2020 SRSFC Research Report
Title: Comparison of Rotating Cross Arm (RCA) and T- Trellis for Impacts on Southeastern Blackberry Production (Year 2)

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Public Abstract:

Our trial compared the yield, fruit quality, pest populations and economics of growing three common blackberry varieties on both a standard T-trellis as compared to the Rotating Cross-Arm (RCA) trellis during the summers of 2019 and 2020 in Clarksville, AR. One goal of our trial was to compare yields per plant and yield per linear row meter between the two trellis systems. Floricane yield per plant on the RCA are likely to be higher due to the increased space allotted to each plant (5' of row/plant on RCA vs 2.5' of row/plant on T-trellis), but floricane yields per row meter are a better indicator of economic returns per meter of row space. Results in both years indicate that floricane crop yields per plant were higher for Ouachita and Osage grown on a RCA trellis compared to when those varieties were grown on a T-trellis. Floricane crop yields per linear row meter were not different between the two trellising systems or lower on the RCA for Osage, and Ouachita, but Prime-Ark® Traveler had higher floricane yields per row meter on the T-trellis. These results are believed to be due to observed differences in canopy coverage along

each trellising system. On the RCA the wider planting spacing resulted in gaps between plants whereas the T-trellis had fewer empty space between plants. This was particularly noticeable for Prim-Ark Traveler which was double cropped and therefore had shorter and fewer floricane laterals. However, trellising was also shown to impact important measures of fruit quality and pest pressure, including observations of lower spotted wing drosophila infestation in both years, larger fruit size in both years and reduced red cell reversion in 2020 on the RCA compared to the T-trellis. Thus while yield per meter row were similar on the RCA and T-trellis, there are other important benefits on fruit quality and pest management that can be obtained from trellising floricane fruiting blackberries on the RCA. Evaluation of the economics of the RCA including requirements for labor to manage each system are ongoing. Further research is needed in order to optimize the RCA system to maximize per linear row meter yields, but this trellising system shows promise for use in Southeastern Blackberry production systems to reduce fruit loss due to culls.

Introduction:

Our research project evaluated the effects of the Rotating Cross-Arm (RCA) trellis as compared to a standard T-trellis for Southeastern blackberry production. Trellising effects on fruit yields, fruit quality, SWD fruit infestation, disease incidence and differences in costs associated with crop management, for three different blackberry varieties (two floricane varieties and 1 primocane variety) were evaluated. The long-term goal of this project is to evaluate the net costs and returns associated with using different trellising systems based on labor inputs, pest management, fruit yields and fruit quality.

Shift-trellises, adjustable arm trellises or rotating cross arm trellis (RCA) are moveable non-static trellising systems. These systems allow for the movement of a raspberry or blackberry crop canopy from the 9 o'clock position to the 1 o'clock position with the goal of forcing blooms to open on only one side of the trellis (9 o'clock position) and then rotating the trellis over (1 o'clock position) so that fruit are positioned on only one side of the trellis in an even plane that is easily reached by a picker. These systems have potential for also facilitating the production of blackberries in regions where high temperatures in summer and late spring frosts are the climatic risks to blackberry production. Summer temperatures regularly exceeding 90° F can result in several fruit disorders that reduce marketable fruit yields and fruit quality losses in post-harvest. Moveable trellis systems may offer opportunities to combat both of these temperature risks to Southeastern blackberry production. For our purposes we will focus on the rotating cross arm trellis (RCA). The RCA trellis if positioned east to west offers the potential to exclusively orient the fruit on the north side of the trellis, where temperatures may be cooler than on the south side. This may result in overall reductions to fruit quality related to high temperature stress. Further because all fruit are on one side of the trellis system it has been hypothesized that harvesting is faster due to only having one side to pick, and fruit is not hidden inside the plant canopy due to the crop being trained to wires in a flat plane. This facilitates a more uniform harvest potentially resulting in higher marketable yields. These are strictly grower observations, and again research based evidence is not available or is limited to older varieties that are not widely recommended for current production systems in Arkansas and the surrounding region.

Materials and Methods:

In the spring of 2017 this study was initiated at the University of Arkansas Fruit Research Station, in Clarksville Arkansas. The study is a strip-plot design with the trellising system as the strip-plot treatment and varieties as the sub-plot treatments. Each variety x trellis combination is replicated 3 times. The 90' rows of rotating cross-arm (RCA) trellis and one row of T-trellis were installed east-west. The trellising structure was donated by Trellis Growing Systems. We are evaluating two thorn-less floricane fruiting types, Osage and Ouachita and one thorn-less primocane fruiting type, Prime-Ark® Traveler (which will be assessed based on both floricane and primocane crops). The three varieties being evaluated in our study, were developed by the University of Arkansas blackberry breeding program and have not been widely evaluated on the RCA but are widely recommended for standard trellising production due to high yields and fruit quality. Primocanes were bent and trained on the RCA during the summers of 2018 and 2019 following Trellis Growing Systems recommendations.

From June -August in 2019 and 2020 fruit were harvested twice per week at the shiny-black stage of ripeness. Fruit were sorted and weighed for cull and marketable fruit weights into 240g clamshells. Average berry weight were calculated. Cull fruit was assessed for % incidence of white drupe. A total of 30 fruit were assessed weekly from each plot for SWD, with 15 fruit from the cull and 15 fruit from the marketable chosen at random. These fruits were examined under a microscope and the number of SWD eggs recorded for each berry along with symptomology for anthracnose recorded. Traps for SWD were baited with a Scentry™ lure and apple cider vinegar drowning solution. One trap was placed in each row of each trellis system and was monitored weekly. Anthracnose cane and leaf incidence was recorded based on visual ratings of severity (0-10) of affected canes and leaves for each plot and trellis system at 3 times during the growing season: early spring, mid-season, and after harvest. This was accomplished by visual ratings of canes and leaves.

Three clamshells of marketable berries from each plot were refrigerated at 2.0◦C±1.0◦C and held for 7 days and then assessed for red-cell regression by counting the total number of drupelets and the number of red drupelets per berry using five randomly selected berries from each clamshell replicate. Fruit firmness, was assessed on five fresh fruit per plot at harvest also in triplicate. Changes in fruit quality (decay, leakage, percent weight loss and firmness), and were assessed after 7 days. Five berries in triplicate were analyzed for fruit brix, pH and titratable acidity (TA) assessed on from each plot for one harvest per week.

Berry temperature in situ (while berries are attached to the plant) was measured at 8am, noon, and 3pm bi-weekly for 6 weeks to monitor difference in berry canopy temperatures.

Data on hours of labor (people x hours of work) was recorded daily for time spent training canes, applying pest management controls, and harvesting fruits for both trellising systems in order to begin collecting data on labor costs associated with each trellising system. Ultimately labor and input costs will be compared to marketable yield results (per foot of row) from both systems to evaluate return on investment (ROI) for each system.

The results of this research will be disseminated directly to growers through the PIs existing extension programs, blog and through various meetings.

Results and Discussion:

This grant helped support the master's thesis project of Erika Henderson. Her thesis contains the full report of this research (Henderson, 2020) but key results will be summarized here. Important differences in floricane crop per plant and per meter row yields were observed in both years (Figure 1). Per plant yields on Ouachita and Osage were higher in the RCA system as compared to the Standard T-Trellis. Due to differences in plant spacing comparisons of per plant yields and per linear row meter yields are necessary in order to better understand how these different trellising systems may affect yield efficiency per acre. Yields per linear row meter were the same for Ouachita and Osage on the RCA compared to those cultivars on the T-trellis in 2019, in 2020 Osage continued to have similar yields per row meter regardless of trellis system, but Ouachita had lower per meter row yield on the RCA compared to the T-trellis. It was observed that at the current plant spacing of 1.52 m (5') between plants on the RCA the plants do not adequately fill the trellis and gaps between plants are apparent. This directly has an impact on per linear row meter yields due to underutilization of the trellis space. Closer plant spacing could ameliorate this issue and increase per linear row foot floricane yields on the RCA. This was particularly noticeable for Prime-Ark Traveler which had poor canopy fill for the floricane crop due to cane death following primocane fruiting which shortened the length and in some case number of laterals. Both yield per plant and yield per meter row tended to be lower on the RCA compared to the T-trellis for Prime-Ark Traveler.

Assessments of the occurrence of white drupe and fruit firmness were not observed to be significantly affected by trellis system in either year (data not presented). However, lower spotted wing drosophila infestation rates in both years, and lower red cell reversion and anthracnose on the RCA compared to the T-trellis in single years were observed (data not presented). While other measures of post-harvest quality and composition were occasionally influenced by trellis in our trial we did not find that these were associated with a cooler berries on the RCA, as floricane berry temperatures were similar in the RCA and T-trellis. The RCA consistently increased berry size for both floricane and primocane crops. These observed improvements to fruit quality and size are important benefits to growers in the Southeast.

Labor data continues to be analyzed. Initial results and observations indicate that the RCA systems requires more labor for training the new primocanes along the bottom wire, but harvest labor is reduced as harvest speed is increased. Student workers were polled at the end of the summer about their experience harvesting off of the RCA and standard T-trellis. Many expressed a preference for harvesting on the RCA due to ease and the berries being shaded.

References:

Henderson, Erika. 2020. Comparison of a T-trellis and a Rotating Cross-Arm Trellis for Arkansas Blackberry Production. Masters Thesis. University of Arkansas

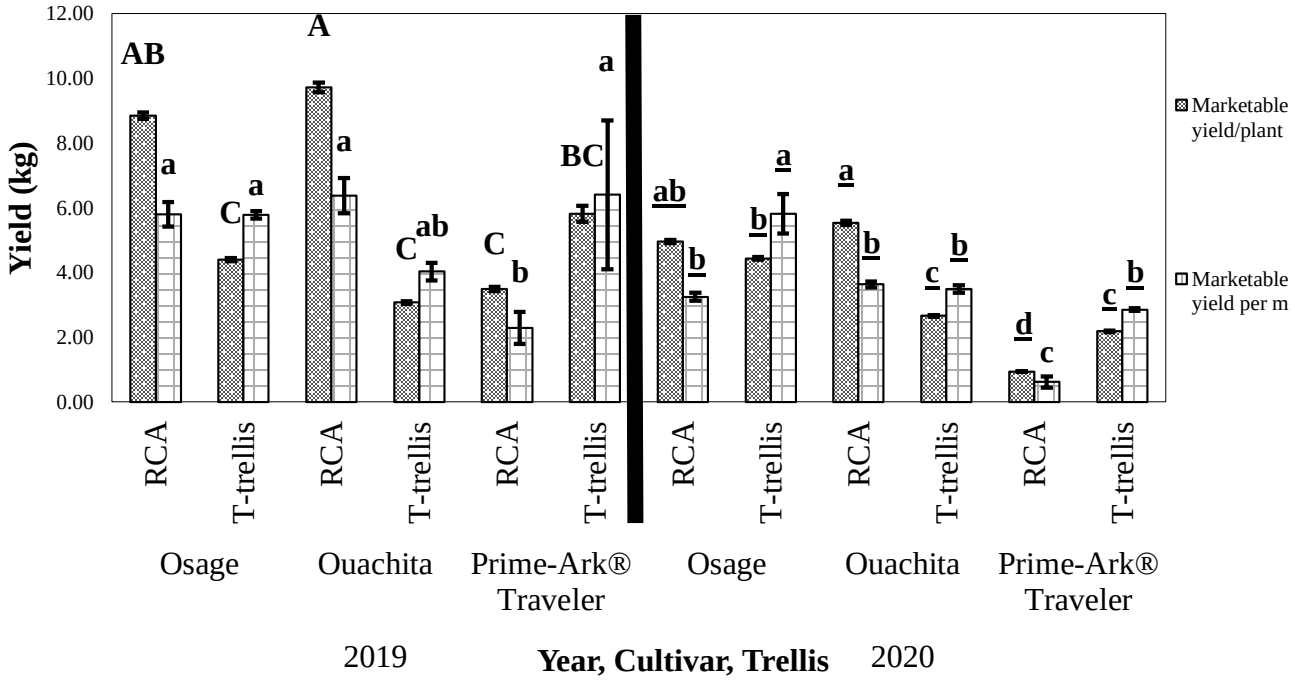

Figure 1. Marketable blackberry yields per plant and per m row on rotating cross-arm (RCA) trellis and a T-trellis planted with three blackberry cultivars (Osage, Ouachita, and Prime-Ark® Traveler) in Clarksville, AR (2019 and 2020). Each standard error bar is constructed using 1 standard error from the mean. Means with different letter(s) within effects are significantly different ($p < 0.05$) using student-t tests for yield per plant (uppercase letters) and yield per m (lowercase letters) in 2019 and yield per plant (uppercase underlined letters) and yield per m (lowercase underlined letters) in 2020.