High Tunnel Hanging Baskets, 2010
A Partnership grant funded by NESARE

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Introduction

High tunnels offer a vertical production environment that is often not fully utilized. Hanging baskets of petunias were selected by the Principal Investigator and cooperating farmer as a trial crop for economic evaluation due to their ability to 'harvest' sunlight while, potentially not interfering with the production of other tunnel crops grown below. The production of hanging baskets in an unheated high tunnel also would represent a dramatic decrease in fuel inputs compared to a heated greenhouse for hanging baskets. Risks include the shading of an in-ground tomato crop and spread of insects and diseases between the flowers and vegetables. Although research from 2009 showed a net positive impact of the baskets on tunnel economic performance, tomato yields were decreased. In 2010 the project team repeated the research with an additional lower density treatment and collected light intensity data.

Materials and Methods

Multiple colors of 'Shock Wave Petunias' (Ball Seed Company, Chicago, Ill) were seeded on February 16 (pelleted seed) in a commercial potting mix (Promix, Premier Horticulture, Quebec). These were subsequently transplanted to 48-cell transplant flats at the 2-leaf true stage on March 12. A final transplant took place on April 12, when 4 plants per 12-inch hanging basket were transplanted and hung on the hoop-cross pieces of a 20 by 240-foot unheated high tunnel. Baskets were hung in two blocks of densities of 16 square feet per basket and 32 square feet per basket. A 24 x 20' portion of the tunnel was left without baskets as a control. Irrigation was accomplished with drip emitters, fertigation twice per week with 20-20-20 plus micronutrients (Millers Nutri-Leaf Greenhouse Grade) at 150-200 ppm Nitrogen, plus phosphoric acid sufficient to achieve irrigation water pH of 6.2, per grower standards.

Seeds of BHN 589 tomatoes (obtained from Sieger's Seeds) were also seeded on February 16 and subsequently transplanted to a 3-inch pot once foliage from adjoining plants began to shade each other on March 2. Tomatoes were then transplanted on April 12 into the tunnel soil, a Lima silt loam soil (pH 6.6), with 5 blocks of 8 plants each randomized under the two different blocks of baskets (16sq ft spacing and 32 sq ft) baskets and 5 blocks of 8 plants each randomized without any overhead baskets. Black plastic mulch and drip tape (Chapin Watermatics, 1.0 GPM/100', 4-inch emitter spacing) were laid prior to transplanting. Plants were irrigated as needed and fertilized with 12-48-8, 20-20-20 and 9-15-30 plus micronutrients at a rate of 100-200 ppm N throughout the season, per grower practice.

Petunia baskets were 'pinched' one time on April 22 to promote branching. A Cornell Vegetable Program Technician scouted weekly for pests and diseases. Baskets were removed from the tunnel over a 4-week period beginning in early May with all sold by the end of the month. Price data was collected for all baskets sold at the Finger Lakes Produce Auction (Penn Yan, NY). Tomatoes were harvested multiple times per week

from June 23 to October 22. Total weight of fruit per block was recorded at each harvest. Data were analyzed using statistical software Analysis of Variance (ANOVA) procedure, and treatment means (baskets vs. no-baskets) were separated using Fisher's Least Significant Difference ($p<0.05$). Photosynthetic Active Radiation (PAR) was collected in micromols of photons per meters squared per second (μmol m-2 s-1) with a photon flux quantum meter (Apogee Instruments, model MQ 100) from 1 random flagged location in under the baskets in each block, as well as the control and outside of the high tunnel, on April 16 and April 23 at approximately 10 AM, 1 PM and 4 PM. Thereafter the same PAR data was collected weekly at 4 flagged locations per treatment and control (12 readings per block per day). Mean PAR readings were created for each day measurements were taken and data were analyzed using statistical software Analysis of Variance (ANOVA) procedure. Treatment means were separated using Fisher's Least Significant Difference ($p<0.05$).

Results

Tomatoes grown without any baskets overhead (control) gave a mean yield of 24.63 lbs per plant compared to 24.18 lbs per plant for those with a low density of baskets and 25.08 lbs per plant under the high density of petunia hanging baskets. These differences were not significantly different (chart 1). The Baskets received an average price of $8.09 at wholesale auction (chart 2). There were no recorded insect or disease issues on either crop.

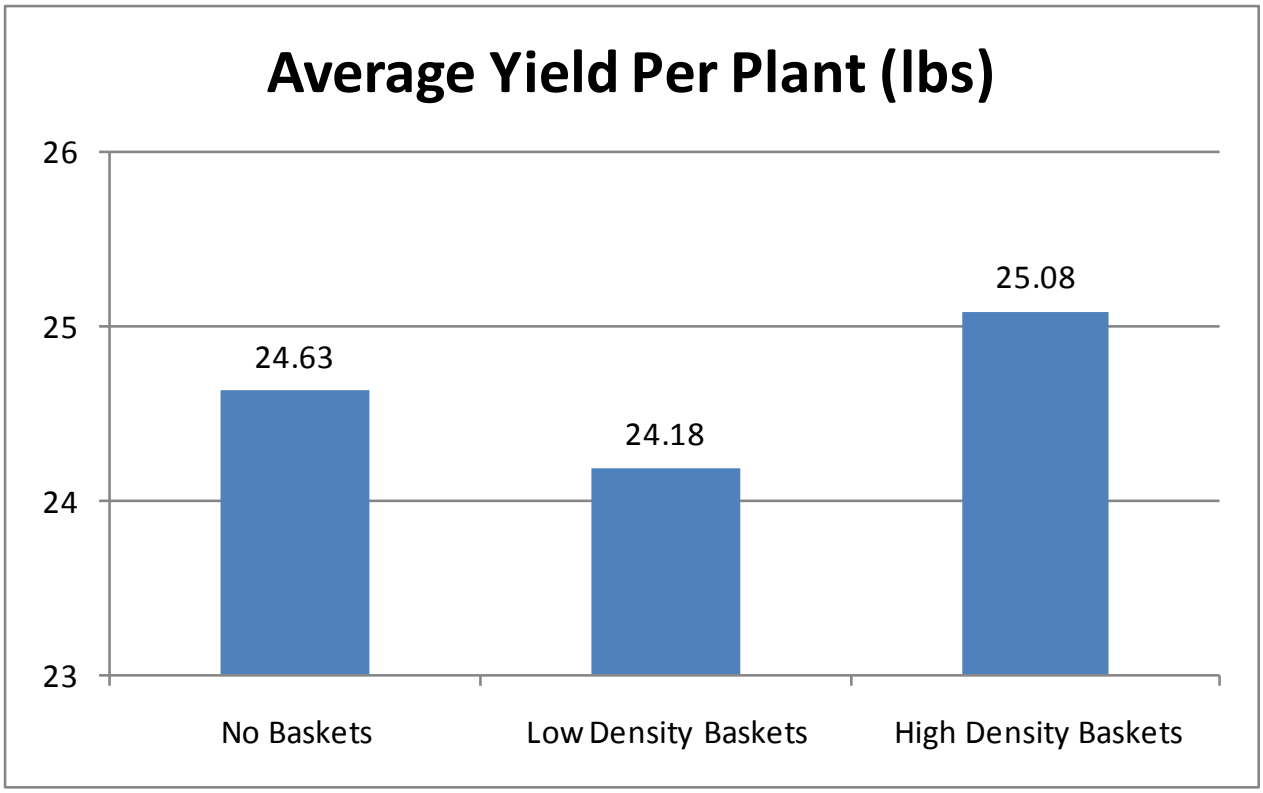

Chart 1. Tomatoes yields under different densities of hanging baskets.

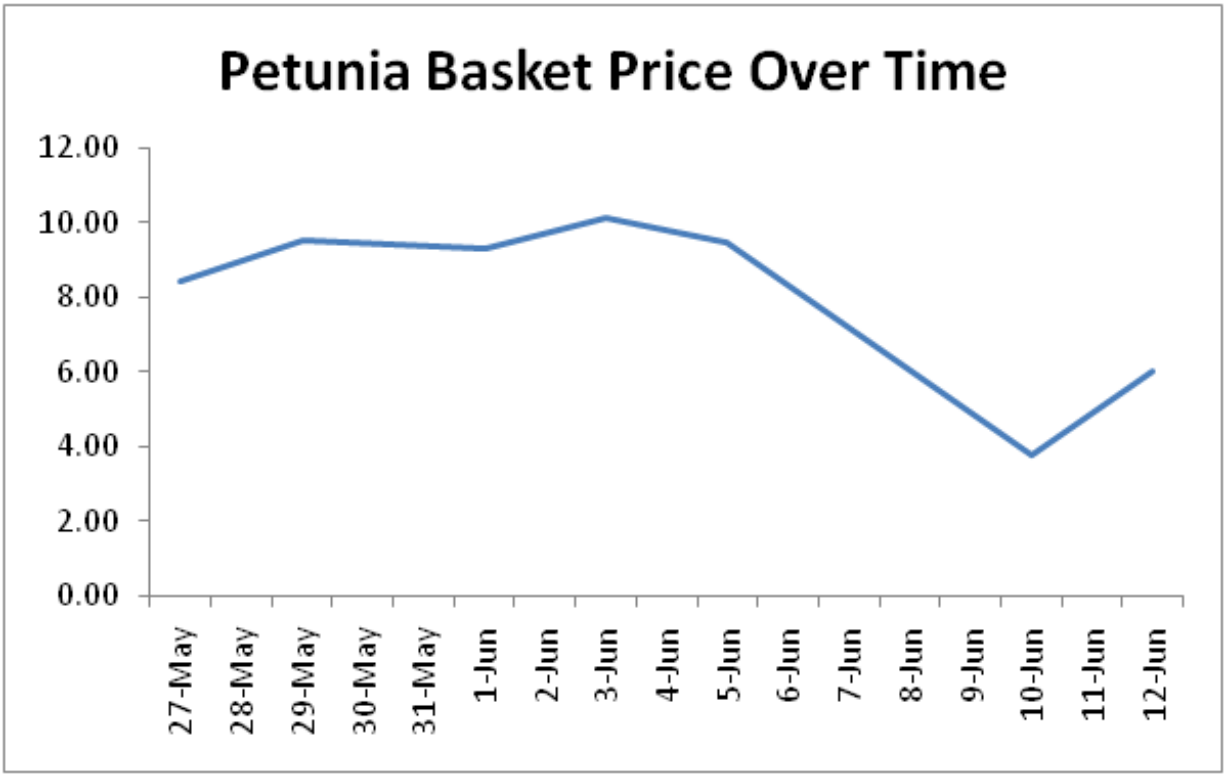

Chart 2. Wholesale prices of baskets grown without supplemental heat.

Economic/Labor inputs
Total labor for the project was calculated and applied a nominal labor rate of $10.00/hour (Table 1).The cooperating grower then estimated a $4.59 input cost per basket (Table 2).

Table 1. Labor estimate per 12" basket.

Task	Hours	Cost (in dollars)
Seeding	1	10
Transplant	2	20
Transplant	2	20
Potting-up and hanging baskets/removal	3.5	35.00
Irrigation set-up	2	20
Pinching/weekly maintenance	5	50
Total	*15.5*	*155*

Table 2. Input costs per 12" hanging basket.

Expense	Cost (in dollars) per 12” basket
Seed	0.64
Potting soil	0.89
Basket	1.09
Fertilizer/acid	0.08
Irrigation water	0.01
Transplant (GH cost)	0.58
Labor (per table 1)	1.3
Total	4.59

Discussion
In this trial hanging baskets above high tunnel tomatoes did not reduce tomato yield, although they did in a 2009 trial. The baskets themselves performed well economically with a wholesale gross of 8.09 per basket, netting $3.50/basket (after expenses are deducted). Hanging petunia baskets would give a net return of $525 per tunnel, if the tunnel were planted uniformly at a density of 32 sq ft per basket (75 baskets in 4800 sq ft). At the high density planting, of 16 sq ft per basket, the net return increases to $1050 for the tunnel. It should be noted the grower reported a higher price for retail markets of 13.75 per basket. This would dramatically improve economic performance, yet these markets have additional marketing expenses and may not sustain the same volume of sales as the wholesale auction.

It should be noted that a similar trial in 2009 decreased tomato yields which when entered into the economic analysis brought the net return per basket to $0.73. At this low return, the system appears marginally profitable, yet increases the risk of insect and/or disease transmission from petunias to tomatoes. These include thrips, aphids, Tomato Spotted Wilt Virus, Botrytis Gray Mold and others. We highly recommend that growers

considering this system start all their own petunia and tomato seeds on-farm to avoid importing the many pests and disease common to greenhouse flowers. We cannot recommend this multi-story approach to growers new to high tunnels as the management demand is high.

Conclusion

Growing petunia baskets over an in-ground high tunnel crop was a profitable enterprise for the cooperating farm in 2010. Benefits include net economic gains as well as sales early in the growing season. Heat inputs for the flowers were constrained to the seedling production representing a decrease in fuel inputs. Caution is warranted as a 2009 trial did negatively impact tomato yields, and pest threats are significant.

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