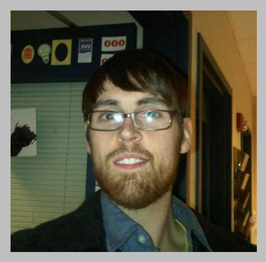
Effect of Row Covers on High Tunnel Temperatures and Yield in Early Spring



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Abstract

High tunnels are low-input, solar-heated greenhouses that are often used for out-of-season vegetable production in Kentucky. They are susceptible to extreme diurnal temperature variation, which may stress plants and reduce yield. We tested the ability of translucent polyester row covers to moderate temperature extremes in high tunnels. Soil and air temperature was recorded hourly throughout late winter and early spring of 2010 and 2011 in covered and uncovered beds growing cool season vegetable crops. Yields were higher under row covers than in uncovered rows. Row covers moderated temperature fluctuations inside the high tunnel: Early morning temperature under row covers was warmer than without row covers; and afternoon temperature was cooler. The observed yield increase and reduced temperature fluctuation under row covers shows promise for increased viability of hoop houses to provide farmers with a sustainable, low-input venue for growing produce out of season.

Introduction

Kentucky State University's Land Grant Program is committed to developing sustainable agriculture systems suitable for adoption by small and limited resource farmers.

High tunnels are a low-energy input system that allow farmers to extend growing seasons but are susceptible to temperature fluctuations in early spring and late fall.

Translucent polyester (Reemay) row covers may reduce temperature fluctuations in high tunnels and improve yields of vegetables grown outside of Kentucky's normal growing season.

Materials and Methods

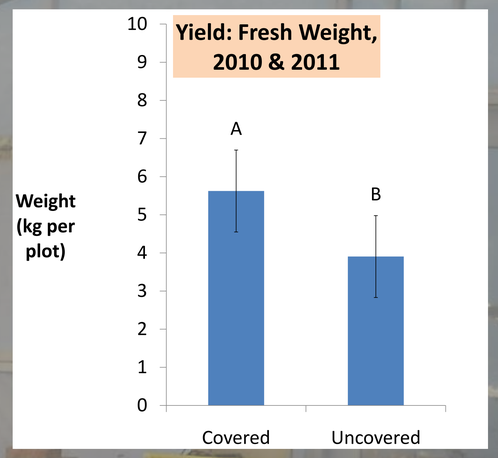
Covered and uncovered high tunnel beds growing transplanted and direct-seeded spinach (*Spinacia oleracea*), kale (*Brassica napus* var. *pabularia*), and beet (*Beta vulgaris*) were compared using a randomized complete block design with four replicates. Average, maximum and minimum air and soil temperatures were logged hourly over the course of two seasons (March 2-May 18, 2010 and Jan 24-March 4, 2011) using a CR-10 datalogger (Cambell Scientific). Aboveground fresh weight of 3 m^2 subsamples of each treatment was recorded at the end of the monitoring period. ANOVA was used to test for effects of treatment, replicate, and year on yield, and means were separated by t-test (JMP 9.0, SAS).

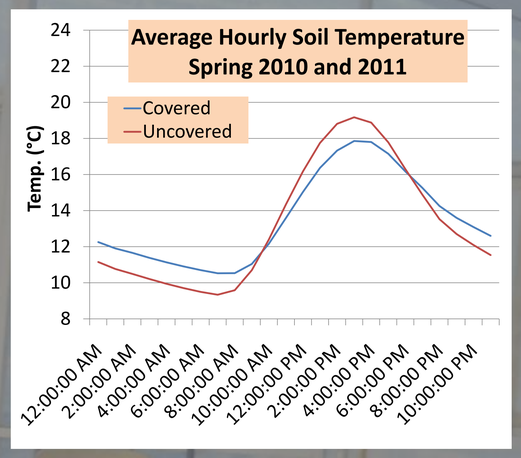
Results and Discussion

Row covers exhibited a moderating effect on soil and air temperatures. Row covers had no effect on daily average temperature overall, but warmed beds at cool temperatures and cooled beds at warm temperatures. Covered soils never fell below freezing. Air temperatures under covers experienced more protection from freezing that the uncovered sections, and periods of freezing were shorter for the sections under covers.

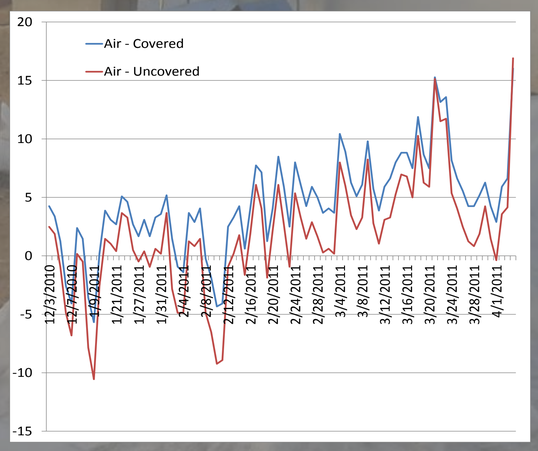
Row covers increased yield in both years.

Based on both temperature moderating effects and yield increase, row covers are recommended for use in high tunnels.

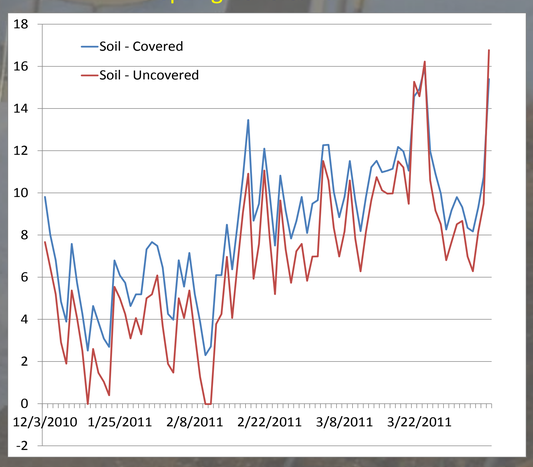




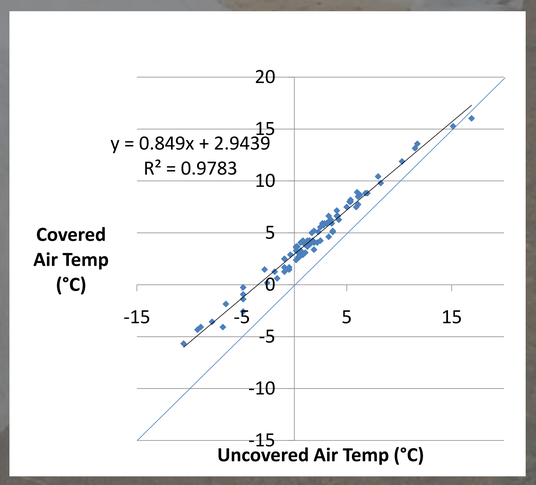
Average diurnal temperature fluctuation, spring 2010 & 2011



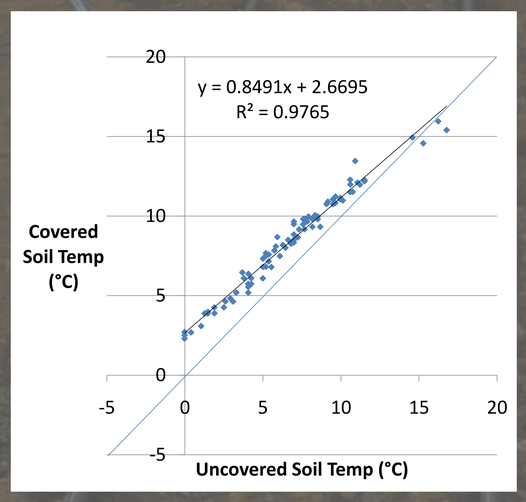
Daily Minimum Air Temperature (°C), 2011



Daily Minimum Soil Temperature (°C), 2011



Relationship between daily minimum air temperatures in covered and uncovered beds



Relationship between daily minimum soil temperatures in covered and uncovered beds