Introduction to High Tunnel Production in Minnesota

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This edition of the Minnesota High Tunnel Production Manual reflects what we have learned in the five years since the first edition. Research in high tunnel crop production continues at the North Central Research and Outreach Center in Grand Rapids. New high tunnel research projects have been initiated in SWROC Lamberton, Crookston, WCROC Morris, Waseca, and on the St. Paul Campus.

Growers have continued to experiment and refine their methods, as well. The ongoing sharing of experiences and research among growers and researchers in Minnesota has long been a source of satisfaction to all of us in the horticultural community. High tunnels are a new, exciting venture for continued cooperation and outreach. The state high tunnel conferences and the U of M high tunnel website http://hightunnels.cfans.umn.edu/ are important ways of forging new relationships and building on the great community we already have.

Two other excellent high tunnel resources are the Penn State Center for Plasticulture High Tunnel Manual, available for purchase at http://plasticulture.psu.edu/node/115 and the Cornell University High Tunnel website http://www.hort.cornell.edu/hightunnel/. While our climate is more extreme than that of either of Pennsylvania or New York, most of the basics of high tunnel crop production are similar, making research and recommendations from these states relevant for growers in the Upper Midwest, too. Researchers in these states have been very generous in sharing their expertise with us, and we gratefully acknowledge their assistance.

What’s New in the Second Edition?
New chapters in the second edition are raspberry and garlic production, ventilation, and pollination. The chapters on fertility and fertigation, irrigation, organic production, internal and external environment, diseases, tomatoes, cucumbers, and marketing and economics have been substantially updated and revised. New information can also be found in the chapters on site selection, construction, tomatoes, cucumbers, and onions.

What is a High Tunnel?
At its simplest, a high tunnel is a non-permanent structure with no electrical service and no heating. A single layer of greenhouse plastic covers the frame, is left on year-round, and lasts two or three years. Vents are opened and sides rolled up manually. Plants in the tunnel are protected from frost by mulch or row covers.

More complex high tunnels have begun to find favor in Minnesota. These structures may have electricity and thermostatically-controlled ventilation, along with heaters to protect plants from freezing. Electrical service also makes it possible to install a fertigation system with a small pump to pull the fertilizer solution into the drip irrigation tubing.

More sophisticated tunnels may have a lot in common with greenhouses, but the structures are still only semi-permanent, supplemental light is not used, and plants are nearly always grown in the soil, rather than in containers, on benches, or hydroponically.

High tunnels require a substantial capital investment up front, but sometimes can pay for themselves in the first year and even return a profit, if managed properly. Before getting
started in high tunnel production, growers are encouraged to learn all they can about the
technology and to develop a sound marketing plan.

Benefits and Risks of High Tunnel Production
High tunnel technology is well-suited for production of horticultural crops in Minnesota.

- Not only can the growing season be lengthened and extreme low temperatures be
  moderated, but also the quality of many crops is greatly improved.
- Fruit and foliage that stays dry inside a high tunnel is less prone to diseases, and
  pressure from many insect and vertebrate pests is lower in a tunnel.
- Growers using high tunnels can plant superior varieties that do not ripen early
  enough or produce high enough yields when field grown.
- In some parts of the state, perennial crops such as garlic and raspberry can only
  be profitably produced in tunnels.

While the potential for early production, high yields, superior quality, and very profitable
plants from high tunnels is great, this method of production also demands more intensive
management. Growers should start small and learn as they go, taking the recommendations
from this manual and refining their production practices to optimize their use of the tunnels.

Some of the ways high tunnel management can be more demanding than field production:

- Native soil must be amended with large amounts of compost and often sand, too, to
  make it suitable.
- Because natural rainfall is excluded from the tunnel, and plants are growing fast,
  keeping a close watch on irrigation is essential.
- Temperatures inside the tunnel, even on relatively cool days, can rise quickly when
  the sun is bright, so adequate, timely ventilation is also essential.
- Plants grow fast and big in tunnels, making sturdy stakes, well-constructed trellises,
  and proper pruning of many crops very important.
- Plants started early inside a high tunnel will flower early, often before insect
  pollinators are available, so growers have to manage pollination.
- With fast growth and high yields comes a demand for nutrients much greater than
  that of field-grown plants.
- While many insect pest pose less of a problem in high tunnels, others can be
  particularly damaging, and mites can flare almost instantly, so pest monitoring is
  another essential.