



Looking inside high tunnel with ChromatiNets + aluminum mulched beds just before planting in Sept 2007



High tunnel covered with red, yellow and pearl ChromatiNets at Charleston SC

**Title: Enhancing the Productivity and Fruit Quality
of Forced Strawberries through Manipulation of Light Quality in High Tunnels.**

Progress Report
Grant Code ie SRSFC Project # 2007-07
Research Proposal

Robert J. Dufault
Clemson University Coastal Research + Education Center,
2700 Savannah Hwy, Charleston, SC 29414
Bdfit@clermson.edu

Proposal Category: Research

Proposal Status: Previously funded by SRSFC: has been funded for one year

Objective: To investigate season extension and forcing fall/winter strawberries in high tunnels with photosensitive nets (ChromatiNets) for the Thanksgiving through New Year's holiday season.

Justification: In the U.S. from November through February, there is a lucrative market for strawberries since domestic supply is low and demand is high. During this time, unit price for strawberries is at its highest point during the year. Forced strawberry yields in fall/winter are far lower than traditional spring harvests and increasing forced yields would provide greater profitability.

Environmental manipulation provides a viable choice for crop improvement. Physiological processes from seedling emergence to fruit production depend on both light quantity and quality. Information on the effect of light quality is minimal, since light quality alteration is difficult under field conditions. Strawberry growth and productivity are dependent on photosynthesis. The use of filters to change spectral distribution of the natural sunlight may directly influence photosynthesis by changing light absorption and/or the quantum yield of photosynthesis. Previous published studies of light quality on strawberry growth and flowering showed decreasing far red to red ratio promoted flowering, while blue and far red light enrichment delayed flowering and stimulated stolon development. New technology has been developed to enrich the light environment in the field. ChromatiNets® were developed by the Israelites (distributed by Polysack, Inc, San Diego, CA) and are a series of colored nets with special optical properties which improve the utilization of solar radiation by agricultural crops. ChromatiNets® enable growers (especially with ornamentals) to control growth, such as leaf size, branch length and plant height in plants, as well as the rate of maturation and flowering. These nets manipulate light quality, composition, and scatter light throughout the plant canopy; the transmitted light is composed of a mixture of natural, unmodified light passing through holes and spectrally-modified light passing through threads. These nets are available in a variety of colors and shading intensities for use during the heat of summer (highest shading) or in winter (lowest shading). Israeli

scientists have worked with these nets on many ornamental and tree fruit crops. Based on previous work with other crops, the following are general and potential plant growth modifications due to the ChromatiNets: Yellow nets - increase only vegetation, Pearl nets - increase branching, Red nets - increase vegetation and fruiting, Blue nets – increase dwarfing.



ChromatiNets used in Israel (courtesy of Yosepha Shahak, Israel)

Methodology: *The research proposed is still in progress.* Presently, in the 1st year of research in 2007-2008 forcing season, I am evaluating Yellow, Pearl, and Red nets. These nets have the best advantage to enhance growth. Blue nets increase dwarfing and I feel would not enhance strawberry growth in our application.

The goal of the 1st year's work is to determine the advantage of ChromatiNets on strawberry yield performance as a forced fall/winter crop. A high tunnel (≈96 feet x 24 feet x 10 feet) located at the Charleston Experiment Station was prepared for the strawberry work. By June 29, 2007, the entire ground surface in the high tunnel was covered with drip tubing and then clear plastic. The high tunnel was sealed closed till Sept 1st to solarize the soil and to kill weed seed and pathogens (done in lieu of methyl bromide fumigation). Irrigation was added periodically to increase a steaming action.

Virus free strawberry daughter tips grown by a Canadian grower, were grown as plugs in our greenhouses using common plug production technology. Daughter tips were planted in the greenhouse plug trays on July 27. On Aug 24th, the plugs were artificially conditioned until Sep 12th in a walk-in growth chamber to shift plants from vegetative to reproductive state. The conditioning treatment exposed the plugs to a 12-hr day/night cycle with a 24°C day/12°C. The soil in the high tunnel was fertilized with about 600 lbs 10-10-10/acre and rototilled. Drip tubing was placed between each row and the beds were covered with aluminum mulch. Three photosensitive ChromatiNets, Red, Yellow, and Pearl (24% shade factor-lowest intensity possible) are in use at present (see top of 1st page). An unnetted control plot is included. The high tunnel was covered with 24 foot wide ribbons of the ChromatiNets, leaving about 4 feet distance between nets as well as an uncover, non-netted portion of the tunnel for a control. Plugs were planted Sept. 12 and spaced 12 inches apart in rows with 18 inches between rows. There are 6 rows planted in the high tunnel with a 4 foot walkway in the middle. We also planted conditioned and unconditioned plants outside beside the high tunnel on a mulched, drip-irrigated bed for comparison. Standard strawberry production practices are used.

High tunnels are vented to maintain day temperatures in the range of 25 to 30°C. Air temperatures inside and outside tunnels are monitored. Data collection includes counting and removing daughter plants within each light treatment area by each row. Since our target market starts near the Thanksgiving holiday, we encourage vegetative growth with weekly fertigation. Surprisingly, our harvest season began before Halloween this year and at this progress report writing, we are still in the midst of the first year's heaviest harvest. We are harvesting berries twice weekly and graded according to quality standards. We are also taking subsamples and recording refractometer readings to judge berry sugar levels.

Harvests will continue through the winter until early-January when the high tunnel will be opened and plants allowed to acclimatize to ambient temperatures. Normal spring berry production will commence about mid-March 2008 and all plots will be harvested to determine residual bonus spring production. Yield data will include days to harvest, fruit yield (fresh weight and numbers of marketable and cull berries at each harvest and total yield) and total soluble solids. The first year's

work will not be completed until approximately April, 2008 after spring harvests when a full report will be more appropriate at that point. At this point, our results are too premature to show treatment effects yet (Nov. 16 2007) and conclusions and an impact statement are also premature.



High tunnel with Chromatinets on Nov. 9, 2007 (foreground to background – include Red, Yellow, Pearl Chromatinets with “no net” control in far background)