings should coincide with each other. If you are not using the tubular braces for irrigating, you can attach the tubular brace directly to the 2-in. pipe using a 2-in. drywall screw. If you will use the tubular brace for watering, you must use a 3/4-in. one-hole or two-hole conduit strap to attach the pipe (figs. 6-8).

ATTACHING POLYETHYLENE PLASTIC COVERING

The greenhouse plastic acts as the skin to the structure, letting light rays in and keeping the weather out. There are different grades of poly covering, but a 6-ml. weight works well for hoop houses. It is recommended to use polyethylene coverings that have been treated with a UV inhibitor, and guaranteed to last at least three years. Unprotected polyethylene plastics will break down over a growing season.

Greenhouse plastic coverings come in rolls 100-ft. in length and in widths ranging from 12-ft. to 48-ft. The length of the pipe that makes the hoop determines the width of the plastic covering, and it is recommended to add at least a foot on each side of the house width.

To successfully apply the plastic covering, take the following steps: have extra labor available; make sure there's no wind; work in the afternoon, when the plastic can heat up and stretch. Lay out the greenhouse plastic in a clean work area alongside of the hoop house, so you can measure and cut the plastic to the size required. Using a straight edge, cut the plastic at least 4-ft. longer than the building. This way, you overlap each side with 2-ft. of plastic. After the plastic is cut, find the edge of the cut piece of poly and center it over the hoops by dragging gently across the top. Let the plastic rest on the hoops for 15 minutes to absorb the heat. Keeping the plastic stretched, attach one side by sandwiching the plastic poly covering between a 1-in. x 2-in. x 8-ft. long furring strip onto the baseboard, driving 2-in. drywall screws every 2-ft. (By using screws in the baseboard, it is easy to take out to replace

plastic covering.) When one side is complete, attach the opposite side in the same manner. When complete, shovel dirt onto the extra plastic at the base of the hoop house.

On the ends, stretch the plastic tight and sandwich the plastic poly covering between 1-in. aluminum stripping and the 2-in. plastic hoop using 1-in. drywall screws every foot apart to attach (figs. 9-12).

ADDING END WALLS

End walls are used for access into the hoop house, protection against the elements of nature and also to permit air circulation and remove heat.

Stretch a string at the bottom of the first hoop, and find the center, which will be used as a guide to construct the entrance. From the center point, measure along the string 2-ft. in each direction. Mark these spots and dig a hole 6-ins. round and 1-ft. deep. Place a 2-in. x 4-in. x 8-ft. board into each hole, and angle the top so that the wood fits under the hoop. Level the 2 x 4 in both directions, making sure there are 48-ins. from the center of the wood. Fill in holes with dirt, and secure the top with a 3-in. drywall screw running through the pipe into the wood.

When the uprights are set, place the first piece of plywood (4-ft. x 8-ft. x 1/2-in.) up against the middle. This will be the door. Trim the door to fit the shape of the hoop. After the door is in place, continue placing plywood on either side of the door, screwing these pieces into the uprights and 2-in. PVC pipe until the wall is complete. Fasten the door to the uprights and plywood using two hinges as well as a latch for securing the door. The finished side should reflect the shape of the hoop house.

This wall can be repeated for the opposite side of the hoop house if you wish to have an entrance on both sides (figs. 13-15).

ADDING THE BACK WALL

The back wall provides protection against the elements and also permits air circulation to remove heat. On the backside of the hoop house make a frame out of 2 x 4s that will cover the bottom half of the hoop house. Make sure that you have upright poles that go into the soil 12-ins. This gives the structure stability. Cover the frame with 1/2-in. plywood, and screw the plywood into the frame and 2-in. hoops.

The upper portion of the back wall will also be covered with plywood but will hinge down to permit air circulation. The hinges attach to the bottom half of the frame (figs. 16 and 17).

ADDING ROPES

Ropes are used to help secure the polyethylene covering in place when gusts of wind blow through the hoop house. Polypropylene ropes 1/4-in. in diameter can be looped over the hoop house every 10-ft. apart and tied to stakes in the ground for added protection. This will help add life to the covering.

CONCLUSION

A hoop house is a practical tool that is affordable to construct, practical to use, can extend the growing season and possibly improve income for an operation (table 1).

By choosing selective low-profile fruits and vegetables that withstand cold temperatures, it is possible to grow most of the year without the use of heating equipment and electricity. These structures, with special plastic covers, can keep inside temperatures 4º to 6º F warmer than outside temperatures, and with a row cover made from specially improved webbings over the crop, another 4º to 6º F increase can be obtained.

With these structures one can make farming of food crops affordable, profitable and fun all year around.

Table 1. Hoop House Construction Material List and Estimated Cost, 12-ft. x 40-ft.

Item	Cost	Quantity	Total Cost
1. Plastic PVC Pipes 2-in. x 20-ft.	$7.00	13	$91.00
2. Plastic PVC Pipe 3/4-in. x 10-ft.	$1.25	8	$10.00
3. Rebar 1/2-in. x 24-ins.	$1.50	22	$33.00
4. Glue 16-oz.	$5.00	1	$5.00
5. Screws (Drywall Screws)			
2 in box, 150 Screws	$5.00	1	$5.00
3 in box, 150 Screws	$5.00	1	$5.00
6. Wood Strips 1-in. x 4-in. x 10-ft.	$3.00	8	$24.00
7. Plastic Cover (6-ml.) 22-ft. x 100-ft.	$200.00	1/2	$200.00
8. Plywood 1/2-in. x 4-ft. x 8-ft.	$24.00	6	$144.00
9. Wood Studs 2-in. x 4-in. x 8-ft.	$3.00	8	$24.00
10. Hinges	$1.00	6	$6.00
11. Latch	$3.00	3	$9.00
12. Aluminum Trim 1/4-in. x 1-in. x 10-ft.	$1.00	12	$12.00
Total Cost			$568.00

Figure 1. Laying out the 2-in. x 20-ft. PVC pipes that will be used for the frame.

Figure 2. Bending the 2-in. x 20-ft. PVC pipe and setting them on 1/2-in. rebar stakes.

Figure 3. The hoop house structure takes shape.

Figure 4. Attaching the baseboards to the bottom of the PVC pipes.

Figure 5. Laying out the tubular 3/4-in. braces.

Figure 6. Marking the height where the braces will be attached.

Figure 7. Gluing 3/4-in. pipe together to be used as braces.

Figure 8. Attaching the 3/4-in. PVC pipe braces to the structure.

Figure 9. Rolling out the plastic to the appropriate length.

Figure 10. Covering the hoop house with 6-ml. plastic film.

Figure 11. Stretching the plastic over the hoop house structure.

Figure 12. Attaching the plastic cover to the baseboards.

Figure 13. Marking the door to be cut.

Figure 14. Attaching the front door to the hoop house.

Figure 15. Finishing the front end wall of the hoop house.

Figure 16. Making a window on the back end wall.

Figure 17. Window completed; hoop house completed.

To find more resources for your home, family or business, visit the College of Agriculture and Home Economics on the World Wide Web at www.cahe.nmsu.edu.

May 2005 **Las Cruces, NM**
Electronic Distribution May 2005