ORGANIC FARMING RESEARCH FOUNDATION

Project Report Summary

MANAGING INSECT-VECTORED DISEASES IN ORGANIC TUNNEL PRODUCTION

P.O. Box 440 Santa Cruz, California 95061 (831) 426-6606 info@ofrf.org www.ofrf.org

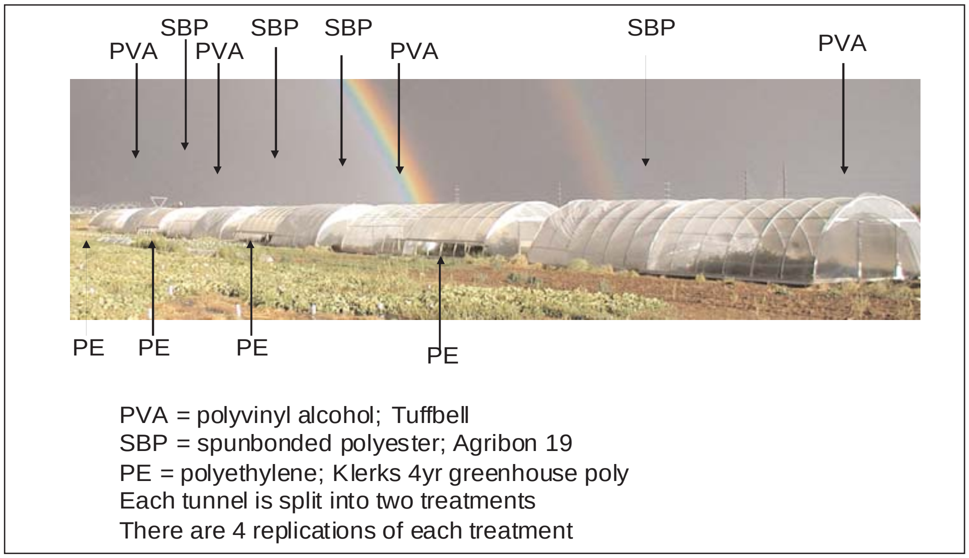
Evaluation of screened high tunnels for production of organic vegetables in Colorado

During the summers of 2006 and 2007, we evaluated four different high tunnel coverings to see if we could reduce the incidence of insect-vectored diseases by excluding insects from the crops. We were also interested in how these different coverings would hold up under our weather conditions, and if there would be differences in the micro-climate within the tunnels that would impact commonly grown vegetable crops.

In Colorado, the most common and problematic disease vectors on organic crops include:

- **Western flower thrips**, which vectors tomato spotted wilt on tomatoes (as well as a number of other diseases to other crops);
- **Potato psyllid**, which is responsible for psyllid yellows on solanaceous crops;
- **Beet leaf hopper**, which vectors curly top virus; and
- **Striped cucumber beetle**, which causes direct damage and also vectors bacterial wilt to cucurbit crops.

High tunnels are commonly covered with polyethylene (PE) glazing which requires ventilation—generally side walls are rolled up and end walls are opened or removed, which allows free entry of insect pests. Exclusion of insects in high tunnels has not been adopted because of the relatively high cost of greenhouse insect screening. Floating row cover materials (breathable spun-bonded polypropylene) may offer an inexpensive alternative (~$30 for a 6X15m tunnel) which would offer insect exclusion and environmental protection with the added advantage of not requiring the daily if not hourly ventilation adjustment required of poly-covered high tunnels.



Above: 2006 high tunnel treatments. Each treatment consisted of a ½ tunnel covered with either polyvinyl alcohol (PVA), spunbonded polyester (SBP), or polyethylene (PE).

Objectives

In this project we proposed to evaluate the utility and performance of two types of floating row cover materials when applied to high tunnels, and compare these to a conventional PE-covered high tunnel.

We had intended to complete this project in one year, but the migrations of psyllids failed to materialize in 2006, and beet leaf hopper numbers were also very low, so we were unable to compare the severity of insect-vectored disease of unprotected crops with those in the screened tunnels. However, the lack of insect pressure allowed us to make crop growth comparisons under the different treatments without having to factor-in possible insect impact, which was an unexpected benefit. Another useful event was the occurrence of a microburst of very high wind, which put the different covering materials to the test of extreme weather conditions.

Materials and Methods

In 2006, "Frost Guard" tunnels (manufactured by Nexus Greenhouse Corp.), meas-

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Project Notes

Principal investigator: Frank Stonaker, Dept. of Horticulture and Landscape Architecture, Colorado State University, tel. 970-491-7068, email Frank.Stonaker@ColoState.edu

Co-investigator: Whitney Cranshaw, Dept. of Bioagricultural Sciences and Pest Management, CSU

Project location: CSU Horticulture Field Research Center, Ft. Collins, CO (certified organic since 2002)

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uring 48 ft. long, 20 ft. wide, and 9 ft. tall were covered with one of the following:

- **Polyvinyl alcohol** (PVA) (Tufbel);
- **Spun-bonded polypropylene** (SBP) (Agribon19); or
- **8 mil polyethylene greenhouse** (PE) film (Klerk K50) with a conventional roll up side ventilation system.

Each covering represented a treatment, and was replicated four times. Each tunnel was split in half, providing two treatments per tunnel, with a vertical plastic wall between the treatments. Two varieties each of tomato and melon and one variety of spinach were grown.

In 2007 much of this same work was repeated. Materials which failed to withstand high wind in 2006 were replaced with more durable **LS Econet** insect screening in spite of its higher cost. Each treatment consisted of an entire tunnel covered with either insect screening or PE. Cropping treatments consisted of tomato, cucumber and salad mix (lettuce, arugula and mizuna).

Key Results 2006

Covering performance; durability and tunnel climate:

- SBP performed well until extremely high winds ripped the material.
- PVA performed well until stitched seams broke down, presumably from UV degradation of the thread used for sewing the seams.
- Tunnel microclimates were hotter and more humid than ambient conditions and resulted in comparable or better production than field production, but there was very similar production between the treatments.
- Vegetative growth was greatest in the SBP treatment.

Crop production:

- Tunnel production results were all comparable or better than field production of the same cultivars; better product quality was especially evident in the greens and spinach due to reduced pressure from flea beetles.
- Even with high daytime temperatures, spinach performed well in all of the treatments.
- Relatively low melon production was surmised to be a result of reduced pollinator presence in the SBP and PVA treatments, however pollinators managed to find their way into these tunnels even though they appeared to be well enclosed.

Key Results 2007

Insect exclusion:

- Successful exclusion of psyllids from the screened houses, and very rapid population increases and subsequent crop decline from psyllid yellows in the open ventilated PE covered tunnels, proved the efficacy of the screened tunnels in excluding psyllids.
- Beet leaf hoppers and thrips failed to present problems in any of the treatments, but were not especially abundant in 2007.
- Flea beetle damage to the salad crops was low in the screened tunnels, and high in the PE tunnels.

Covering performance; durability and tunnel climate:

- Microclimatic differences between the screened and PE treatments were measurable, but did not result in yield or quality differences.
- The durability of the LS Econet screen was excellent, holding up well to high wind and light hail.

Crop production:

- Crop production between treatments was not different, however the quality and earliness of peppers and tomatoes was enhanced in tunnels over field production at the same site.

Above: Melons and tomatoes in spun-bonded polypropylene (SBP) covered tunnel

Discussion

Amortized costs of tunnels with any of the coverings are very similar, and so performance of the material should be the guide for determining which cover to use. The marginal yield advantages and lower amortized costs of PE suggest that PE coverings will offer the grower a marginally better return, however this should be weighed against potential disease mitigation insurance offered by insect screening. In areas with predictable infestations of disease vectoring insects, the marginal cost advantage of PE would quickly be lost. Consideration of labor requirements for installation or replacement of short lived covering materials should also be considered, suggesting that LS Econet or PVA, both of which are presumed to last several years, may be better choices. ❧

Amortized cost of tunnels with PE, PVA, SBP or LS Econet coverings.

	Cost of covering materials			Cost of structure			
Covering material	Initial cost ft/sq	expected life, years	amortized cost/yr	structural cost	expected life, years	amortized cost/yr	total cost of tunnel yr/sq ft
4-yr greenhouse PE	$0.15	4	$0.04	$1.78	10	$0.18	$0.22
PVA	$0.23	3	$0.08	$1.78	10	$0.18	$0.25
SBP	$0.02	1	$0.02	$1.78	10	$0.18	$0.20
LS Econet	$0.50	5	$0.10	$1.78	10	$0.18	$0.28