

## TEMPORARY STRUCTURES FOR WINTER GROWING

PAUL & SANDY ARNOLD  
PLEASANT VALLEY FARM  
118 SOUTH VALLEY ROAD  
ARGYLE, NY 12809  
(518) 638-6501 Phone & Fax  
[sparnold@capital.net](mailto:sparnold@capital.net)  
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### DETAILED FIELDHOUSE DESIGNS

#### PLASTIC PIPED:

The standard fieldhouse that we build is 14 feet wide and 96 feet long. Our first design uses 1 inch by 20-foot plastic schedule 40 PVC pipes for the hoops, and twenty-five are needed to build a 96-foot house. Two 100-foot strings with stakes attached to each end are set up parallel to each other and 14 feet apart. These are used as guides to keep the house in an approximate rectangle. 1¼" galvanized pipes approximately 2' long are set along the strings 4 feet apart. The pipes are then sledge hammered into the ground as close to the string as possible; if you have rocks like we do, a pipe can be moved a few inches either way up or down the string. If the pipes are being re-used, the dirt must be removed from them first by tapping them together (great kid job!). We place a 2x4 board on the pipe to prevent damage to the top of the pipe as we hammer. About 6 inches of pipe is left above the ground. Most of these pipes have been obtained free from fencing companies, who, in our area, throw away pipes shorter than 3 feet. The plastic hoop ends are then placed into these metal pipes about 6 inches. Next we attach 1x4 rough-cut boards along one side of the fieldhouse about 3' off the ground to create a vented side. It is best to choose the side that does not get the prevailing wind. The boards are secured to the plastic hoops by 5/16 inch U-bolts (come in all different sizes—we use mostly 2"x2 ½"x5/16"zinc-plated) with the nuts facing the outside of the fieldhouse. The U-bolts go through holes that have been pre-drilled before mounting to accommodate the bolts every four feet, starting about 2 inches in from the end and a little below the center of the board. Shorter boards (15 to 18" long) are used to splice the boards together, with the short board being placed behind the 2 boards butted together, then 3 screws (1 ¼ to 1 ½") are placed on each side (6 total per splice). We either countersink the nuts, or wrap two layers of duct tape over the ends of the bolts to prevent damage to the greenhouse film, depending on how far out the bolts stick out beyond the boards. If rough-cut boards are not used, they are not strong enough to have countersunk nuts. At both ends of the board, we duct tape on a piece of carved rigid foam insulation to protect the greenhouse film; it can be saved and used for many years. The ridge pole is a series of 5 additional PVC pipes (each 20 feet long) which are duct taped as straight as possible to the inside of the hoops and down the center. The pipes are overlapped about 10-12 inches and wrapped with duct tape, especially on the cut ends that could damage the plastic. Side diagonal bracings (PVC) are attached by duct tape, 2 on each end, starting at the ridgepole at the greenhouse ends and ending at the ground level, attaching to each of the 4 hoops they cross. At both ends of the fieldhouse at the peaks, the pipe ends need many loops of duct tape to stay put. These houses are only temporary, so 2 wrappings of duct tape are usually all that is required every other place a PVC pipe crosses another pipe. A trench 6-8" deep is dug along the side of the fieldhouse that does not have the

vented side (and board). The trench is dug very close to the outside of the metal posts. The end walls are pre-made units made of 2x4 construction that utilize a 4' wide x 5' high door and are permanently covered with plastic (lathed on). Our doors are 4' wide to accommodate our harvest wheelbarrows, but can be made to any size that works best. These removable end units are screwed into four 2x4x2' long stakes. The stakes were sledge hammered into the ground about 10-12" and two 3" sheetrock screws are used to secure each stake.

We use 3 year greenhouse film (24' by 100') which is lathed and screwed onto the end units when the winds are totally calm (always roll the lathe/plastic under for rain drainage), and then the one side is buried into the trench. It is important to pull the plastic tight in all directions before securing. If the plastic is buried too deep into the trench, it can't be pulled up easily by hand, and if it's buried too shallow, it pulls out with the wind. Practice makes perfect! The other side is secured to the side boards by screwing lathe strips on the top part of the boards, and the plastic can then be rolled up for venting when Spring temperatures reach 60 to 70 degrees. We use a simple string system to tie up the plastic every 8 feet. One end of the string is tied onto the side board through a 1/2" hole we drill on the lower side; then after the plastic is lifted or rolled up, a small tied loop at the other end of the string is hooked over a screw partly inserted into the lathe strips above the drilled hole. It helps to roll the plastic under before securing so rain runs off, instead of inside, the plastic rolls. If there will be strong winds, the vented side plastic can be secured to the ground with boards and cement blocks placed on the boards. These are temporary structures, so are not designed to withstand heavy winds, but we never have problems if both sides are secured down. It takes us about 8 hours with 2 people to put one up and a lot less time to dismantle! We dismantle the 1x4 boards in sections, and number them as we go (leaving the splice board attached to one board), so they can be pieced back together the next season and the drilled holes for the u-bolts come out 4' apart again. This design with PVC hoops is only used in the spring (and sometimes in the fall), since it is not able to withstand any snow load. Ours have gone down to the ground several times with snow and they actually do spring back up nicely, but eventually the pipes will break! Total cost of the plastic house was about \$600 when we built ours years ago (no labor included).

#### METAL PIPED:

This design uses twenty-five 3/4" inch galvanized water pipes that are 21 feet long. These are available from any plumbing supply facility and cost about \$23 each in our area. We bend the pipes ourselves into a half-circle using a jig with about twenty short pieces of 2x4 boards (about 8-10" long). The boards are each screwed with 2 screws onto our hay wagon about one foot apart. The one end of the pipe is attached to the wagon with 2 boards, and then one person merely "walks" the pipe around the jig until it touches the last small board. Next, using a pipe bender, we bend the peak to be gothic style, bending until an attached string shows the ends are 14 feet apart. Finally, a slight bend is put six inches from the end of each pipe, so the hoop drops into the fence pipes easily. If this type fieldhouse is used only when there will be no snow, the pipes can be placed every 6 to 8 feet instead of every four feet. This type of fieldhouse is utilized all winter on our farm and it can take almost any snow load. However, we often remove the snow using a large push broom and clear along the sides if necessary with shovels or front-end loader, mostly to get light faster to the plants inside. During the winter, the plastic on both sides is buried in the ground. All other details of construction are similar to the plastic house as

described above. Total cost of the metal house was about \$800 when we built ours years ago (no labor included).

If tomatoes are grown in either type fieldhouse, some means to get adequate pollination must be used, such as rolling up the plastic on both sides or hand pollinating. Duct tape is used to bind everything together and to tape over bolts, pipe ends, etc. to protect the greenhouse film. The greenhouse film usually lasts us 6 seasons, but often as many as 9 seasons. We fold, label, and store it in a dark, cool place (root cellar). Screws and not nails are used when needed for ease of removal and reuse of all materials, and the specified lengths can be changed depending on board widths, etc.

#### ALTERNATIVE SIMILAR DESIGN

Instead of using the 1 ¼" galvanized pipes in the ground, steel re-rod can be used and the hoop pipes placed over them. We often do not put the side boards up for venting, but instead run small ropes over the houses at 8' intervals, attaching them onto stakes in the ground on both sides, or onto "U" shaped re-rod pounded in the ground. These ropes secure the plastic on and give the house a "caterpillar" look. The plastic can then be slid up and the friction between the plastic and hoop pipes is usually enough to hold the plastic up for venting; alternatively for venting, we run a string (usually baling twine!) attached to the ground on one side, over the house, under the plastic and to the inside of the house, tying the string to the ridge. This allows the plastic to be pulled up for venting, and to drop it in the evening merely requires a few strings to be untied. On our 96 foot houses, only 1 or 2 venting ropes are necessary near the center as we only use these houses in the spring before summer heat occurs; the 2 ends not vented are usually left buried.

There are many options for building hoop houses and everyone comes up with new tricks to make things easier or quicker for construction or maintenance.

#### FIELDHOUSE HISTORY AND USE

When we started farming in 1988 here in Argyle, we realized that having produce in early May when the farmers' markets opened would be very beneficial for many reasons. After a long winter with no income, since farming is our full-time living, May sales were important for financial reasons. A full display of lots of great, fresh, May produce also draws the customers to our table and they become loyal customers for the entire season. We do our best to grow a high diversity of crops to create a "one stop" shopping experience for everyone.

Since 1992, we started designing our own "fieldhouse" structures on our own that would serve this purpose and be very low-tech and simple to build and dismantle. We have termed these structures "fieldhouses" because they are temporary, sit directly on our growing fields, and lend themselves easily to rotations. Rotations are critical to managing crops for disease and insect control. We have utilized two homemade designs that have worked well for us, one with metal hoops and one with PVC plastic hoops. In the fall, two metal-hooped houses are constructed and remain up all winter, since they can withstand snow loads. In the early spring (March), one or two plastic-hooped houses are constructed. All houses are dismantled by approximately June first when all danger of frost has passed.

Many different vegetables can benefit from being grown in a fieldhouse. We have trialed lettuce, spinach, peppers, tomatoes, beets, swiss chard, basil, and interplanted radishes and scallions. We choose to extend the season on a particular vegetable due to the fact it is in high demand by customers, it is a high value crop, and we would not be able to have it at that time of year if it were not grown in fieldhouses. For example, lettuce is seeded weekly in 200-cell speedling trays in the greenhouse starting in February. Then in March, after they have grown for 5 weeks in the greenhouse, we transplant 600 lettuce plants each week for three consecutive weeks into one fieldhouse. Planting them 12 inches between rows and 8 inches in row gives us a total of 1800 early, marketable heads of lettuce (12 rows in each house). Therefore, this one fieldhouse provides us with lettuce for the month of May and the lettuce has a value of about \$3100 since we sell them for \$1.75 at our retail markets.

Similarly, we start spinach in the greenhouse in late February in four 200-cell speedling trays. Spinach is seeded every week with 3 seeds per cell. We generally use the varieties Space and Tyee, but several other varieties are trialed every year. Our experience has shown that Tyee works best as a transplant, and Space is best for direct seeding in the ground. After the seeds have germinated (5-7 days), we grow them on in the greenhouse for another 4 weeks. They are then hand-transplanted into fieldhouses with a 6-inch spacing between plants and 12 inches between rows. We plant two fieldhouses with spinach over a 4-week period and each crop is ready to start harvesting about 4 to 5 weeks after transplanting. We pick the larger leaves only and each planting can be re-picked 3 to 5 times about one week apart. Each fieldhouse produces a crop valued at about \$3200 if we pick leaves only and sell them at \$6 per pound at our farmers markets. This extrapolates out to over \$100,000 per acre! Our timing of transplanting crops into the fieldhouses and out in the fields provides a continuous supply throughout the year.

For several years, we interplanted scallions or radishes between the rows of spinach when the spinach was harvested as a plant (the whole plant was taken). Since the spinach is planted in rows 12" on center, the addition of radishes made all rows 6 inches on center. Those trials were successful for the most part; however, the timing is critical so that the spinach does not overcrowd the radishes.

The lettuce and spinach in the fieldhouses are row covered with P-19 Agribon in the early part of the season when temperatures are low. The inside temperatures are monitored daily, and before temperatures reach 70 degrees inside, the plastic on the side with the boards (that has been secured all winter) is pulled out of the ground and can then be rolled up for ventilation.

Basil is another very lucrative crop to extend the season on in the spring. Basil is seeded in the greenhouse in early to mid-March and grown on in 2-inch soil blocks. We then transplant them into a fieldhouse the first week of May and utilize rowcovers to protect them on cold nights. Zip houses over the basil are also another method to protect them and grow them on fast inside the fieldhouses. Basil will be ready to cut for fresh bunches soon after transplanting or even at transplanting time, and can be harvested for many months.

We use a very simple irrigation system for the fieldhouses, which consists of drop nozzles mounted on one main overhead plastic pipe attached to the ridgepole. Drip irrigation is another simple system we have used where a hose can be hooked up to a header pipe with irrigation lines

running off of it. Any hose system can use quick disconnects if many houses are watered with the same hose like ours to save hook-up time. Cultivation is more difficult when interplanting or using drip irrigation. We cultivate the lettuce and spinach crops once with Dutch push-hoes, and side-dress with soybean meal for nitrogen if needed at cultivation.

These fieldhouses have given us a great return over the years, especially since the structures are used over and over each year. They are basically unheated except when planted to crops such as tomatoes and peppers. In those cases, the plants were started in the greenhouse in February and planted into the fieldhouse about May 1<sup>st</sup> when they were in 4inch soil blocks and flowering. When necessary, we have used a portable, propane-fired heater when the temperature drops below 40 degrees. One year we grew lettuce and then interplanted tomatoes; those two crops grossed \$5300. Therefore, you can see the high return these fieldhouses can produce.

In addition to using these fieldhouses for growing early crops, we have also used these structures as an overflow/hardening off area for transplants which had been started in our greenhouse in the spring; examples of these crops are: perennials, onions, and greens that are cold tolerant. During the winter, our ducks and laying hens live in one of the metal-piped fieldhouses, which provides them shelter.

Winter growing is another use for these metal-hooped fieldhouses. We have grown hardy greens that are planted in early fall, such as spinach, mache, kale, and lettuce. About September first, we seed lettuce and spinach in the speedling trays and grow them for 4 weeks in the greenhouse. The plants are then transplanted onto the field about October first where we have marked out the location for the fieldhouse. The actual fieldhouse will be constructed over the plants about November first. If there is time, the framework of the house could be put up at or before planting time. It is important not to put the plastic on too early since the plants lack cold-tolerance if they are too big going into winter. The temperature in the fall can vary quite a bit, therefore planting in 2 successions one-week apart takes away some of the risk. We place wire hoops over the lettuce, then all greens are covered with two layers of row cover. Only the larger outer leaves are harvested, so that the plants can be re-picked all winter. They are usually ready for harvest in December and harvesting can be done when the temperature is above 32 degrees outside, or if the sun is shining. Depending on the severity of the winter, lettuce does not usually survive the winter, hence we plant very little of it. Mache is a very hardy winter green that can be direct seeded into the fieldhouse area about September first, and kale is another crop we've enjoyed that we put in as a transplant that was seeded approximately August first. Aphids can be a problem in late winter, but they usually do not come until March when we are tilling them under to ready the ground for the spring crop. We successfully used purchased lady bugs for the first time in spring of 2005. We often have snow on the ground until early or even mid-April, so these houses give us a great advantage to early crop production for May sales.

There are many varied reasons why we do winter growing. The most important reason is to provide our family and friends with good, organic, fresh greens all winter long. Winter for us is an important family time and a time of rest, so we do not push to sell a lot of produce over the winter. Some of our dedicated customers come on a self-serve basis since they enjoy the fresh greens in the dead of winter, and our vegetables in the root cellar (potatoes, carrots, beets, onions, etc.) also add to their selection. These winter sales provide us with a modest income, and

if we ever needed more income, we certainly know how to make a thriving business of winter growing. In addition to providing winter food, the fieldhouses must be up prior to the winter snow season, so that the ground is ready to plant in March for the new spring crops.

Season extension on our farm has been a very lucrative addition that we will continue to improve upon and experiment with; however, all this time and energy spent on season extension would not be worthwhile if we didn't know the cost/benefit of these systems. We utilize simple but critical record-keeping to determine what crops give us the biggest and fastest return in these fieldhouses. All this leads to a great diverse supply of produce for May, November and all winter; happy customers; and higher profits.

**\*\*NOTE:** Photos of our fieldhouse structures can be seen at the [newfarm.org](http://newfarm.org) website with an article we wrote several years ago. The site is:  
[Newfarm.org/features/0503/arnoldsbuild.shtml](http://Newfarm.org/features/0503/arnoldsbuild.shtml)  
Contact us with further questions.