2019 SRSFC Research Report
Title: Comparison of a Rotating Cross Arm (RCA) and T- Trellis for Impacts on Southeastern Blackberry Production

Principal Investigators:

Dr. Amanda McWhirt
Horticulture Production Specialist
University of Arkansas Cooperative Extension Service
2301 S. University
Little Rock, AR 72204
501-400-6374
amcwhirt@uaex.edu

Dr. Jackie Lee
Horticulture IPM Specialist
University of Arkansas Cooperative Extension
2301 S. University
Little Rock, AR 72204 USA
Phone: 479-530-8163
Fax: 501-671-2252
jalee@uaex.edu

Dr. Renee Terrell Threlfall
Research Scientist, Enology & Viticulture
Department of Food Science
University of Arkansas
Fayetteville, AR 72701
Phone: 479-575-4677
rthrelf@uark.edu

Public Abstract:

Our trial compared the yield, fruit quality, pest populations and economics of growing three common blackberry varieties on both standard T-trellising as compared to the Rotating Cross-Arm (RCA) trellis during the summer of 2019. Results indicate that per plant yields were higher for Ouachita and Osage grown on RCA trellising compared to when those varieties were grown on T-trellises. Yields per linear row foot were not different between the two trellising systems for any of the varieties evaluated (Osage, Ouachita, Prime-Ark® Traveler). Fruit quality (brix, incidence of white drupe, red cell regression, or post-harvest issues) were not significantly impacted by trellising system in 2019. However, the percent culls for Ouachita and Osage were over 50% lower on the RCA as compared to the standard T-trellis. Hours of labor to manage each system were monitored and this data continues to be evaluated for its impact on the economics of each trellising system. Further research is needed in order to optimize the RCA

system to maximize per linear row foot 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 summer of 2018 following Trellis Growing Systems recommendations.

From June 2019-August 2019 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:

The 2019 season was rainy and cool through early June and then hot and dry in July. Final results continue to be analyzed for this project. Important differences in per plant yields were observed (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 foot yields are necessary in order to better understand how these different trellising systems may affect yield efficiency per acre. Yields per linear row foot were numerically higher on Ouachita and Osage in the RCA but not statistically different. These numerical differences are likely economically significant for Ouachita if not statistically significant, as they represent an increase of nearly 800 grams (1.76 lbs.) per plant on the RCA. Further it has been 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 foot yields due to underutilization of the trellis space.

Closer plant spacing would ameliorate this issue and increase per linear rot foot yields on the RCA. Assessments of the occurrence of red cell regression, anthracnose, white drupe and post-harvest decay were not observed to be significantly affected by trellis system (data not presented). However, the cull percent of the total yield on the RCA was nearly half of the cull rate on the Standard T trellis. This represents an important impact on the economics of the RCA system as more harvested fruit can be sold.

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.

The occurrence of spotted wing drosophila (SWD) in trap catches and fruit infestation was low during 2019. There was an observance of high stinkbug populations and damage suspected to be related to stinkbug damage was rated on berries using a similar rating system to that used for white drupe, anthracnose and red cell regression. Results seemed to indicate slightly lower stinkbug damage in Ouachita and Osage on the RCA. However due to the field orientation higher rates of damage from stinkbugs on the standard and traveler RCA may be due to an edge effect. Data analysis continues and the results of this project will be presented at two extension meetings over the winter of 2020.

Figure 1. Marketable and cull yields of Ouachita, Osage and Prime-Ark Traveler ® on Rotating Cross Arm (RCA) and Standard T-Trellising in Clarksville, AR during 2019.

Trellis	Variety	Marketable Yield		Cull
		g linear row foot-1	*g plant-1*	*%*
Osage	RCA	1,682.53	8,412.50 ab	6.7% ab
	Standard	1,551.70	3,879.27 cd	19.7% d
Ouachita	RCA	1,868.00	9,339.90 a	11.0% a
	Standard	1,035.50	2,588.70 d	24.7% cd
PA Traveler®	RCA	1,116.70	5,583.57 bc	17.0% bc
	Standard	1,908.97	4,772.40 cd	15.0% bc
Prob > F				
	Trellis	*0.8445*	***0.00240***	***0.0004***
	Variety	*0.8922*	*0.57704*	*0.1139*
	Trellis* Var	*0.1051*	***0.02782***	***0.0036***

** Different letters within the same column indicate significant differences at p>0.05*