

**CASE STUDY**

# High Tunnel Operation in Harsh Climates: Lessons Learned

Greg Schweser, Community Food Systems Planner, University of Minnesota Extension Regional Partnerships  
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**INTRODUCTION**

Mike Klawitter is a pioneering high tunnel operator who farms on the Minnesota prairie about 15 miles north of Crookston. He was one of the first farmers to experiment with the University of Minnesota Extension's high tunnel researchers to examine the potential benefits of the season extension technology.

While high tunnels offer the potential for farmers to increase their revenues by expanding the growing season and offering a sheltered environment in which to grow, they are not without their risks. Severe weather including tornados, high winds, hail, and excessive heat can threaten both the high tunnel infrastructure and the crops within. After operating under such weather extremes for more than ten years Klawitter has persevered and identified solutions to keep his high tunnel operational. The rewards of high tunnel production are clearly evident: increased yields, higher quality, a longer production season, and stronger plants. But achieving those rewards comes at a cost of heightened vigilance, hard work, and constant infrastructure maintenance and upkeep. The following are some of the problems Klawitter has faced and the solutions he has found to overcome these problems.



Fig. 1: Weather torn high tunnel

**High Winds and Thunderstorms***Problems:*

- When high winds enter through the sides of the high tunnel, the upward pressure on the plastic sheeting creates a tremendous force that can tear the plastic, rip it free from the structure, or even uproot the entire high tunnel and send it airborne. Winds can also cause structural damage to poles.

### *Solutions:*

- Klawitter contends that he needs to replace the plastic on a yearly basis which requires a crew of eight people and a calm day – an occurrence which can be relatively rare in windy northwest Minnesota. Klawitter plans on replacing the traditional 6 mil plastic sheeting with a thick 5.2 oz 12 mil white woven greenhouse cloth in the future. This thicker cloth has uv inhibitors, will hold up better in strong wind, and may last several years but presents a significant up-front cost.
- Anchor kits and straps provide additional support to the high tunnel frame that is necessary to prevent the structure from blowing away in high winds.
- Locating high tunnels near thick stands of trees can provide some protection from strong winds. It is also important to orient the high tunnels from east to west to reduce wind damage from strong winds.
- Utilizing a soft cotton rope to tie plastic onto the poles prevents the plastic from stretching in high heat and winds. Preventing the plastic from stretching also makes it less vulnerable to strong winds in the future.
- Use of anchors and soft cotton rope together make high tunnels more resilient in thunderstorms.



Fig. 2: Inside high tunnel

### **Hail**

#### *Problems:*

- Hail damages the plastic sheeting of high tunnels causing penetration and tearing. Plastic sheeting that has holes and tears is more likely to blow away completely.

#### *Solutions:*

- Using thick translucent fiber cloth instead of thin high tunnel plastic can protect against hail.

### **Pests/ Disease**

#### *Problems:*

- Klawitter has experienced a variety of diseases and pests in his high tunnel including blights, funguses, anthracnose, mites, white flies, aphids, thrips, and even deer. High

tunnels create a high heat, high humidity environment that is optimal for such diseases and pests to flourish. Pests can migrate to your high tunnel from infected seedlings that have been started off of your farm.

*Solutions:*

- To avoid pest stowaways from other farms, Klawitter suggests starting plants from seed directly in the high tunnel. Debris from some of the plants is left in the walkways to provide habitat for beneficial insects like crickets and spiders that eat mites and aphids. Klawitter suggests learning about pests and investing in a microscope. Find out what is on your plants and do what you have to do to combat your pests.
- To kill off unwanted microbes that can cause disease, Klawitter soaks all of the high tunnel and garden parts (hardware, strings, brackets, steel hooks, etc.) in a bleach solution at the end of the season.

**Heat**

*Problem:*

- The air temperature in high tunnels can be 40 degrees warmer than the outside daytime temperature. Excessive heat can adversely affect some plants.

*Solution:*

- Ensure that the sides of the high tunnel are rolled up when days are hot to provide ventilation. This requires constant monitoring as the sides will have to come down when thunderstorms roll in to prevent the wind pressure from damaging your high tunnel's structure or plastic.

**Final notes:**

The high tunnel provides major benefits including higher yields and better quality product. But these benefits come at a cost. High tunnels require constant monitoring and vigilance to ensure proper maintenance and upkeep of equipment (parts), and proper moisture, humidity, and temperature levels. Regular maintenance is required to replace or repair mechanical and structural parts that wear out due to wind and weather. Klawitter says "It's like farming. Regardless of what happens the year before, you put in another crop and play the cards that are dealt you." Those that are willing to put in the time and effort to maintain a high tunnel structure will reap the rewards of longer seasons and better products.