Report for the period March 1, 2022 to December 31. 2022
to the North Carolina Commercial Blackberry and Raspberry Association

Long Cane Production of Raspberries

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Lisa Rayburn, Gina Fernandez and Brian Jackson, NC State University

Summary of the problem

Raspberries are a high-value crop that are not commercially grown in the hot, humid climate of the southeastern US. A possible solution is annual production using long-cane raspberries plants. The long-canes can be produced in a nursery in a cooler climate and grown out in substrate for harvest in the SEUS. This system involves growing plants in soilless media that are placed in pots or bags and grown in tunnels when the season is more moderate in the spring. This technique is wide-spread in Europe and Canada but new to the southeastern US.

The long-cane production system relies on coco coir as the industry standard. However, coconut processing and transport has resulted in shortages and increasing cost of coconut products. Research at NCSU has focused on the development and utilization of regionally sourced bark and wood products as substrate alternatives for multiple crops including raspberry. The objective of this study was to evaluate plant performance in coco coir and a locally produced pine bark product.

Experimental Design

The study was conducted at Lewis Farms in Rocky Point, NC. Long cane plants of ‘Kwanzaa’ were produced in a Canadian nursery in the summer of 2021, shipped and stored in a cooler at the farm in the fall. January 24 and 25, 2022, long-cane raspberries were potted up in 7 L containers and placed in the high tunnels.

Four Haygrove high tunnels were used. Each high tunnel was 30 feet wide and 200-220 feet long. Length varied based on field dimensions. Tunnels held between 350 and 400 plants depending on tunnel length. Tunnels contained three rows of plants. Two high tunnels had coco coir substrate (produced by Botanicoir) and two tunnels had pine bark substrate. The pine bark substrate was produced by a regional mulch facility, TH Blue. The pine bark substrate consisted of a fine nursery mix with 5% screenings that was buffered to a pH of 6.5.

Figure 1 Two tunnels were planted to coco coir (left) and two tunnels were planted to pine bark (right) substrate. Each pot had two drip emitters.

Plants were spaced 18” apart and supported by a wire trellis. Each pot was equipped with two 0.5 g/hr drip emitters. The irrigation system was pressure compensated to ensure even water distribution despite the short run times. Irrigation events ranged from three to four 3 minute events early in the season to as many as 28 four minute events during peak demand.

A monitoring station was set up in each tunnel to collect a sample of the fertigation solution (drip) and pot leachate (drain) daily. Fertility and irrigation were managed by daily monitoring of the drip and drain EC as well as percent drainage. Target drip EC was 1.6 during vegetative growth and 1.3 during fruiting. Steps were taken to lower substrate EC when the drain EC exceeded 1.9 during vegetative growth and 1.7 during fruiting. Steps to reduce EC included Increasing the number of irrigation events, lowering input EC and/or a clear water flush.

Figure 2 Long-cane raspberry plants when potted up and lined out in the high tunnel (left). Long-cane plants after 1 month growing in the tunnels (right).

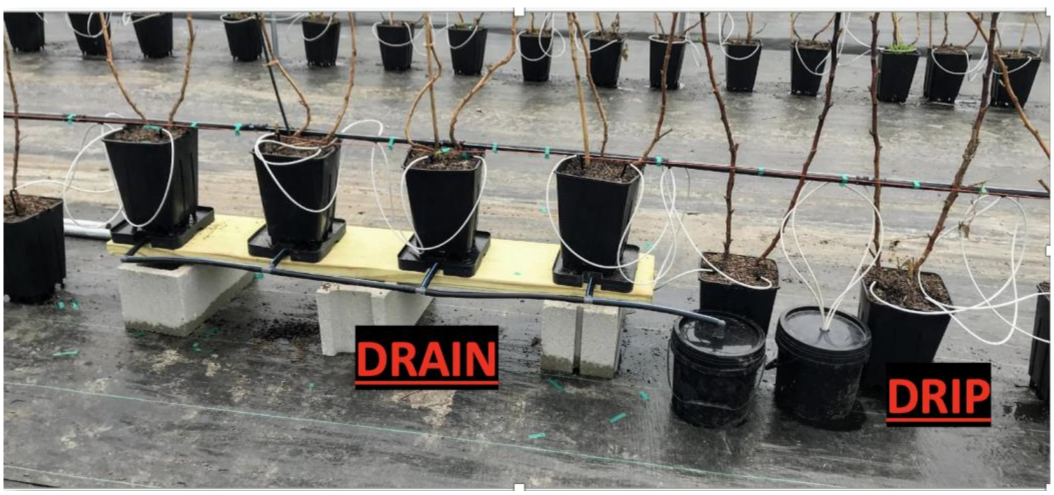

Figure 3 Monitoring station used to track fertigation input (drip) and pot leachate (drain) on a daily basis.

Plant tissue and solution samples were collected every two weeks to assess plant nutrient status. Media samples were collected at the beginning, middle and end of the growing season.

Total yield was collected on each picking date by counting the number of flats harvested per row. Berry size was collected by weighing a 10 berry sample from each row, seven times during the harvest season. At the end of the season, plants were destructively sampled to assess number of laterals, lateral length, lateral dry matter, total flower buds and fruitful flower buds.

Results

Plants grew out well in both substrates. Pine bark was a more freely draining than the coco coir substrate. Because this system managed irrigation based on percent leaching, pine bark leached more and was thus irrigated less early in the season. Later in the season, this was adjusted and pine bark was irrigated for a similar number and duration of irrigation runs as compared to coco coir. It would be ideal if there were pot moisture sensors and irrigation was driven based on percent pot moisture in the containers.

There was no significant difference in total yield or berry size between the two substrates. Coco coir yielded 3,568 flats/acre and pine bark yielded 3,522 flats/acre for the season. There was a small absolute difference in berry size with pine bark berries (average weight 5.4 g) being slightly lighter than coco coir (average weight 5.5 g). This difference may be related to the fact that pine bark is a more freely draining substrate and thus having less pot moisture as managed in this system.

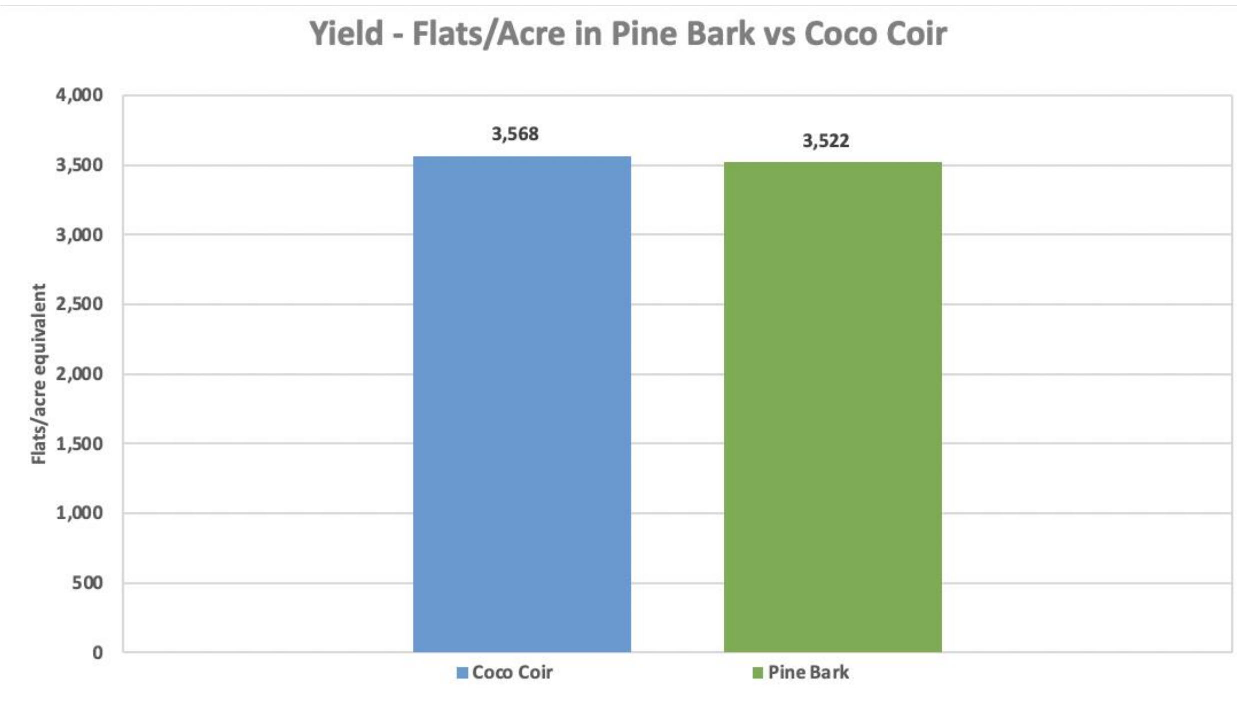

Figure 4 Total marketable yield in each substrate over the course of the season. There was no statistical difference in total yield between the two substrates.

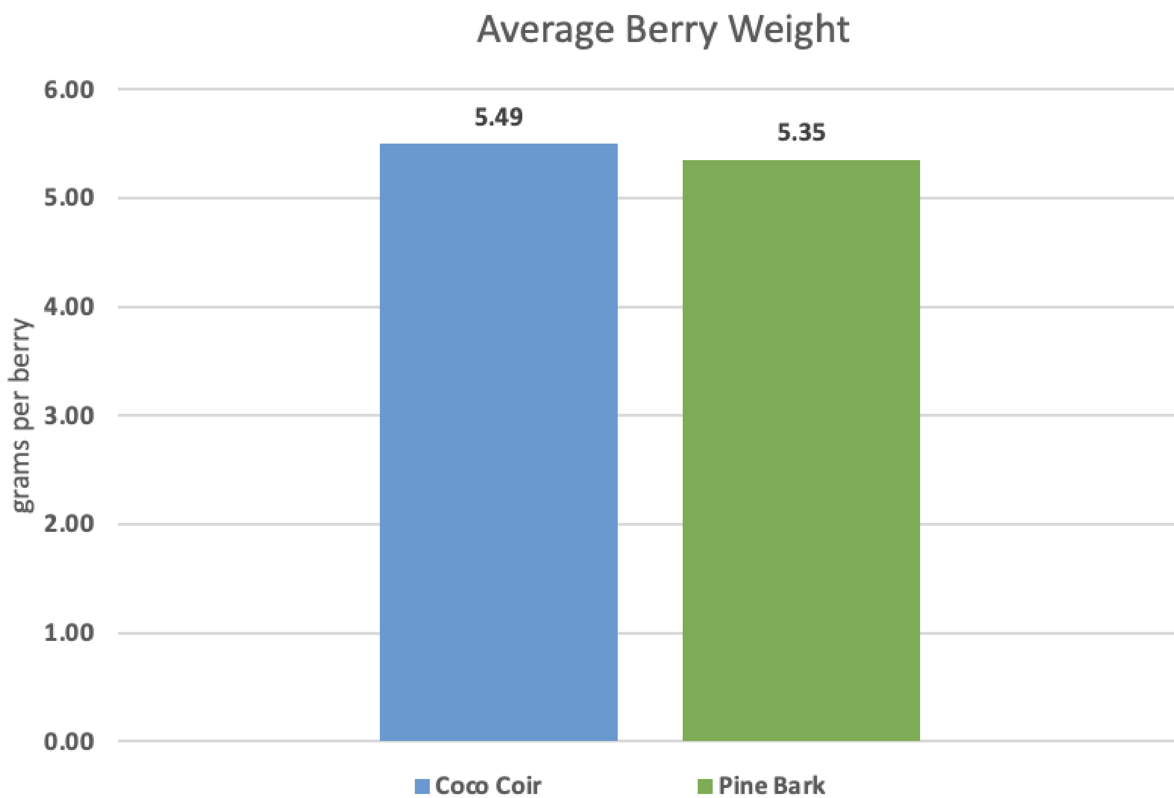

Figure 5 Average berry size over the course of the season in both substrates There was not a statistical difference in berry size but a slight absolute difference with pine bark berries being slightly smaller.

Plants grown in coco coir exhibited laterals that were on average 4.9 cm longer than laterals from plants grown in pine bark. However, there was no significant difference in dry matter weight of the laterals. This may be a function of plants in coco coir have access to more pot moisture throughout the season.

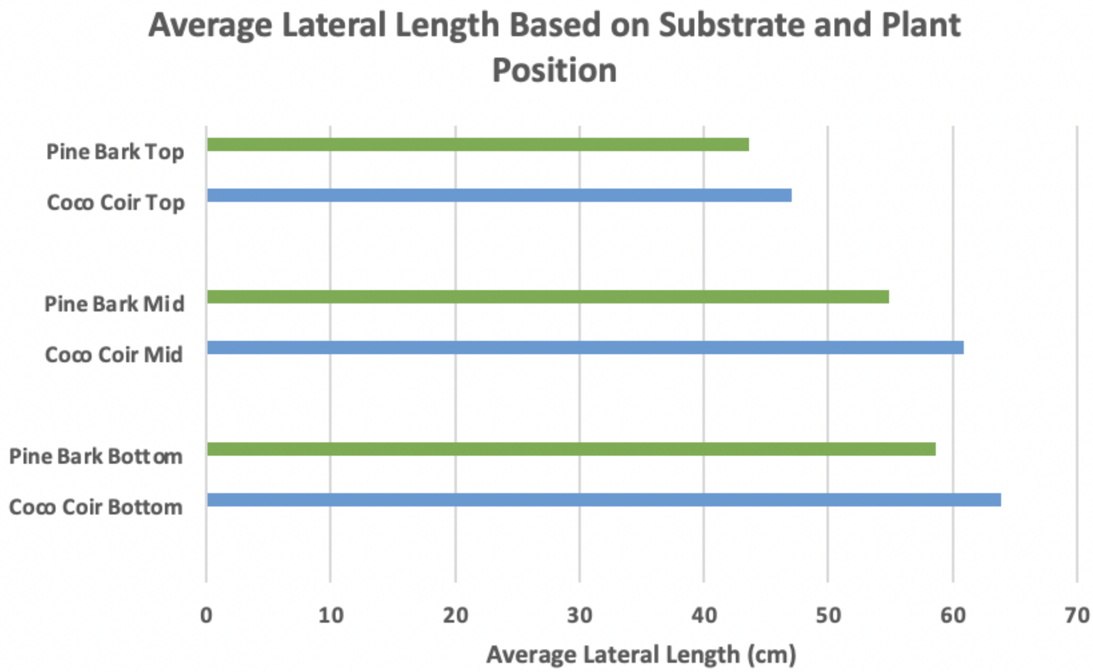

Figure 6 Lateral length based on substrate and plant position. Laterals were collected in the top, middle and bottom thirds of the canopy. Laterals in coco coir were on average 2.9 cm longer than comparable laterals in pine bark.

The number of fruiting laterals, total flowers and fruitful flowers were the same. Fruiting laterals in coco coir were longer than fruiting laterals in pine bark but there was no significant difference in dry matter accumulation.

Plant tissue levels of major nutrients was similar between substrates throughout the season. There was no difference in plant tissue levels of N, P, K, S or B between the two substrates. There was a slight trend towards Ca being higher in plants grown in pine bark but it was not statistically different. The pine bark substrate was buffered with dolomitic lime while the coco coir was buffered with calcium nitrate during production. Mg was higher in plants grown in pine bark. This may be due to the additional Mg provided by the dolomitic limestone. Fe was higher in plants grown in pine bark. This is likely due to the slightly lower pH in the pine bark substrate during the course of the season.

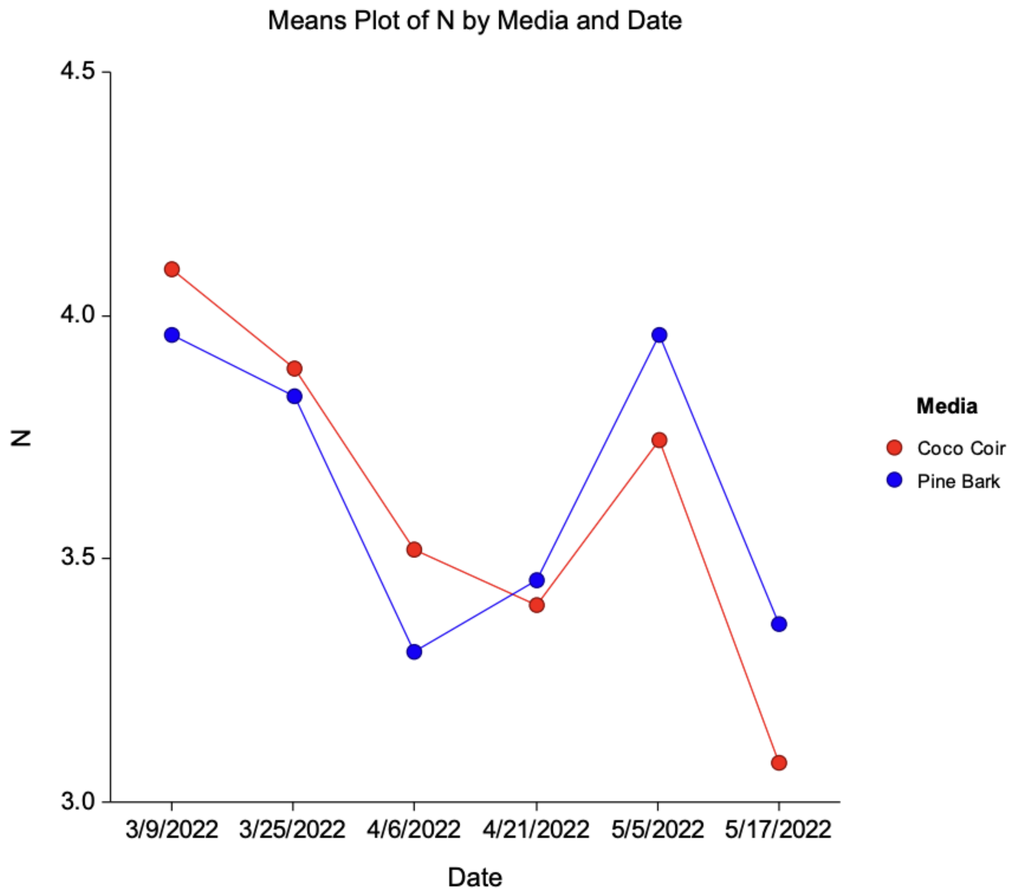

Figure 7 Plant tissue nitrogen through the season. While N did fluctuate based on crop stage, plant nutrient status was not different between the media. This held true for N, P, K, B and S.

Solution sample data was used to drive irrigation system management. Pine bark was more freely draining than coco coir and when temperatures heated up later in the season, it became apparent that pine bark needed more frequent irrigation than it had been receiving earlier in the season. When irrigation intervals were increased, EC in pine bark dropped back into the desired range quickly. Pine bark maintained more consistent drip pH over the course of the season and a slightly lower drip pH compared to coco coir.

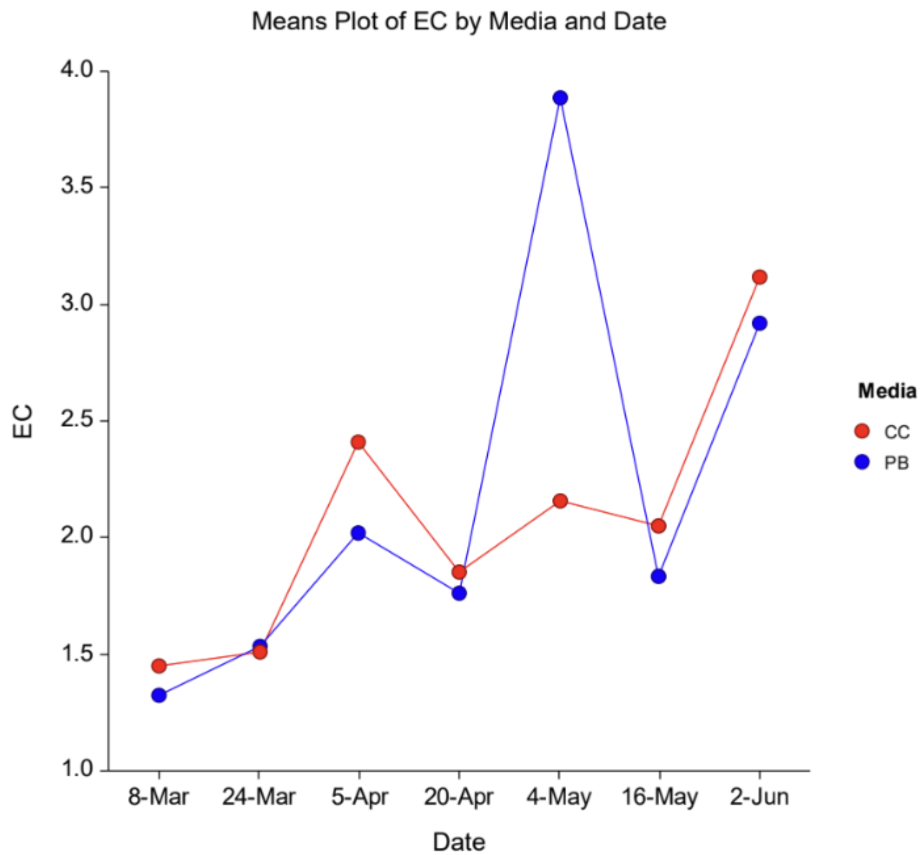

Figure 8 Drain EC over the course of the season. Drain EC tracked similarly between the two substrates except for a period of hot temperature in early May. Adjustments to bring pine bark irrigation in line with coco coir irrigation corrected this.

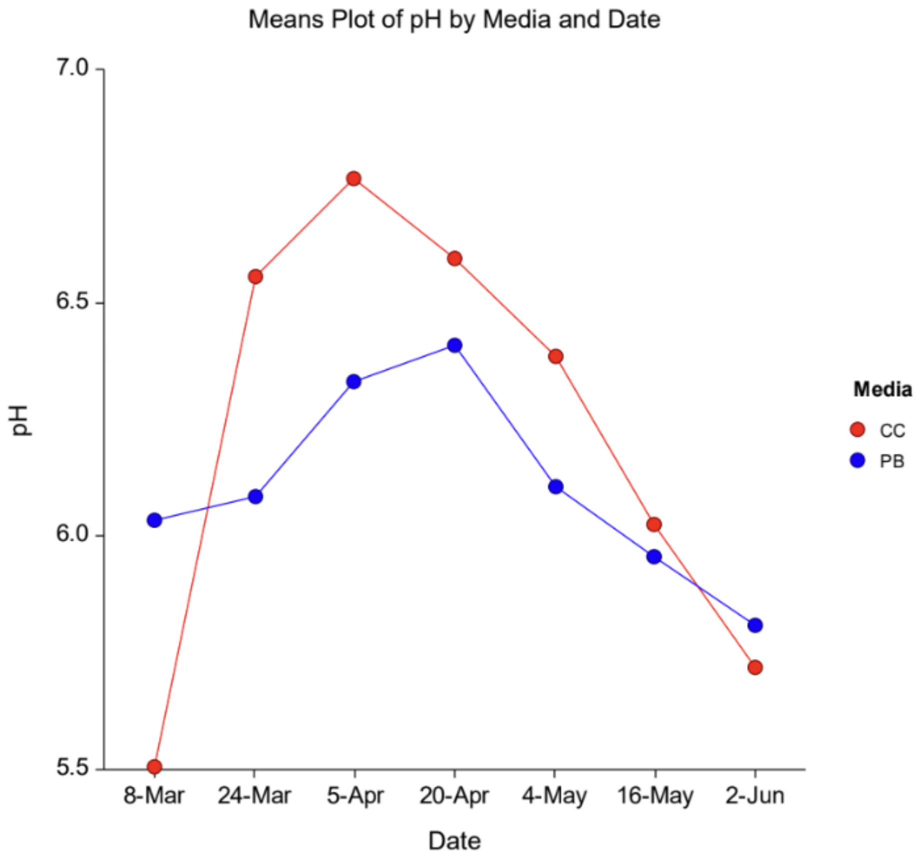

Figure 9 Drain pH over the course of the season. Coco coir pH had more variation in drain pH over the course of the season. Pine bark had less variation and on average slightly lower pH.

This year's data indicates that pine bark can be a viable substrate for long-cane raspberry production in the southeastern US. Total yield was comparable between the two media as were berry size, flower number and plant nutritional status. The addition of substrate moisture sensors would be beneficial to make irrigation management more precise in the 2023 season.