

Increasing Small Fruit Production Capacity through Improving Annual Plasticulture Production Systems in Kentucky

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Project Objectives

This project augmented and enhanced ongoing research to improve annual strawberry production in Kentucky in high and low tunnels. Annual plasticulture systems in the open field are the industry standard for strawberry fruit production in the largest strawberry producing states (e.g. California, Florida, etc.). In these climates, very moderate cool season temperatures allow for strawberries to grow and fruit in a single year. In Kentucky and other temperate climates, perennial, matted row systems are the commercial standard. However, season extension techniques have been adopted by Kentucky producers to produce high quality berries with an earlier fruiting window. However, the economic trade-offs of season extension of strawberries has not been evaluated, nor have data been collected on the climate conditions under varying season extension systems and management techniques.

The project scope contributes to the future development of production guidelines for strawberry production in high and low tunnels, from propagation to harvest. In this project, various season extension strategies including thermal blankets, low tunnels and high tunnels, were integrated alongside of data collection of the air and soil temperatures within the production plots. These varied growing environments provide a more nuanced understanding of the interplay between temperature and strawberry fruit production in order to help Kentucky growers improve their annual plasticulture strawberry systems.

Project Methods and Outcomes Progress Report

Air and soil temperatures are potential mechanisms of improving plasticulture strawberry production, by considering their effect on plant vitality, fruit earliness, fruit yield, and overall quality. Row covers of 1.5 oz., 2.0 oz., and 2.5 oz. thicknesses are used over open field plots as well as over strawberries inside high tunnel structures, creating six different microclimates when the berries are covered.

One WatchDog sensor was installed in each treatment for a single strawberry variety, Chandler. The treatments with sensors are as follows:

1. Open field, 1.5 oz. row cover, Chandler
2. Open field, 2.0 oz. row cover, Chandler
3. Open field, 2.5 oz. row cover, Chandler
4. High tunnel, 1.5 oz. row cover, Chandler
5. High tunnel, 2.0 oz. row cover, Chandler
6. High tunnel, 2.5 oz. row cover, Chandler

Each treatment was a bed section of 15' in length and each plot contained around 30 plants. Wire hoops were installed over the beds for the row covers to be held aloft, and row covers were weighted on the

sides by sandbags. The WatchDog sensors were installed in September for the 2023-2024 growing season, to evaluate the temperatures for the entirety of the growing season. Data from these loggers is being collected (on-going), and will be evaluated in 2024 to consider temperature effect on fruit earliness, yield (both overall weight of production as well as average berry size), and fruit quality via Brix measurements.

An undergraduate student worked on this project during the entirety of 2023. This student is a veteran and planning to be a future farmer. Work on this project allowed them to gain hands-on practical experience in small fruit production as well as research and data collection. This student took the lead to secure the propagation setup for the berries, installed the beds in both the high tunnel and the field, and helped to establish the plantings and research set up. They assisted on plant maintenance, including weeding, pruning, row covering/uncovering, and venting the high tunnel during the cold season. They were instrumental in also collecting data at harvest.

A graduate student presented on this project scope, including materials and methods, at the 2024 Kentucky Fruit & Vegetable Conference in Bowling Green, KY this January. There were approximately 30 attendees. A few growers in attendance expressed interest in working with us in the future on strawberry production. The project will continue through spring 2025 and full analysis of the data from the WatchDog sensors will be undertaken at that time for the multi-year tabulation of air and soil temperatures.

Final Budget

Expense Category	Funds Expended
Personnel – UK student	\$8,387.34
Fringe benefits	\$702.86
Supplies	\$2,909.80
Total	\$12,000.00

WatchDog series A loggers were placed under row cover treatments in each of the six row cover treatments in each system (6 loggers x \$159.00 = \$954) plus shipping (\$35).

Data is being downloaded using SpecWare 10.0 Pro Software (\$199.00) and USB-to-3.5 mm stereo plug adapter (\$30.00).

External soil temp sensors (A-series) were added to monitor difference in soil and air temperatures in the plots. One sensor was added in each of the row cover treatments along with the data loggers (6 sensors x \$68.50 = \$411).

Other supplies that were procured included 25 harvest totes (\$418.75) and berry containers (\$47.50) for data collection of marketable yield. In addition, label tags (\$58.50) were used for the experimental set up. Additional row cover in both 2.0oz (\$278.00) and 2.5oz (\$241.46) weights was procured, and weed barrier (\$161.73) was added for weed control between the strawberry beds. This necessitated an additional amount of sod staples (\$74.86) for weed barrier installation.

Personnel costs covered hourly wages for an undergraduate UK student and fringe benefits (\$9,090.20) who assisted with crop harvest, data analysis, and crop propagation and establishment in fall of 2023. Hourly investment of labor on the project totaled 556 hours over the course of 15 weeks in 2023.

Final Budget Justification

The WatchDog A Series Data Loggers had gone up in price since the initial budget, but the software costs remained the same. The additional external soil temp sensors were added for enhanced temperature tracking under the row covers in each treatment plot. The comparison between soil and air temperature gives a more nuanced understanding of the production parameters and how each parameter of air and soil temp affects strawberry crop performance.

The budget for row cover was underestimated due to not being able to procure the exact dimensions needed for the plot layout; this required purchasing a more expensive row cover to get the needed dimensions. Additional materials and costs covered material gaps in the project design as a result of budget deficits within the original project proposal, mostly due as a result of increased costs above the budgeted amounts; these items included the harvest bins, berry quart containers, and labels. Weed barrier was added along with more sod staples to manage weed in the field plots; existing weed barrier on site was reused for the tunnel plots.

Personnel needs were fairly consistent with those budgeted, with a slight reduction to 556 total hours. Personnel hours were spent on harvest intervals during the spring flush of fruit; plant maintenance (irrigation, weeding, pruning); plant propagation; field work; bed installation; transplanting; row covering and venting during fall and winter.