

Title: Photoperiod Manipulations to Optimize Early Season Fruit Production with a Short Day Strawberry Cultivar in High Tunnels

Progress Report

Grant Code SRSFC-2009-11

Research

Principal Investigator:

E. Barclay Poling
Department of Horticultural Science
Kilgore Hall 252
NCSU Campus Box 7609
Raleigh, NC 27695-7609
E-Mail: barclay_poling@ncsu.edu

Objectives:

The overall objective is to evaluate promising propagation strategies for conditioning the short day strawberry cultivar, 'Strawberry Festival,' for higher yields in the late fall and early winter in the high tunnel system. Specifically:

1. Evaluate transplants of 'Strawberry Festival' from 3 locations (1. Upper Mountain Research Station, Laurel Springs, NC; 2. Appalachian Fruit Research Station, Kearneysville, WV; and 3. Prince Edward Island, Canada),
2. Evaluate long photoperiod conditioning treatments with reduced red light (less than 700 nm), for plant material from Kearneysville, WV (Takeda),
3. Evaluate short photoperiods (< 12 hr) for plant material from Canada and NC,
4. And, determine the potential economic benefits of using specially conditioned containerized transplants of 'Strawberry Festival' compared to non-conditioned plant material.

Justification and Description:

As has been identified to the SRSRC in a related proposal, "*Estimated Costs and Returns of Producing, Harvesting and Marketing*," (Safley, Ballington, Poling and Pattison), there is increasing interest in meeting the "off-season" market demand for locally produced fresh strawberries using high tunnels in our region. But, the economic potential of high tunnel strawberry production in the southeastern US is going to depend on: 1) plant yields and distribution of these yields from late fall to early spring, 2) market prices for fresh tunnel strawberries from late fall to early spring; 3) tunnel fixed costs (about \$37,000/acre for Haygrove Tunnels), as well as overhead costs related to specialized equipment (e.g. bed-maker, sprayers, etc.), and 4) the variable costs for growing, harvesting, and marketing strawberries in high tunnels. With the support of the SRSFC,

Dr. Safley is prepared to develop a complete enterprise budget for individuals in our region who are considering high tunnel strawberry production.

This particular proposal is aimed at improving early harvest plant yields in the high tunnel system, and it involves a USDA small fruit researcher, Fumi Takeda, who has had considerable experience in propagating and manipulating containerized plants (plugs) for higher early season yield potential in the Mid-Atlantic region, where prices can be very attractive for off-season strawberries.

In North Carolina, it is our belief that prices for high quality tunnel fruit may approach \$3/lb (\$24/flat), or more, in early November through mid-January. But, prices typically fall in mid-to-late January as volumes of berries from Florida begin to increase. And, by late February and early March, wholesale prices can drop below \$1.25/lb (\$10/flat), depending on the season and weather conditions in Florida and Southern California. Thus, there are clear market and financial incentives for growers to find ways to optimize early yields in the late fall and winter, and in this study we hope to identify a propagation protocol that would allow growers to economically produce at least 0.80-1.0 lb/plant over the period from early November through mid-January in an unheated high tunnel.

Promising new research by Dr. Takeda, which will soon appear in *HortScience*, has shown that early July-plugged transplants of short-day cv. Strawberry Festival can flower in October and November, although they were grown under long photoperiods and warm temperatures (greater than 70 F) in July and August. These unexpected results were attributed to a high plant density that provided continuous and heavy leaf cover, which eliminated red light (less than 700 nm) from reaching the crowns, and it is his belief that the shift in red light relative to far-red light within a canopy of strawberry transplants appears to play a role in controlling flower bud induction. Thus, his plants started as plug plants in early July (in Kearneysville, WV) under a high ratio of far-red light to visible light appear to have a capacity for significantly earlier fall and early winter harvest in a high tunnel system.

Poling and Schiavone, in cooperation with a nursery in PEI Canada, conducted a preliminary trial in 2007-2008 with 'Strawberry Festival' plugs that had artificially shortened photoperiods, and this work is being repeated once again in fall-winter of 2008-2009. Essentially, black cloth is being pulled over the plug trays starting in the 3rd week of plug propagation (in PEI) to reduce the photoperiod to approximately 12 hours in length, and this is done for 2 weeks. The conditioned plugs are then ready for transplanting in the tunnel by mid-September. The hypothesis is that they will produce a higher percentage of their total crop in the months of November, December and early January than non-conditioned plugs from PEI, and potentially more than 1 lb/plant can be produced in the late fall and early winter with these plants vs. less than ½ lb/plant for non-conditioned material of the same cultivar (unpublished data from 2007-2008).

A third option under investigation in Salisbury, NC, for the 2008-2009 high tunnel season, involves a similar protocol to the PEI grown plugs, but the actual propagation (and photoperiod manipulation) was carried out at a high elevation location in Western,

NC (Laurel Springs), for comparison to PEI plant material. We have no previous experience with conditioned plugs from this high elevation area in the upper northwestern section of state, but we are inclined to believe they will be just as effective as PEI conditioned plants, and this production area is only a few hours away from Salisbury (close to Charlotte, NC) vs. 18 hrs from Prince Edward Isle.

For this proposal to the SRSRC (which applies to the 2009-2010 tunnel season), we have designated one of the Haygrove tunnels in Salisbury that is 3,750 sq. ft (150 x 25 ft). The 25 ft width allows 4 rows per tunnel (5 ft center), and with double-row setting at 12 inches in-the-row, we can plant up to 1200 plants in this tunnel. In a randomized complete block design with 4 replications, we propose to evaluate:

1. July plugged 'Strawberry Festival' plants that are grown in Kearneysville, WV (by Dr. Takeda) under a high ratio of far-red light to visible light reaching the crown (200 plants)
2. July plugged 'Strawberry Festival' plants grown outdoors under natural light in Kearneysville (200 plants), and both No. 1 and No. 2 will be set in mid-August (in Salisbury).
3. Artificially shortened photoperiod plugs of 'Strawberry Festival' will be grown in summer 2009 in PEI, and transplanted in mid-September in Salisbury (200 plants)
4. Natural condition plugs of 'Strawberry Festival' will be grown in summer 2009 in PEI, and transplanted in mid-September in Salisbury (200 plants)
5. Artificially shortened photoperiod plugs of 'Strawberry Festival' will be grown in summer 2009 in Laurel Springs, NC, and transplanted in mid-September in Salisbury (200 plants)
6. Natural condition plugs of 'Strawberry Festival' will be grown in summer 2009 in Laurel Springs, NC, and transplanted in mid-September in Salisbury (200 plants)

This trial will be harvested from late-October 2009 through early May 2010. This data will also be made available to Dr. Safley and his graduate student for a partial budget analysis that will help us determine whether the additional costs associated with propagating conditioned transplants is justified.

Results:

There are no results to report at this time as a result of an unforeseen problem with very limited space in the existing high tunnel facility at the Piedmont Research Station (Salisbury, NC). Consequently, a no-cost extension for SRSFC Research Project 2009-11 was requested, and on December 18, 2009 we were informed that an extension until December 31, 2010 has been granted. A full report will be given to the SRSFC upon conclusion of this project in May 2011 (the trial will be planted in mid-September 2010, and harvest completion is anticipated in May 2011).

The following activities were conducted to satisfy the grant objectives:

Through a recent grant submitted to the NC Tobacco Trust Foundation Commission in November 2009, we anticipate getting funds to add critically needed high tunnel research

space at the Piedmont Research Station by June of 2010 (the planting of this particular research trial will be in mid-September). We will advise the Coordinator of the SRSFC of our progress next spring with the NC TTFC (award announcement will be made in May 2010). If the TTFC grant does not come through, our back-up plan is to dedicate the one tunnel of the original Haygrove Tunnel facility at Piedmont Research Station (built in July 2006) to this project.

Conclusions:

No conclusions can be drawn at this time

Impact statement:

No impact statement can be drawn at this time

Citations:

No citations exist at this time.