

**AGRICULTURAL RESEARCH FOUNDATION
INTERIM REPORT
FUNDING CYCLE 2019 – 2021**

TITLE: Exploring Vertical, Soilless Systems for Increased Efficiency in Oregon Strawberry Production

RESEARCH LEADER:

Javier Fernandez-Salvador, Assistant Professor (Practice), Department of Crop and Soil Science, Oregon State University. Berry Initiative Leader, North Willamette Research and Extension Center (NWREC), Javier.F-S@oregonstate.edu

COOPERATORS:

Erica Chernoh, Assistant Professor (Practice), Lane County Extension, Erica.Chernoh@oregonstate.edu

Cora Bobo-Shisler, Biosciences Research Technician, Marion County Extension, NWREC, boboshic@oregonstate.edu

EXECUTIVE SUMMARY:

After evaluating multiple recommendations from producers and researchers, the vertical systems were substituted with tabletop-based systems due to the extreme cost and inferior yield of vertical structures. We constructed two types of tabletop structures, including a wooden A-frame and a cinderblock tower. A winter demonstration was planted in 2019 to compare substrates and become familiar with system operation. The plants established well and produced fruit throughout the winter. This initial trial provided useful information for the full-scale study conducted in fall of 2020. This included completion of the tabletop structures, irrigation system, fertigation system, as well as planting two cultivars. The strawberries were established in the fall and maintained over the winter to prepare for a trial with main-season production. Standard pruning and irrigation will be maintained throughout the production season and fertility will be managed according to the different treatments. Data collection from both trials includes labor costs for planting, management, and harvest, plant growth data, and yield.

OBJECTIVES:

The objectives of this project are to conduct a two-part preliminary study on new technologies that may improve efficiencies and yields in Oregon strawberries:

- Evaluate different planting media combinations for their effect on plant yields
- Determine best practices for the use of organic fertilizers, including combinations with microbial amendments and a combined irrigation/fertigation recirculation system, for plant yields and fertilizer use efficiency
- Explore planting structure tower arrangements to compare costs and impact on yields

- Determine overall equipment and labor costs for vertical, soilless production of strawberries under greenhouse cover in Oregon

PROCEDURES:

This study is currently being conducted in an unheated retractable roof “Cravo” brand greenhouse as well as a heated greenhouse at the North Willamette Research and Extension Center in Aurora, Oregon. Year one of the study (2019-2020) focused on the initial tabletop trial, and year two (2020-2021) will involve full-scale implementation of the tabletop system.

The initial tabletop trial was established in the heated greenhouse and observed over the winter of 2019 - 2020. The purpose of the initial trial was to learn more about substrate composition and properties, strawberry growth during the winter, pot size, as well as to test equipment and the tabletop designs. The full-scale trial includes the following treatments (1) planting media, (2) fertilizer, and (3) cultivar. For planting media, we are evaluating two soilless media mixes: a commercially purchased mix of peat moss, coco coir, and perlite, and a hand-mixed combination of the same components. The fertilizer treatment will include (1) organic composted food waste liquid fertilizer, (2) organic composted food waste fertilizer plus microbial amendment, and 3) conventional liquid fertilizer as a control. ‘Albion’ and ‘Seascape’ are the two day-neutral cultivars selected for this study and are obtained annually as chilled, bare-root plants from California nurseries. Additional sub-treatments that are being compared outside of the experimental treatments include two tabletop tower styles (A-frame, and cinderblock tower) and two types of irrigation (drip tape, drip stake emitters). The full-scale trial has a split plot, randomized complete block design, with treatments blocked in towers. The trial includes eight treatments, two replications, and eight two-sided tabletop structures with a total of 360 plants.

All tabletop systems are equipped with automatic drip irrigation and fertigation systems, powered by an aquarium-style pump connected to a drip hose fitted with emitters, and a reservoir bucket at the base of each structure for adding liquid fertilizers. Each system is set up with an automated timer for irrigation management. Irrigation is based on crop evapotranspiration and Agrimet weather data, adjusted for greenhouse settings. Fertigation is managed based on current Oregon State University strawberry nutrient management standards. Strawberry plants are managed by trimming runners and old leaves every 2-3 weeks. Harvest is expected to start in March of 2021. Plots will be harvested one to two times per week. Starting in late fall after harvest is concluded, the trial will be replanted and a new experiment on supplemental lighting optimization for off-season production will begin.

Throughout the study, data is being collected on labor hours required for system construction as well as daily crop maintenance tasks, equipment and supply costs, and harvest. Data will be statistically analyzed. The cost analysis will estimate return on investment based on current year fresh market fruit prices, and expected lifetime of equipment.

SIGNIFICANT ACCOMPLISHMENTS TO DATE:

During year one of this study, the vertical system design was substituted with a similar tabletop design which is more cost effective, accessible, and higher yielding. The tabletop design was tested in a heated greenhouse for off-season production in the winter of 2019-2020 and included two tabletop designs, four substrate mixes, and two pot sizes. The strawberries were planted in the fall, flowered in mid-January, and fruit was harvested in early February of 2020. Data was collected on substrate performance, temperature, plant nutrients, plant growth, and yield. An initial cost-comparison of tabletop designs was performed, and we found that the cinderblock tower was cheaper to build than the A-frame style, though the A-frame was sturdier. Additional findings from the initial trial guided important decisions for the main study. We discovered that the hand-mixed substrate must be buffered prior to use, as to regulate nutrient availability to the plants. We also found that the large trays were more suitable than the small pots for this production style.

As the initial trial came to a close in the late winter, activities at NWREC were paused due to COVID-19 regulations. Instead of starting the main trial in the late winter, limited operations delayed our team until the fall of 2020. Between September and December, final modifications were made on the tabletop system. Two cultivars of bare-root strawberries were planted, the irrigation and drainage system were completed, moisture sensors were installed, and the large planting trays were covered with plastic. The plants have been maintained throughout the winter with standard fertility, irrigation, pest control, and microbial amendments. The strawberries were pruned several times to remove runners, flowers, and dead leaves. The study will officially begin in the spring, with hopes of a full production season beginning in March of 2021.



Figure 1: Established strawberry plants. Figure 2: Strawberry plant flowering in December, prior to monthly pruning.



Figure 4: View of the entire tabletop project set-up, complete with two tabletop designs, irrigation, and a working drainage system.

ADDITIONAL FUNDING RECEIVED DURING PROJECT TERM:

A continuation of this project has been funded by ARF for 2020 – 2022 that is focused on supplemental lighting optimization for off-season production of tabletop strawberries.

FUTURE FUNDING POSSIBILITIES:

Additional funding for a year-round tabletop production study has been proposed to the Oregon Department of Agriculture's Specialty Crop Block Program for 2021 – 2023.