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Evaluation of a modified Cordon pruning system on a Primocane-fruiting Blackberry

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Introduction

The "Prime-Ark®Traveler" is a thornless primocane-fruiting blackberry variety that produces a crop considered suitable for the commercial markets (Clark, 2016). The canes on traditional floricane fruiting blackberry plants are biennial, i.e. last season's vegetative primocanes will become this season's fruiting floricanes after overwintering. The primocane-fruiting variety has flowers and fruits produced on the current season primocanes and plants can be "double cropped", i.e., a second crop is harvested from primocanes during late summer to early fall in addition to the late spring and summer harvest from overwintered floricanes. In Southeastern Virginia, fruiting laterals on the floricanes will bloom in April and have ripening fruit in late May through July. During this time, new primocanes begin emerging from the crown. By June, when primocanes reach approximately 1m in height, tipping (removal of ~1-5cm of the terminal growth) of these primocanes is recommended to encourage branching with additional flowering on new laterals for increased yield (Strik, 2012). Fruit will develop from June to July on the uppermost portion of these new primocanes. Successive emerging primocanes continue to produce flowers and fruits, up until October, depending on weather conditions.

Commercial blackberry growers face many challenges for sustainable fruit production, most importantly labor, extreme weather, insect pests, and fungal, bacterial and viral diseases. High wind and increased fruit weight will damage unsupported canes. The primocanes and floricanes coexist while floricanes are producing fruit in late spring to early summer. Multiple and robust primocane growth can result in a very dense canopy, reduced air flow and competition for sunlight and support. A thick canopy and warm, humid weather provide an ideal habitat for many problem insects including spotted wing drosophila as well as problem diseases such as anthracnose, botrytis, leaf spot and cane blight.

Conventional pruning and trellising system

Many growers utilize a "V" or "T" trellis system to support the canes. The "T" trellis is comprised of two opposing lower wires at 3 feet above ground and two parallel upper wires at 5 feet. In late winter, the floricanes are thinned to four to six canes and evenly trellised on each side to the outer wires leaving open space in the middle for primocane growth. The lateral branches on the floricanes are trimmed back to 15-18 inches for fruit production (Fig. 1, 2). New primocanes emerging from the crown starting in late spring season are tipped at 30 to 40 inches to encourage lateral growth which is trellised vertically to promote fruit production on the uppermost portion of the canes.

Cordon pruning and training

The "Cordon" pruning system is based on the practice used in viticulture production: a main branch arm is trained to grow horizontally from the vine trunk and new fruit-carrying branches grow from this horizontal cordon each year.

During the 2023 and 2024 growing seasons, this system was adapted to a Prime-Ark® Traveler blackberry planting with a "T" trellis system at the Hampton Roads AREC in Virginia Beach, VA. The previous summer's primocanes were tipped and upper laterals trained to grow horizontally along the trellis wires (Fig. 3, 4). Alternatively, one cane was

bent to grow horizontally along the wire. This allows for greater air flow, opens the canopy to sunlight for ripening fruit and fruit weight is supported by the wire to prevent cane breakage.

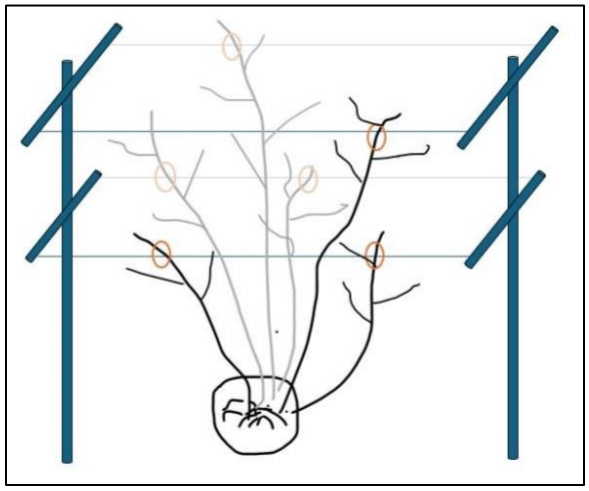

Figure 1. Representative drawing of conventional pruning of winter floricanes on a “T” trellis. Faded lines in the figure show canes on the back two wires and the orange circles are orchard ties.

Figure 2. Conventional winter pruned Prime-Ark® Traveler floricanes in early February.

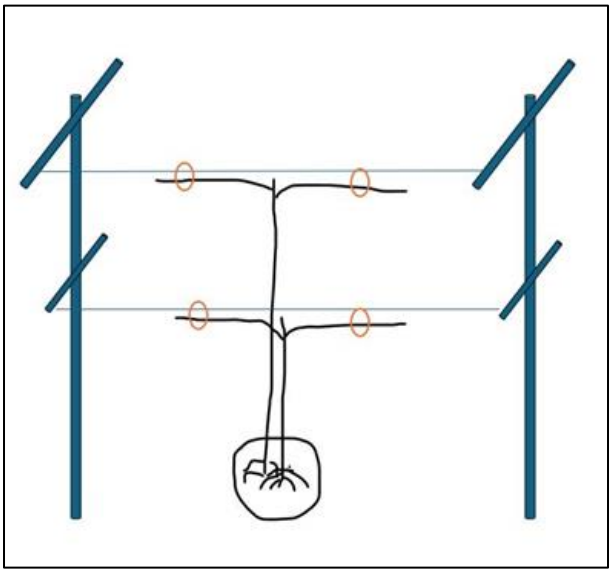

Figure 3. Diagram of “Cordon” pruned canes with only the front two canes and wires shown.

Figure 4. Cordon pruned and trained Prime-Ark® Traveler floricanes in early February.

In the spring, fruiting laterals will develop on the cordon trained horizontal canes attached to the trellis wire (Fig. 5, 6).

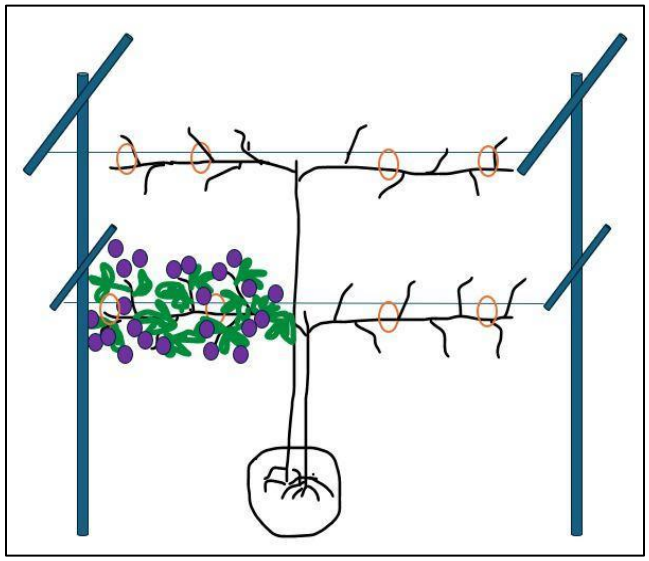

Figure 5. Diagram of desired spring lateral growth and fruit production in a Cordon system.

Figure 6. Late April flowering laterals on a Cordon trained floricane.

The cordon pruned and trained floricanes have a very open canopy with easily accessible fruit along the trellis wires (Fig. 7, 8). Most of the emerging primocanes are pruned out during the growing season, leaving only four to six canes to prune and train for a second crop.

Figure 7. Cordon trained floricanes in bloom (Photo taken April 22).

Figure 8. Cordon trained floricanes with ripening fruit and new primocane growth from the crown (Photo taken May 28).

Primocanes emerge in two continuous flushes (Takeda, 2020). As the floricanes finish fruiting, the first flush of primocanes have reached the upper trellis wire and new fruit production begins in late July. A second flush of primocane growth may occur with fruit production through October, resulting in a very dense canopy in the conventionally pruned plants (Fig. 9) which can make it difficult to find the ripened fruit.

Figure 9. Late summer dense canopy with fruiting primocanes in a conventional system. (Photo taken July 31).

The cordon trained fruiting primocanes have fruit production on the laterals trellised to the wires. All leaves and lateral growth below the bottom wire were removed (Fig. 10). This was done to channel resources towards fruit production and to minimize any soilborne disease incidences.

Figure 10. Cordon trained fruiting primocanes. (Photo taken July 31).

Study procedures and data collection

Training of the floricanes began in March 2023 and January 2024. The floricanes and newly emerging primocanes were thinned, trimmed and trellised for the season as needed for each pruning system. Recommended pest management practices were utilized as needed as per the Southern Region Small Fruit Consortium's Southeast Regional Caneberry IPM guide. Fruits were harvested two to three times per week beginning May 30, 2023, and May 28, 2024, until the first week of September. Fruits were sorted as marketable and non-marketable and weighed by category. The marketable fruits were graded as US No.1 or No. 2 according to USDA Standards for Grades of Dewberries and Blackberries. Ten fruits of US No. 1 were weighed to get an estimation of fruit size in grams, measured for firmness with a fruit texture analyzer, then stored frozen for processing to determine total soluble solids (TSS ºBrix) and pH. Non-marketable fruits were sorted and weighed separately by the following categories: diseased, bird or insect damaged, and white drupelet disorder (WDD).

Results

During the 2023 and 2024 fruiting seasons the conventional pruning system demonstrated significantly higher ($P < 0.0001$) total yield, marketable yield, Grade 1 and Grade 2 fruit, non-marketable yield, and incidence of WDD when compared to the modified cordon system (Table 1). No differences in fruit size, firmness or pH were observed (data not shown). These results suggest that the conventional system may better support yield optimization, albeit with a higher occurrence of WDD. However, this system exhibited a significantly lower TSS value compared to the modified cordon system (Fig. 11) over both fruiting seasons ($P <0.0001$).

Table 1. Effect of the conventional system (STD) and a modified cordon system (COR) on fruit yield and white drupelet disorder presented as lb/plant for the 2023 and 2024 fruiting seasons.

	Total Yield * 2023	Total Yield * 2024	Marketable Yield* 2023	Marketable Yield* 2024	Non-Marketable Yield* 2023	Non-Marketable Yield* 2024	White drupelet disorder * 2023	White drupelet disorder * 2024
STD	7.7	11.7	4.4	9.1	3.4	2.6	0.4	0.6
COR	4.6	5.0	2.7	3.8	1.9	1.1	0.1	0.3

*Means within a column were significantly different using the least significant difference test at P ≤0.05.

This suggests that the conventional system may be associated with lower sugar concentration, highlighting a trade-off between yield volume and fruit sweetness.

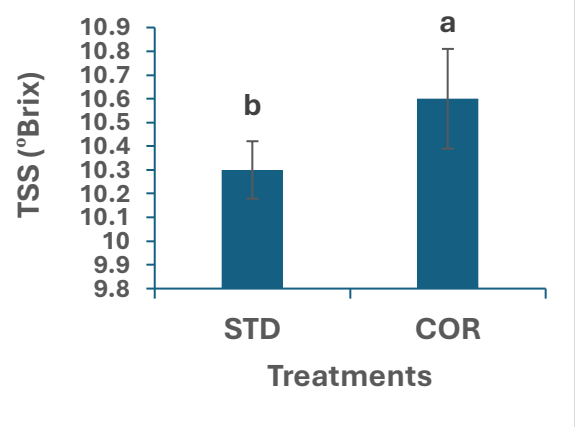

Figure 11. Effects of the conventional system (STD)

Challenges of the cordon system

Several visits to the field are required to properly train the primocanes and trim off new lateral growth below the bottom trellis wire. If there was any leaf growth between cordon wires, those were removed to promote air circulation, light penetration and minimize sunscald.

It is difficult to select the best primocanes that would be suitable for a fall crop which will then overwinter for a spring crop when double cropping. The upper fruiting cane sections will die back at the end of the season and be pruned out when dormant, leaving only the bottom two thirds of the cane for overwintering, lateral development and spring fruit production.

High temperatures typical of southeastern Virginia during late summer can impair flower and fruit development on primocanes, resulting in poor quality fruit and low yield for the fall crop. However, the potential for a high floricane yield may increase for the following spring.

It is interesting to note that the weekly harvest peak yield trends between the conventional and cordon system generally mirror each other (Fig. 12) even though cordon yield is lower, which was expected since there are fewer canes overall (34% fewer in 2024).

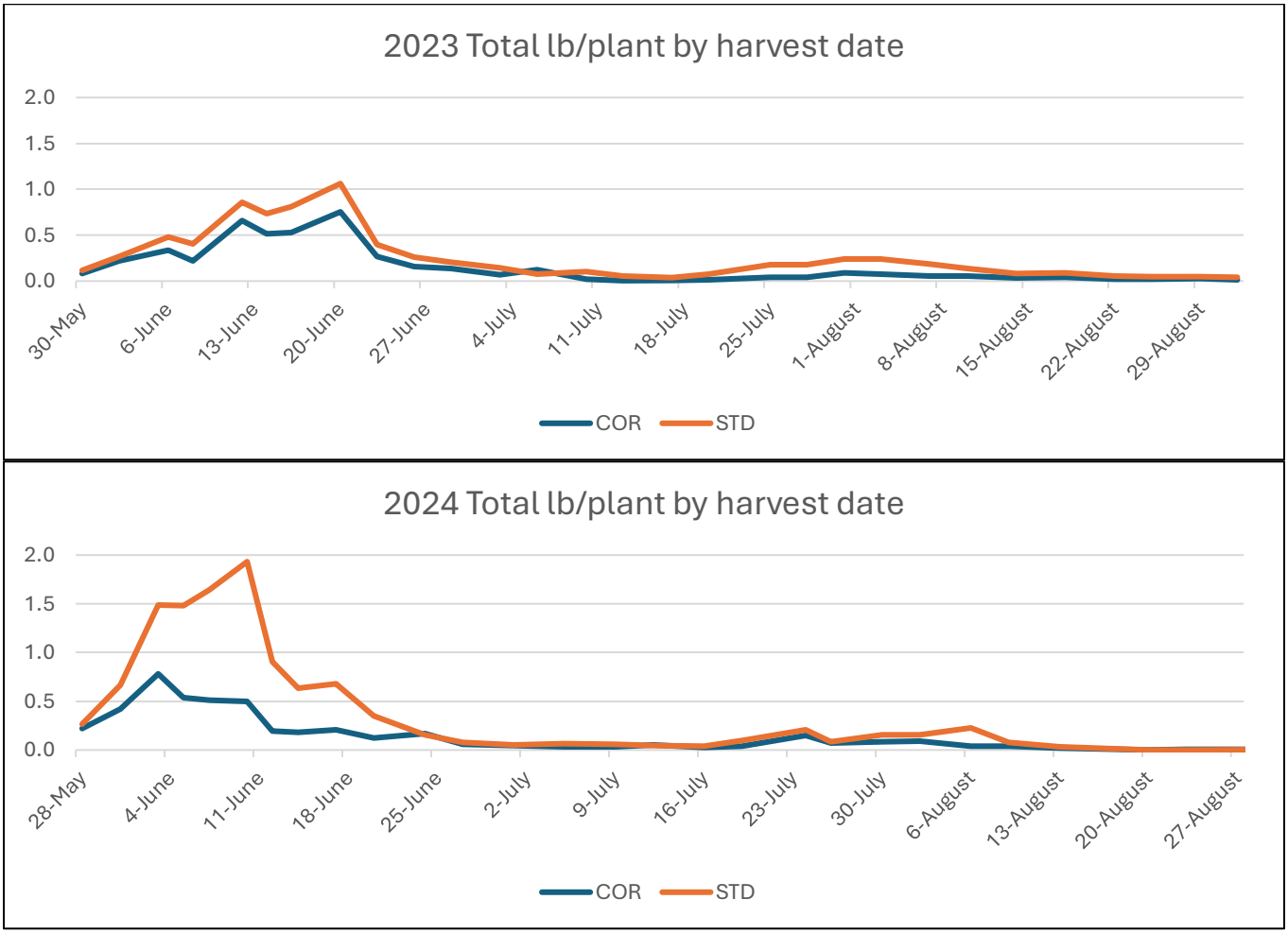

Figure 12. Total yield (lb.) per plant for each harvest week during the 2023 and 2024 fruiting seasons.

References

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