

Progress Report to the Southern Region Small Fruits Consortium

Evaluating Protected Culture for Season Extension in Small Fruits

Research Report SRSFC Project 2006-11

Principle Investigators:

Jeremy A. Pattison
Virginia Tech, Southern Piedmont AREC
2375 Darvills Road
Blackstone, VA 23824
Tel: 434-292-5331 Fax: 434-292-5623
E-mail: jpfruit@vt.edu

Tony K. Wolf
AHS AREC
Virginia Tech, 595 Laurel Grove Rd
Winchester VA 22602
Tel: 540-869-2560 Fax: 540-869-0862
E-mail: vitis@vt.edu

Objective:

To optimize production practices under protected culture to provide season extension and increased fruit quality for strawberries and brambles.

Justification:

Strawberry production in the southeastern and mid-Atlantic United States primarily uses the annual hill plastic mulch system known as plasticulture. Several advantages of this cultural system include: earlier and longer harvests, cleaner fruit, and increased quality and yields. Under the growing conditions found in the Southeastern US, the majority of the field season suitable for strawberry production is utilized. However, despite the increased seasonal pattern that plasticulture provides, the harvest season is relatively short compared to other major strawberry producing regions of the country.

Protected fruit production is routine in many European countries because of the advantages associated with earlier fruit and higher marketable yields, and in the case of containerized cultural systems, elimination of soil fumigation. Here we are defining the off-season to include the **fall** as well as **early spring**. Fall fruit is not a traditional season for strawberries in this region despite the presence of optimum climate during this time of the year. Production research has focused on optimizing spring yields and great progress has been made over the past 20 years. The demonstrated success of protected culture in other areas of the world has opened new possibilities for production research in the southeastern US. Holiday fruit (thanksgiving and possibly Christmas) should allow for the development of a viable local market outlet for high-valued, off season fruit. We are currently thrusting forward to define optimum production practices to assess the potential of expanding strawberry production to the fall and early spring.

Materials and Methods:

Two locations were chosen for studying protected in the 2006-07 season to represent diverse growing conditions that can be found across the state. The Southern Piedmont AREC is located in Blackstone, VA (37.06N -78.01W, 394' above sea level and USDA hardiness zone 7a). The Alson H. Smith jr. AREC is located in Winchester VA (39.18N -78.18W, 800 ft elevation and USDA hardiness zone 6b).

Southern Piedmont AREC (2005-06)

During the fall of 2005, a pilot study was initiated to evaluate cultivar performance grown in an unheated poly-greenhouse (Figure 1). Plug plants of 4 cultivars (Table 1) were propagated by rooting strawberry tips in soil-less media under intermittent mist. Plug plants were transplanted on November 3, 2005 in to soil-less media bags (Figure 1). Water and fertility were supplied using drip irrigation. Plants were over-wintered in the greenhouse without heat. Floating row covers were also used to provide additional protection during cold temperature events. The experiment was a randomized complete block design replicated three times.

Table 1. Cultivars tested in 2005-06 at SPAREC in poly-greenhouse

Cultivar	Field season ^z	Average field yield (lbs/A) ^y
Sweet Charlie	April 7-10	15-20,000
Festival	April 10-14	15-20,000
Camarosa	April 14-17	20-25,000
Chandler	April 17-20	25,000+

^y Typical first picking date at SPAREC

^z Based on yield data from SPAREC



Figure 1. Planting strawberries into soil-less media in a poly-greenhouse. Top left, unheated poly-greenhouse (18' x 24'); upper right, 14 day-old plug plant; lower left and right, planting plugs by hand at 12" in row spacing x 14" between row spacing. Each bag contains 5 plants in a staggered double row.

Southern Piedmont AREC (2006-07)

A multi-bay Haygrove high tunnel was erected during the early spring of 2006. Bays are 24' wide by 200' long. Trials for this season are focusing on cultural comparisons between unprotected field culture to two methods of production inside the high tunnel (conventional ground plasticulture and soil-less culture) (Fig. 2).



Figure 2. Conventional outdoor trial, left; conventional plasticulture in tunnel, center; soil-less culture in tunnel, right.

Plug plants of Camarosa, Chandler and Everest were obtained from commercial nurseries and planted by hand. For the conventional ground plots, both outside and inside the tunnel, rows were 5' on center with a staggered double row of plants set 12" x 14" (17,400 plants/A). Plots were fumigated with methyl bromide (200lbs/A). Soil-less plots inside the tunnel were also on 5' row centers but consisted of a staggered triple row of plants set at 12"x14" (26,000 plants/A) (Fig. 3). Conventional outdoor plots were also established with the same three cultivars including Sweet Charlie, Festival and border plots of Albion. All plot sizes for each trial is 24 plants. Plants were established over three dates (9/15, 9/28 and 10/9). Each trial was set up as a split plot design replicated four times (whole plot is planting date and sub-plot is cultivars).



Figure 3. Plot design for soil-less culture in the high tunnel.

Results:

Southern Piedmont AREC (2005-06)

The winter of 2005-06 was mild with a brief cold period during December. All plants survived well without supplemental heat. The greenhouse temperature was moderated over the winter to control for excessive heating due to solar radiation using a thermostat controlled venting fan set at 60°F. Plants never went fully dormant and continued to produce additional leaves and branch crowns. Flowering began in late February for Sweet Charlie and early March for Camarosa and Chandler. By early to mid-April, most of the plants were at 75% bloom, which is 3-5 weeks ahead of field season depending on the year for this location. A floating row cover (1.2 oz/yd²) was used as frost control during bloom.

Harvest began on 3/11/06 with Sweet Charlie and continued to May 11, 2006 when fruit size had begun to decrease and field picking became the primary focus. Chandler was the highest yielding cultivar (1.36 lbs/plant) and Sweet Charlie was the lowest (0.96lb/plant) (Table 3.). This is consistent with previous results obtained from field ranking. Average fruit size ranged from 18 to 14 grams (Table 3), which is slightly less than what is observed in the field. Sweet Charlie had the highest percentage of marketable fruit followed by Festival, Chandler and Camarosa (Table 3).

Table 2. Percent flowering for the test cultivars in early spring 2006.

Cultivar	Date	% Bloom
Sweet Charlie	3/16/06	25
Festival	"	25
Camarosa	"	15
Chandler	"	15
Sweet Charlie	3/28/06	60
Festival	"	50
Camarosa	"	50
Chandler	"	50
Sweet Charlie	4/11/06	80
Festival	"	75
Camarosa	"	70
Chandler	"	85

Table 3. 2006 Yield data for greenhouse grown strawberries.

Cultivar	Total Yield (lbs/plant)	Berry size(g)	%marketable
Chandler	1.36	15	83
Festival	1.12	18	86
Camarosa	1	16	81
Sweet Charlie	0.96	14	88

Southern Piedmont AREC (2006-07):

We have observed moderate flowering in both the day-neutral and short day strawberry cultivars in the soil-less plots during the fall of 2006 for the early planting date (Table 1.). However, runner production was excessive for Chandler plots planted on 9/15. Frost

has been moderated by the high tunnel in combination with floating row covers. This pattern will continue for an expected harvest in early December.

Table 1. Mean number of runners, flowers and fruit on Nov. 20 for Chandler, Camarosa and Everest planted on three planting dates in the fall of 2006 in soil-less high tunnel plots.

Cultivar	Planting date	# runners ^z	# Plants flowering ^z	# open blooms ^y	#green fruit ^z
Chandler	9/15	174	10.3	10.8	4.3
	9/28	36	2	1.5	0
	10/9	1	0	0	0
Camarosa	9/15	4	8	11.5	3
	9/28	5	8	7.5	0
	10/9	5	1	0.8	0
Everest	9/15	0	20	19.3	16.3
	9/28	0	23	22	8.5
	10/9	0	5.3	4	0.5

^z represents the average of 4 replicate plots (24 plants/rep)

^y represents the average of a sub-sample of 4 replicate plots (12 plants/rep)

Flowering in the conventional protected and outdoor plots has been mostly limited to the day neutrals (Everest and Albion) with very few short day cultivars having emerged flower buds. Sweet Charlie plots planted on the first date are beginning to bloom with some flowers also being produced by Festival in the outdoor trial. In all later dates, Everest and Albion are the only cultivars producing flowers. Despite flower production on the outdoor plots, frost has eliminated nearly all blooms and green fruit. Vegetative growth has mostly consisted of canopy and branch crown development with very little runner production across all cultivars and planting dates. Albion is the only exception and has produced moderate runners in plots planted on 9/15 and 9/28 (data not shown) Row covers will be applied to this trial to be used as winter protection and removed late winter/early spring when new growth begins.

Alson H. Smith AREC (2006-07):

Strawberry plots were established using the same technologies as in SPAREC, however, a standard hoop house (30'x90') is being used as protection. Sweet Charlie and Chandler are the two cultivars being evaluated in replicated tests both in outdoor conventional ground culture and indoor soil-less culture. Plants were established over three dates. The experiment was set up as a split plot design replicated six times.

Discussion-

The results from the 2005-06 season were promising and showed that strawberry bloom and harvest in hoop house structures can be advanced 4 weeks compared to field culture. Yields were slightly less than field averages for this area, although the planting date was late.

We have learned from the 2006-07 trials that planting will need to be significantly earlier than September 15 for a harvest around thanksgiving. Other day neutral cultivars will likely need to be evaluated to determine the potential range of harvest period for the fall

period and also for the spring. Fruit yield and quality will be measured for all cultivars, environments within a location and also across locations.

We had proposed to include brambles for the 2006 research trials, however planting material was unavailable. Furthermore, space is limited in this structure and it has been determined to keep the focus on strawberries in the short term and introduce brambles at a later date.