High Tunnels: A First Years Experience

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Production of vegetables, fruit, flowers and other commodities in tunnels is common in Europe but relatively new in the United States. Cost causes many large-scale producers to be cautious, resulting in more tunnels being used by small, niche market growers. This is changing and in 2005 Michigan State University's Southwest Michigan Research and Extension Center (SWMREC), in cooperation with Haygrove Tunnels, established a one-acre system of nine bays 24' wide by 200' long (Figure 1). This is a report on our experience.

Tunnel Construction

The tunnel consists of pipe, hardware, wire, plastic and rope. The first step is to position legs and drill them into the soil, something difficult in clay or stony soils. A hydraulic driller helps and fortunately we have sandy soil. Straightness and distance uniformity is important. Our acre required 290 legs - we were glad to be through.

A Haygrove representative bent pipes and provided instructions, which helped, since the manual is vague, something Haygrove is changing. Hoops are then placed on the legs. Being tall helps since hoops are lifted up and slid onto the legs. It also helps to load a forklift with hoops and drive it down the bay middle. Since legs connect bays, it helps to place hoops on one bay and then move to an adjacent bay, leaving one row of legs not connected and flexible allowing for slight variances in distance. Once hoops are up, interconnecting and the bracing of legs and hoops begins. This takes awhile and we were short a few pieces which Haygrove quickly shipped.

The plastic is one heavy roll and some way of supporting it has to be devised. We placed the roll on a trailer, ran a pipe through the center and supported the ends on overturned cherry tanks. To unroll it, a rope was placed in the valley between the hoops; one end tied to the plastic, the other to a tractor which slowly pulled the plastic. This creates static electricity so warn those feeding plastic into the valley. Once plastic is in the valleys a calm day is needed to place it over the hoops and secure it with rope.

The whole process took approximately 350 hours for our acre, about 100 more then what Haygrove suggests. We were inexperienced and could not devote consistent time to the project. So we can believe Haygrove's estimate.

Soil Preparation and Planting

The only difference in soil preparation, plastic laying and other activity is the need to be careful to not hit pipes. Difficulty depends on equipment height and width. We found hoop height adequate for our equipment to work within two-feet of support legs. Since everything is uniform and straight, once you learn where to place the tractor tire in relation to support legs, each process goes quickly. The only problem we had was when a stone stuck in the disc, causing it to track to the side.

Plant Growth

Tunnels were planted to research trials of sweet cherry, raspberry, strawberry and tomato with observation trials of flowers and other vegetables. Comparative plantings were established outside tunnels. This report is on vegetables and flowers.

Plantings were established 2 June as transplants or direct seeded. Due to weather, plastic was placed over the plants 28 June. Obvious differences were noted after a week. Tunnel-grown 'Mt. Spring' tomatoes had larger leaves and flowers. The entire plant was also larger with out of tunnel tomatoes reaching the top of a three-foot stake, while in tunnel plants went a foot or more over the stake and had more lateral growth. 'Mt. Spring' total fruit yield increased 552 cartons/acre (Table 1). More importantly, number one large fruit yield increased 666 cartons and number one fruit size increased 31 grams. Cull fruit decreased 362 cartons inside the tunnel. There was an increase of nearly 20,000 fruit/acre in tunnels over outside tunnels

In tunnel tomatoes were not pest-free, however, there was a reduction in foliar disease as evidenced by the amount of foliage at the end of the season. This may be due to lower disease pressure, increased chemical efficacy, or both. Mites and thrips became a problem under the tunnels, but they were also a problem out of the tunnels. Other vegetables in the observation trials also had larger plants, leaves and fruit. Flowers appeared to have brighter colors, longer stems and larger plants. The tunnels also offered a certain degree of wind protection.

Weeds were still a problem between rows in the tunnels even though the only water received by the planting was through the drip irrigation system. This poses a potential problem for late season planting or replanting. In coarse, sandy soils the only moist area in a shaped, drip-irrigated bed is around the emitter. If crops are planted that cover the whole bed (lettuce, spinach and others) additional water will have to be added in an overhead application to encourage seed germination and early growth.

We were impressed with the plant growth and the fruit yield and quality from under the tunnels. It is a system that justifies closer scrutiny as to how it might fit into existing production practices. However, there is much to be learned about improving plant performance in the area of spacing, fertilizer, pruning and variety adaptability

Table 1. Yield comparisons in 25 pound cartons of 'Mt. Spring' fresh market tomato grown under high tunnels and outside of high tunnels at the Southwest Michigan Research and Extension Center in 2005.

Trait	Out of Tunnel	In Tunnel	Change
Total Yield	2677	3229	+552
Yield No. 1 Large	1082	1748	+666
Avg. Fruit Weight	276	307	+31
Yield No. 2	399	550	+151
Yield No. 1 Small	345	442	+97
Yield Cull	851	489	-362

Figure 1. Haygrove tunnels at the Southwest Michigan Research and Extension Center; under construction (top) and complete (bottom).