Effects of Low Tunnel Plastic Type on Organic Production of Day-Neutral Strawberries

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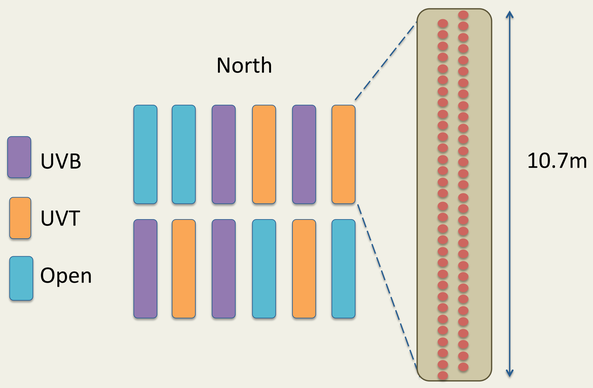
Introduction

Demand for local, organic strawberries (*Fragaria* x *ananassa*) can be difficult to meet in the Upper Midwest, where short growing seasons limit fruit yield and quality (Martin and Tepe 2014). Low tunnels can be used to extend the growing season, improve strawberry yield, and protect plants from pests and pathogens (Freeman and Gnaymen 2005). Specialty plastic types available for use as low tunnel coverings offer a variety of options for influencing the quality and intensity of light reaching plants under the tunnels. Growers are interested in understanding more about the potential for optimizing growing conditions for strawberries by using some of these novel plastics. In this study, we evaluated how variance in light intensity and quality, as modified by characteristics of different plastic coverings, affects the microclimate, fruit yield and quality, and insect pest presence in an organic strawberry production system.

Experimental Design

- 'Albion' day-neutral cultivar selected based on previous growing success in Minnesota
- Lumisol brand tunnel plastics selected based on availability of multiple light-filtering options
- 3 low tunnel treatments: Ultraviolet-blocking plastic (UVB), Ultraviolet-transmitting plastic (UVT), and Open
- Complete block design applied across 12 plots



May through September, tunnel sides remained up (above). When night temperatures dropped below 5°C in October, tunnels were closed (below).

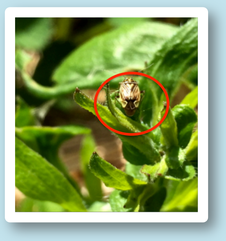
Data Collection Methods

- **Fruit Yield:** Ripe fruit harvested and weighed 1-2x per week, July 21 – November 8, 2016

- **Fruit Quality:** Berries sorted into categories based on USDA standards: Marketable (No. 1 or No. 2) or Unmarketable

- **Insect Pests:** Weekly scouting focused on two key pests

Tarnished Plant Bug, (*Lygus lineolaris)*



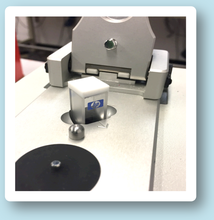
L. lineolaris nymphs and adults recorded separately on a per plant basis.

Two-Spotted Spider Mite, (*Tetranychus urticae)*

One leaf per plant scored on graduated presence/absence scale: each of three leaflets marked 0 (no *T. urticae*) or 1 (*T. urticae* present) for total leaf score of 0, 1, 2, or 3.

- **Microclimate:** Temperature, humidity, light intensity recorded in the field; light absorbance through plastics measured at monthly intervals in the lab

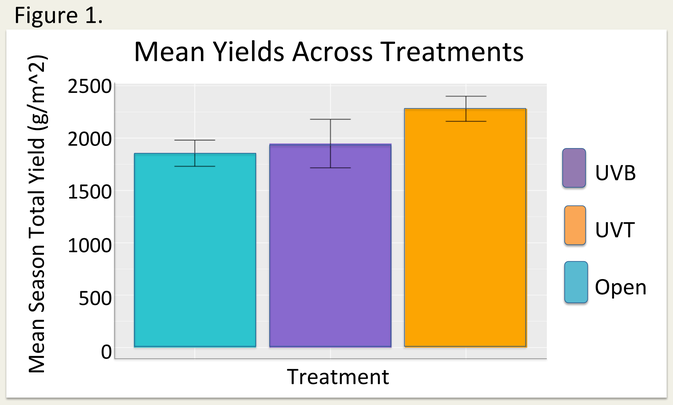
HOBO Onset RX3000 Remote Weather Station with sensors



"Nanodrop 2000" Spectrophotometer

Results

Figure 1.



A one-way ANOVA of cumulative (season total) yield as function of treatment revealed no significant variation (p=0.222) (Figure 1).

A one-way ANOVA of proportion marketable yield as function of treatment revealed significant variation (p=3.52e-07) (Table 1).

Table 1.

Treatment	Mean proportion marketable fruit
UVT	0.708 a
UVB	0.553 b
Open	0.427 c

A nice example of a U.S. No. 1 grade berry

Minimum and average temperature, humidity and light intensity did not vary significantly among treatments, but maximum levels did. Figure 2 compares trend lines for mean weekly high and mean weekly low temperatures recorded throughout the season.

Figure 2.

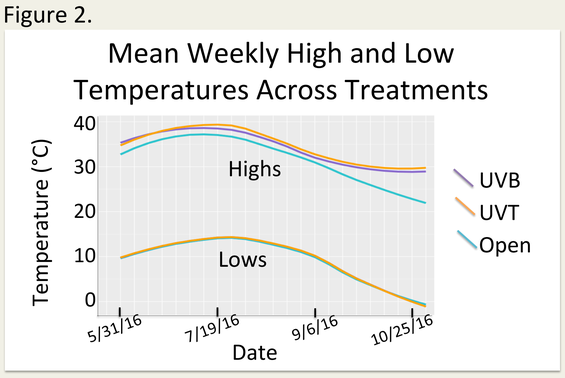
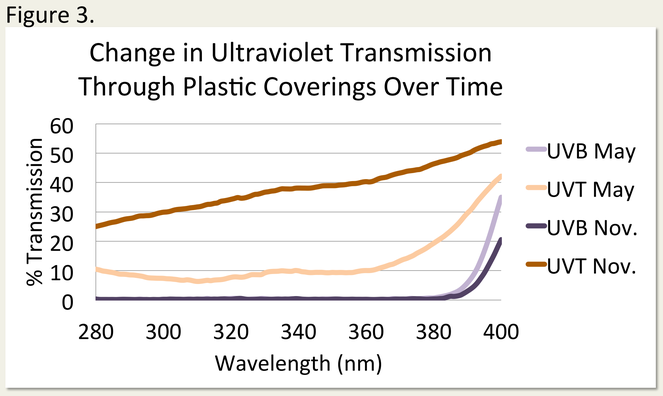


Figure 3.



The UVT plastic material changed significantly over the course of the season (Figure 3).

Table 2.

Treatment	*T. Urticae* mean score
Open	0.326 a
UVB	0.277 ab
UVT	0.185 b

T. urticae presence varied significantly among treatments (Table 2), but *L. lineolaris* numbers did not.

Conclusion

We conclude that covering strawberries with an ultraviolet-transmitting material is better than either leaving them uncovered or using an ultraviolet-blocking material. The UVT treatment in this study resulted in the best fruit and the lowest levels of *T. urticae.* Subsequent studies will examine more aspects of fruit quality and the effectiveness of different organic biopesticides under various low tunnel coverings.

Acknowledgements

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References: Freeman, S., and N. Gnayem. 2005. Use of plasticulture for strawberry plant production. *Small Fruits Review.* 4(1): 21-32.
Martin, E., and E. Tepe, eds. 2014. Cold climate strawberry farming. Department of Horticultural Science e-book, University of Minnesota, St. Paul, MN.