



Deep Winter Greenhouse tomato production trial overview and recommendations

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Background:

Vegetable farmers use Deep Winter Greenhouses (DWG) to grow crops through the winter months in Northern cold climates. The structures capture and store solar heat which provides warmth in the growing area at night. To minimize use of fuel or electricity for backup heat, growers allow their DWGs to cool down to around 40 degrees Fahrenheit at night. This provides an optimal growing environment for various cool season crops like salad greens, brassicas, Asian greens, sprouts and shoots. While growers find these crops to be lucrative in direct-to-consumer markets, the growing season in the DWG ends in Spring as temperatures inside the structure become too hot and difficult to control.



One way to increase the revenue generation potential of DWGs is to find crops that can be grown profitably in the summer or shoulder seasons without interfering with the production of the winter greens season. University of Minnesota Extension researchers partnered with three DWG growers on a limited tomato production experiment to determine if DWGs could be used to grow tomatoes that would be ripe and ready for sales at Minnesota farmers markets earlier than is currently common. **Unfortunately, growers participating in this experiment were unable to produce a crop that would yield enough to be profitable.**

Methods:

Because many DWGs currently in operation are very small, and growers use planters placed in vertical configurations or shelving units rather than growing in the ground, the project team opted to grow tomatoes in pots rather than in raised beds or in-ground. Growers started seeds of one determinate slicer variety and one determinate cherry variety with plantings on January 10, February 10 and March 10. Seedlings were started on germination mats. Once seedlings grew larger, growers up-potted them two times into 5 gallon, then 10 gallon containers. This allowed growers to utilize as little space as possible until the plants were large enough to require their own pots, extending the opportunity to use the DWG for greens production without displacing greens with tomato plants.

Results:

The best performing tomatoes were the cherry tomato variety that was seeded earliest (in January). The best performing DWG averaged fewer than 2 pounds of fruit per plant (of 4 cherry tomatoes seeded in January). We utilized approximately 1/3 of the DWG (total DWG growing space is 15' x 23', or 345 square feet) for this experiment. If the entire greenhouse had been planted in tomatoes that had matched the highest producers, there would be 72 plants with a total of 144 pounds of cherry tomatoes in the best-case scenario.

Cherry tomatoes began producing in early June, at least one month before tomatoes begin to produce fruit in the average Minnesota high tunnel. Thus, while the yields were low, for some growers, growing a few tomato plants in a DWG may be worthwhile if having the earliest tomatoes at the farmers market is an important marketing strategy.

Slicer tomatoes did not grow as well. The first year, growers had significant issues with blossom end rot. They were able to mitigate this in year 2 with more frequent watering, but yields were still low. The highest average slicer production was from plants seeded in January which averaged 1.29 pounds of fruit per plant.

For more detailed information:

To see more detailed information on planting schedules, soil medium used, fertilization schedules, and more, refer to project results written up in: *Expanding the use of deep winter greenhouses for summer tomato production: feasibility and profitability.*

Recommendations:

Based on the results of these DWG tomato trials, we would recommend that growers do not consider growing tomatoes for market in a DWG, at least as a significant part of their farm business. Yields of the best producing plants were limited and costs associated with production exceeded any suitable expectations for revenue.

Despite the results of these limited trials, we understand that some growers will want to conduct their own experiments with market tomatoes grown in their DWGs. Other growers may want to grow tomatoes throughout the winter for personal use regardless of production costs. For these growers we offer the following recommendations based on the DWG tomato production trials:

- **Choose an affordable soil medium** - The experimenters chose Purple Cow transplant mix for the production trials because it was an Organic Materials Review Institute (OMRI) approved soil. This mix, however, was very expensive and cost approximately \$17.32 per 10-gallon pot. A cheaper alternative would be required for profitable tomato production.
- **Consider growing in raised beds** - If you grow in raised beds, you might be better equipped to grow tomatoes as the plants will have more space for root growth and better potential to hold moisture.
- **Ensure proper watering** - Tomatoes grown in pots can easily dry out resulting in adverse plant health effects or death. The environment in the DWG, though often humid, can become very hot very quickly causing plant stress if tomatoes are not watered. Even daily watering (and during very hot weather watering multiple times per day) can also help reduce blossom end rot.
- **Check salt levels** - Though they are somewhat tolerant, tomatoes do not tolerate excessive salt levels well. DWG soils and many potting soil or soilless media can have elevated salt levels.
- **Ensure proper ventilation** - As with all crops in the DWG, it is important to provide adequate ventilation. The DWG can heat up fast creating an environment that can hamper crop growth. Ensure ventilation windows are open and that there is ample air circulation. If necessary, use a shade cloth on the south facing glazing wall to prevent solar heat accumulation beyond the storage capacity of the heat battery/thermal mass.
- **Have fun** - While you might not be able to make a large profit from growing tomatoes, test your limits, see what is possible, and have fun. You can always use this opportunity to gloat to your neighbors and farmer friends that you have home grown, fresh, ripe tomatoes in the middle of winter and they don't. (Of course, you will share your bounty, right?)



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