Season Extension for Production of Vegetables under Protection Cultivation Systems

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Introduction
High tunnels can offer uninterrupted growing periods for specialty crops in addition to protection from late spring frosts, unseasonal hail, and foraging pests. Vegetable and herb production in Wyoming is a relatively small industry; most of the fresh vegetables consumed are produced outside the state or imported from other countries. Some Wyoming growers and homeowners are interested in small-scale, extended-season production.

Objectives
The goals of the project are to establish sustainable vegetable production in Sheridan and surrounding areas and study the possibility for season extension under protected conditions. Specific objectives include (1) comparing low-tunnel (LT), high-tunnel (HT), and open-field production systems for tomatoes, hot peppers, broccoli, beans, and cucumber; and (2) optimizing the transplant time of selected vegetable species for early spring and fall production seasons.

Materials and Methods
Seedlings for tomatoes, hot peppers, broccoli, beans, and cucumber were started March 15, 2015, in a Sheridan Research and Extension Center (ShREC) greenhouse. The land was tilled, and raised beds were prepared and covered with black plastic mulch. Seedlings were planted in replicated blocks and randomized throughout the raised beds in the high tunnel. Similar plantings were carried out in low tunnels and under open-field conditions. Seedlings were planted at the test site on May 29. The cumulative yield for each crop was recorded by combining crop weights recorded at weekly intervals during the duration of the crop. The length of the duration for crop harvest was also recorded to study potential differences in cropping season extension under each cultivation system.

Results and Discussion
Greenhouse-grown seedlings established well in the high tunnel, in low tunnels, and under outdoor field conditions (Figures 1–4). The broccoli and tomato plants exhibited extremely vigorous growth and were not suitable for low-tunnel cultivation/production. Summer temperatures exceeded 90°F under low and high tunnel, and bolting (production of flower stalks) was observed in broccoli. Harvesting was initiated July 6 and continued till October 30 in the high- and low-tunnel treatments. The plants growing under field conditions without any covers showed diminished production in early September due to decreasing night temperatures, and harvesting in this treatment was terminated at the end of September.

The majority of vegetables grown under the high tunnel exhibited higher yields and could be grown for a longer duration compared to the crop grown under open-field conditions. We will continue to record data for production under high tunnel, low tunnels, and open conditions for another year to study the seasonal variation and long-term effects of providing protective covers for vegetable production.

Vegetables harvested from the project were served at the Sheridan Research and Extension Center Field Day meal. Information was provided to field day attendees, and arrangements were made to interested parties who wanted to visit the field site.

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Figure 1. A view of the experimental plot.

Figure 2. Vegetable production in the high tunnel.

Figure 3. Low-tunnel production of vegetables.

Figure 4. Vegetable production under field conditions.