

High & Low Tunnels



MSU Tunnel Workshop, August 3rd, 2016
Patrice Gros, Foundation Farm

FARM BY THE NUMBERS:

High & Low Tunnels



- 24,000 square feet in cultivation (1/2 acre), set over 5 acres.
- \$80,000 yearly sales, 25+ crop types, 4 seasons.
- 4 high tunnels: 3 (100X17), 1 (100X30)
- 1 planned for fall of 2016: 150X24
- 3 weekly farmers' markets (65%), small CSA (5%), 1 large store & 4 restaurants (30%).
- Labor: 3 mornings (Mo/We/Fr), crew of 3 to 6 for a total of 60 hours man-hours weekly.



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FARM PHILOSOPHY: ORGANIC, NO-TILL

- **Optimal microbial life:** natural soil texture and structure plus micro-biological "glue" form "aggregates" which creates an ideal ecosystem. Tilling destroys soil's natural texture, structure and micro-biome!
- **Optimal water and air content:** soil in its un-tilled, natural state optimizes water and air availability to plants and micro-organisms. Tilling cuts moisture and air capacity in half leading to heavier irrigation and repeated tilling.
- **Optimal nutrient availability:** undisturbed soil structure and biology optimizes nutrient accumulation/release, hence can reduce, and even eliminate the need for any fertilizer.

Plants are capable of producing "exudates" which attract specific micro-organisms (bacteria) which in turn can feed the plants throughout the extensive rhizosphere (root area). Rhizosphere can be vastly extended by fungal networks.

Tilling leads to more fertilizing, organic or conventional.



High & Low Tunnels



1-Lowest Cost Options: mini-tunnels and row-covers:

- ❖ best for season-extension and winter tunnels and, more marginally, for outdoor over-wintering.
- ❖ Freeze-safe to 25 degrees or 20 degrees if doubled. Use medium grade covers.
- ❖ Increase quality and marketability of early spring, late fall and winter crops (no freeze burn).
- ❖ Easy to set up (covers) and use for harvest (covers).
- ❖ Cost-efficient; mini-tunnels can be build for less than 50 cents/square-foot
- ❖ Reduce the impact of predators like crows, rabbit and deer.



High & Low Tunnels



2- Low Cost Option: low tunnels/specs

- ❖ 17' wide, 8' tall (highest) and 100' long (flexible); low profile against winds, no internal support or cross-beams, good cross ventilation.
- ❖ Full access from the outside and inside paths with 6' foot clearance
- ❖ Standard 24' long arches which can be transported on a 18' trailer.
- ❖ Allows 3 beds (3.5 to 4 feet) with path (2.5 feet)



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2- Low Cost Option: low tunnels/specs

- ❖ individual components gathered from cost-competitive sources, for a 50% savings over kits of similar size.
- ❖ Total cost: 1\$/square foot (see breakdown).
- ❖ High quality materials, designed to sustain high winds (70mph so far), and to last over 10 years:
 - Arches: 1" square-tubing, micro-galvanized steel
 - Plastic cover: Tufflite IV, 6mil, UV-treated
 - Structure anchors
 - Plastic Attachment: U-channels and Wiggle Wire
 - All hardware rust-proof (SS, galvanized, zinc-plated)



LOW-TUNNEL PARTS & SUPPLIES
SIZE: 100X17 (Rev. / Nov. 2010)



qty	description	price	supplier	phone/website	total
1	100'x25' Tarfilite IV Plastic, Clear	175.50 +\$&LH	Imperial Business & Supply, Inc.	www.imperialbusiness.com 1-800-442-4147	175.50 +60.00
1	20'x10' Tarfilite IV Plastic, Clear	70.20	Imperial Business & Supply, Inc.	www.imperialbusiness.com 1-800-442-4147	14.40
18	1 Square X 16 galvanized X 24" 5/8" rebar	21.90 +\$&LH	U.S. Wholesale Pipe & Tube	Dane Phillips 800-708-8823	394.20 +101.42
3	5/8" rebar	10.00	C&H Bunch Hardware Store	870-425-2463	30.00
8	Eye Bolts 1/4X1.5 20 min.	1.00	Hardware Store		8.00
100+	18 1/2" self-drilling metal screws	.12	Hardware Store		12.00
20	7/8" EMT conduit	3.70	Hardware Store		74.00
18	1/2" EMT coupler	.70	Hardware Store		12.60
	Misc. PVC parts for 2 cranks		Hardware Store		3.00
100	Nylon 5/8" rope		Hardware Store		13.00
200+	1" x 3" cedar planks	25	Local wood-mill		25.00
36	Galv. 1/2 x 2.5" carriage bolts/nuts	1.00	Hardware Store		36.00
31	Aluminum Poly Patch Single Channel	7.84 +\$&LH	Farmtek Morgan County	www.farmtek.com 800-327-8825	243.04 +74.00
23	35 Spaving Wiggie Wire	1.85	Farmtek Morgan County	www.farmtek.com 800-327-8825	61.05
34	Auger Style Earth Anchor	4.89	Farmtek Morgan County	www.farmtek.com 800-327-8825	117.36
18	1" EMT conduit	6.00	Hardware Store		108.00
16	1" EMT conduit couplers	1.60	Hardware Store		25.60
32	1" x 1/2" 3-hole metal traps	.70	Hardware Store		22.40
TOTAL					\$1,525

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2- Low Cost Option: low tunnels/set up

Factors: sun exposure, drainage, heat/cold management, ventilation, bed surface optimization.

- ✦ Tunnels are best lined North-South if prevailing winds from the West-East
- ✦ Tunnels are left open on the off-wind side for temperature regulation
- ✦ Beds are 3 1/2' or 4' wide with 2 1/2' paths
- ✦ 6" drainage ditches on fan sides for drainage
- ✦ Beds are covered individually with covers floating on metal wire hoops
- ✦ Ventilation is from open end (always) and both sides (can be rolled up)



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2- Low Cost Option: low tunnels/cultivation techniques

- ✦ No tiller/tractor, all work is manual; only machine is mower
- ✦ Mulch: used against weeding
- ✦ Fertility: organic matter (rabbit manure, mulch, plant residues), feather meal (nitrogen)
- ✦ Heat protection/ventilation: roll-up sides, permanent opened end
- ✦ Plant winter positioning: hardiest plants are set on outside beds



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2- Low Cost Option: low tunnels/benefits

- ✦ Increased production time: 6 months added (Dec-May)
- ✦ Increased yields and quality (improved weather, low soil compaction)
- ✦ Increased crop protection (crow, deer)
- ✦ Bottom line: \$12,000 winter income and triple tomato income (summer-fall)



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3- High Cost Option: high tunnels

- ✦ Maximized tunnel benefits: weather, space/access, durability
- ✦ Protection against killing freezes down to 0 degree!
- ✦ Kit from Morgan County Seed: 2 3/8" diam. 14 gauge galvanized steel arches, 6mil. UV-treated plastic, 3 lines of purlins, corner braces and drop curtains.



100' by 30' by 15' Cost = \$8,000
 Cost/Square foot: \$2.65

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3- High Cost Option: high tunnels/weakness

- ✦ Increased wind sensitivity: tunnel height (15 feet versus 8 feet for low tunnels) makes it prone to destruction under catastrophic winds (70mph and higher).
- ✦ Recommendation: heavy-duty square-metal frame on the wind side; generous concrete footings on all poles.
- ✦ Next tunnel compromise (fall 2016): around 12 feet high



4- Low & High Tunnels/ returns

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Both types of tunnels easily justify their costs by providing large incremental returns, in the form of increased yields in summer (tomatoes, peppers, etc.) and additional crop production in winter.

	LT 1						LT 2						LT 3						HT								
	250	350	450	550	650	750	250	350	450	550	650	750	250	350	450	550	650	750	250	350	450	550	total sq. feet				
1st season 6/15	[table with 6 columns]						[table with 6 columns]						[table with 6 columns]						[table with 6 columns]						4250		
2nd season 12/21	[table with 6 columns]						[table with 6 columns]						[table with 6 columns]						[table with 6 columns]								
total	[table with 6 columns]						[table with 6 columns]						[table with 6 columns]						[table with 6 columns]						\$6,415		
total cost	[table with 6 columns]						[table with 6 columns]						[table with 6 columns]						[table with 6 columns]						\$11,110		
additional summer income assuming all tomatoes between June 1st and November 1st (8 months):																							\$12,750				
4250 square feet X \$30/sq/season = 12,750																							\$12,750				
total																							\$29,660				
total cost	\$1,000	\$1,000	\$1,000	\$2,000																					\$22,000	Total Investment:	\$23,000

Foundation Farm organic/no-till system



My gardening/farming books are available for \$10 each or \$25 for all 3...

The image displays three gardening and farming books. The first is 'MAKING FRUIT VEGETABLE PRODUCTION BOOK 2: WINTER HARVEST' with a blue cover. The second is 'MAKING FRUIT & VEGETABLE PLANTING - A GUIDE FOR PROGRESSIVE MARKET GARDENERS' with a white cover featuring a person in a garden. The third is 'E-LIGHTS - GROW YOUR OWN VEGETABLES' with a red cover showing various vegetables. The books are presented as available for purchase at \$10 each or \$25 for all three.