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High Tunnel Demonstration Project Design & Set-Up

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What is a High Tunnel

• A High Tunnel can be loosely defined as a non-permanent structure with no permanent heat source with a single layer of greenhouse poly covering a frame which is left on year-rounds. Opening vents and rolling up sides to remove heat is done manually. Additionally, the crops are generally planted directly in the soil and can be protected from frost by removable row covers.

Background

• The use of High Tunnels to extend the growing season has been gaining in popularity with producers looking to increase the time span they have produce for sale.

• Commercially available kits (FarmTek, Haygrove, etc.) generally use tube aluminum pipe as a frame (Fig #1).

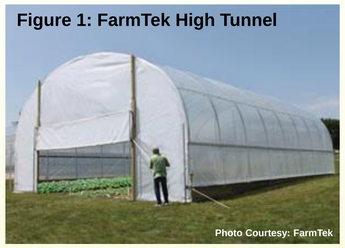
Figure 1: FarmTek High Tunnel
Photo Courtesy: FarmTek

High Tunnel Project Design

• This poster will summarize the design, materials used and construction of the high tunnel project.

• The use of locally available materials and making the high tunnel as strong as possible were the project goals.

• A tube steel frame was used so as to increase the design's structural strength & use materials available locally.


Figure 2: One Inch Tube Steel Arches
Photo Courtesy : T. Gonsalves

• The choice was made to use 1" tube steel for the arches (Fig #2).

• The tube comes is 24 foot lengths.

• The material is bent into an arch 7 ½' high & 15 ½' wide at the base. Twenty six arched were used on 4' centres, therefore the tunnel is 100' long.


Figure 3: Foot Attached to Base of Arch
Photo Courtesy : T. Gonsalves

• A 4" x 6" flat iron steel "foot" was welded onto the base of each arch to allow it to be attached to a treated 2x6 base used to anchor the arches (Fig #3).

• Two inch deck screws were used to attach the foot to the 2x6 plate.

• A 4' piece of 1" rebar was used to arch every second arch to ground.

• This was done by welding a link from a chain to the inside of the arch and to the top of the rebar.

• The rebar was pounded into the ground and a 2" ratchet strap was used to secure the arch to the rebar (Fig #4).

High Tunnel Project Design (continued)

• A 4" x 6" flat iron steel piece with four 3/8" holes punched through was welded to the inside top centre of each arch (Fig #5).


Figure 5: Steel Plate to Anchor Arch Centres Together
Photo Courtesy : T. Gonsalves


Figure 6: Side View of Arches Attached
Photo Courtesy : T. Gonsalves

• Random lengths of 2x6 were bolted to the inside of the arches 3' above where the foot is attached to the plate (Fig #6). Four foot lengths of 2x4 (Fig # 7). were bolted into the holes This provides "lateral strength".


Figure 4: Anchoring Arch to Rebar Stake
Photo Courtesy T. Gonsalves

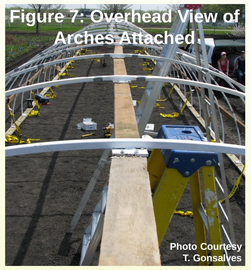
Figure 7: Overhead View of Arches Attached
Photo Courtesy T. Gonsalves

• Any place that the poly was to be installed over wood or metal, a layer of "cinch strap" material (flexible high density plastic) was first fastened.

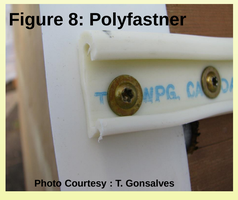
Figure 8: Polyfastner
Photo Courtesy : T. Gonsalves

• A two-part Polyfastner was used to hold the 11 mil greenhouse poly to the tunnel frame (Figs #8 & 9).

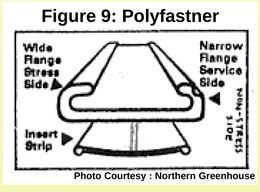

Figure 9: Polyfastner
Photo Courtesy : Northern Greenhouse

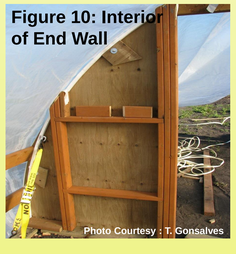
Figure 10: Interior of End Wall
Photo Courtesy : T. Gonsalves

• End walls were framed using 2x4 & plywood (Fig #10).

• End doors were covered in greenhouse poly to save weight & hinged window vents with temperature actuated piston were installed.

• Gable vents were cut above doors (Fig #10).

• The 2" galvanized pipe, top rail from a residential chain link fence was used as the centre core to roll up the side vents on the bottom 30" of the tunnel.

• ABS pipe was used to make a T shaped handle for rolling the side wall vents up and down.


Figure 11: High Tunnel in Use
Photo Courtesy : Portage Online

High Tunnel Parts & Price List

Table 1: High Tunnel Parts List for 100' Long High Tunnel in 2014 Dollars (7½' high in the centre & 15½' wide at the base)

Item	Source	Quantity	Cost
Poly (120' x 30')	Northern Greenhouse Sales	3600 sq. ft.	$1,260.00
Cinchstrap 3 x 100 foot rolls)	Northern Greenhouse Sales	6 x 100' rolls	$138.00
Polyfastener strip (300' roll)	Northern Greenhouse Sales	1 x 300' roll	$270.00
Polyfastener Tool	Northern Greenhouse Sales	1	$35.00
Metal Arches (24' long 1" sq. tubing, bending & welding arches/anchors)	Hard Cor Welding	26	$2,600.00
Metal stakes (5' long 1" rebar) to anchor arches to the ground	Hard Cor Welding	28	$110.00
2" Ratchet Straps	Princess Auto	28	$200.00
Metal Anchors (5' long, 1/2" rebar) to anchor end walls to ground	Coop Lumber	16	$37.50
Sub Total 1 (comparable parts to High Tunnel kits on the market)			$4,650.50
2x6 PWF Lumber (220')	Coop Lumber	220 ft.	$220.00
2x6 Lumber (200)	Coop Lumber	200 ft.	$240.00
2x4 Lumber (325')	Coop Lumber	325 ft.	$210.00
Plywood (1" PWF)	Coop Lumber	5 sheets	$275.00
Coated Deck Screws (1.25, 2.00, 2.5 & 3.5")	Coop Lumber	5 lbs	$25.00
3 1/2" Round Head Fasteners (for Polyfastener strip)	Rona	750	$100.00
1 1/4" Round Head Fasteners (for Polyfastener strip)	Rona	8	$10.00
3/8" x 3" bolts, flat washers, lock washers & nuts	Coop Lumber	100	$40.00
1/4"x 3" carriage bolts, flat washers, lock washers & nuts	Coop Lumber	104	$27.50
1/2" X 3" bolts, flat washers, lock washers & nuts	Coop Lumber	12	$8.00
1/8" cable	Coop Lumber	48 ft.	$20.00
1/8" cable clamps	Coop Lumber	16	$8.00
5" turnbuckles	Coop Lumber	4	$8.00
3" hinges	Coop Lumber	12	$36.00
4" lag eye screws	Coop Lumber	8	$5.00
Rust Paint	Coop Lumber	8 litres	$56.00
Sub-Total 2			$1,288.50
Pre-Tax Total			$5,939.00
Taxes (13%)			$772.07
Grand Total			$6,711.07

Project Comments

• The irrigation system was not included in the above costs.

• Soil on site was approx. 60% clay, 20% silt & 20% sand. Fifteen yards of sand were added to amend the texture to approx. 20% clay, 20% silt & 60% sand. This cost is not included in above parts list.

• If the site has poor internal drainage, sub-surface tile installation could be considered to improve net return but that would increase project costs.

• Building the tunnel was a challenging process as there were no "assembly instructions".

• Trial & error was the way of learning what worked best.

• Design entryway to fit all equipment you plan to use inside high tunnel.

• Quality parts will contribute to a longer lifespan but at an increased cost.

• Include as many sq. ft. of venting area as possible via end walls, gables, sides, etc.

Acknowledgements

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