High Tunnels in Minnesota

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It has been said that Minnesota has no spring. Weather in April and May can be very unpredictable with the potential for frost that can damage tender vegetable transplants always present. Typically vegetable growers and home gardeners must wait until mid-to late-May to plant warm season vegetable crops for fear of frost injury. Indeed, frost can occur in northern Minnesota well into June. Growers who take a chance and plant in May often need to take special precautions or use frost protection systems to keep the young transplants from suffering damage. When successful, growers are rewarded with earlier production and better market prices. When unsuccessful, extra time, labor, and other expenses greatly reduce profits. Producers want that early market, and any growing system that will help produce an earlier crop is desirable.

At the same time that the frost danger is so great in April and May, the day length is increasing and the sun angle is at its highest, making conditions optimum for plant growth and development. High tunnels offer a way for Minnesota growers and gardeners to capture some of the light and heat from these long days. At the same time, high tunnels enable growers to start the tender warm season crops in an environment that is less threatening and easier to protect from frost. It is not uncommon during a sunny early May day when the air temperature is in the 50’s to have the temperature inside the high tunnel be well over 80 degrees -optimum for plant growth and establishment.

By definition, a high tunnel is a non-permanent structure that has no electrical service, no automated ventilation and no heating system. High tunnels typically are ventilated by manually rolling the sides up or down as needed using a roll bar. They are covered with a single layer of 6-mil greenhouse plastic that is left on the structure year around and normally will last two to three years. Frost protection in the spring and fall should be available and typically can be provided by heavy row covers or, more reliably, by standby portable propane heaters.

The Minnesota High Tunnel Project started in 2003. During the 2003 and 2004 growing seasons great contrasts were seen in growth and production both within and between the high tunnels and the field. The 2003 season was early, had no major frost events in May, had much-above-average temperatures during the entire season, and resulted in outstanding production both in the high tunnels and in field-grown plants. By contrast, the 2004 season was very late, had as many as 13 frost events in May, had frost on June 16, had another on August 20, and was much cooler than average all season. Field production was delayed and poor at best. If it had not been for the much-above-average temperatures in September, no field tomato production would have occurred at all in 2004. High tunnel production was again early, dependable, and prolific. The benefits of high tunnels in Minnesota were never more evident than during the 2004-growing season. High tunnel production in both seasons was significantly earlier, greater, and resulted in fruit that was larger and of better quality than that produced under field conditions.

In addition to the yield factors listed above, high tunnel production has some other noticeable benefits over field production. Because of the earlier planting date and better growing environment in the high tunnels, it is possible for the grower to provide a steady amount of
good quality product to the market for a longer period of time. High tunnel production also seems to be more predictable and dependable than field production, making market planning easier. These factors are good for both the grower and customer. For example, during the 2004 season, customers frequently asked when the tomatoes would be available. High tunnel tomatoes were available much earlier than field ripened tomatoes and at a time that was very close to when ripe fruit had been available during the 2003 season. Another very noticeable factor in high tunnel production was the much-reduced occurrence of insect and disease damage. Tomatoes were grown in both seasons without septoria or early blight symptoms in the high tunnels, whereas, by late August these diseases had killed nearly all of the field-grown plants. Aster yellows, which infects many of the carrots grown in the field, was not a problem in carrots grown in the high tunnels. Radishes grown in the field are usually infested with root maggots, and they were not bothered by maggots in the high tunnels. Reducing these insect and disease factors led to less pesticide use as well as better, more dependable production. A third noticeable advantage in high tunnel production was cultivar selection. Often in Minnesota, a grower may have to select a cultivar for field production because it matures earlier than others, though it may not have the yield potential of cultivars developed for regions with longer growing seasons. High tunnels allow growers to not only grow these earlier-maturing cultivars for their early crop, but also allow growers the opportunity to maximize production by choosing longer-maturing, full-season cultivars. For example, the tomato cultivar Cobra produces very little ripe fruit in the field under northern Minnesota conditions; however, under high tunnel production it is capable of producing up to 20 pounds of fruit per plant.

High tunnel production is very different from field production in that the grower has much more control over the environment. In high tunnel production, the grower can control water, fertility, and temperature. The grower needs to monitor and select the best levels of these factors and to choose which cultural practices to implement. There are different levels of management and culture within the high tunnel. For example, one grower may chose to let the tomato plants grow on the ground in a matted row system where another grower may chose to tie the plants to stakes or to trellis the plants and prune them as they develop during the season. Whichever the growing system or environmental factors used, careful and more-detailed management is necessary. This manual contains many suggestions you will need to get started in high tunnel production. It is hoped that this manual will assist growers in their quest for success.

World wide, the greatest success with high tunnels has been in regions where growing seasons are somewhat marginal either being too cool or too short. In Minnesota, the growing seasons are both too cool and too short, making the potential value of high tunnel production unlimited for Minnesota producers and gardeners.