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Pinot noir can be spur pruned without yield losses

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Most Oregon vineyards are cane pruned, with Pinot noir being the most common cane pruned variety in the state. There is growing interest in mechanization of vineyard practices, including dormant pruning. Spur pruning is more easily and affordably mechanized than cane pruning, as implements exists for pre-pruning that can be done earlier in winter with follow-up pruning by manual labor. Final spur pruning is done in one step, as there is no need for workers to remove brush or tie down canes. The use of pre-pruning can reduce dormant pruning operations by 40% (Seavert 2019) compared to cane pruning and can reduce worker injuries. Despite the benefits of spur pruning, Oregon growers have concerns of inconsistent yields and reduced fruit quality with spur compared to cane pruning that have prevented them from changing pruning practices (Skinkis and Gregory 2017).

Many growers believe that spur pruning results in very low yields due to Pinot noir having unfruitful basal buds. However, recent research in my lab showed that Pinot noir basal buds are fruitful (Reeve 2018), and other Pinot noir studies show the same (Jones et al. 2013). We hypothesized that Pinot noir could be spur pruned without compromising yield and established a study to compare cane and spur pruning. The study was conducted in a commercial vineyard near Dayton, OR from January 2017 to January 2019. The vineyard was planted in 2007 to Pinot noir (clone Pommard) grafted to 101-14 rootstock and had been cordon trained and spur pruned for three years prior to the initiation of the study. The trial was established as a randomized complete block design comparing cane and spur pruning across five field replicates. To achieve the cane pruned treatment, vines were converted from cordons to canes in January 2017. The plots were maintained as cane and cordon-spur for the duration of the study. We monitored aspects of vine fruitfulness, starting with dormant buds through to spring fruitfulness (number of inflorescences per shoot), flower number per inflorescence pre-bloom, percent fruit set, and harvest yield and cluster metrics (cluster weight, berry size). We also measured vine growth between the two pruning methods to determine shifts in vine balance and potential canopy management implications.

Grapevines have compound buds that consist of one primary and two secondary buds at each node. Compound buds develop during the current growing season for growth the next season. Having more than one bud within the compound bud serves as the vine's insurance against less than ideal growing conditions, allowing the grapevine to grow shoots and survive if the primary bud is damaged during winter or early spring. By dormancy, each bud has shoot apical meristems (growing tips), vestigial leaves, and flower initials (also known as primordia). Research shows that a lack of sunlight and low temperatures can result in fewer floral primordia initiation in buds (Li-Mallet et al. 2016), particularly in vigorous, shaded canopies and may be a potential cause of low yields in Willamette Valley Pinot noir relative to Pinot noir in warmer production regions of the state and on the West Coast.

Bud fruitfulness and harvest yields. We investigated bud fruitfulness to determine if yield potential was impacted by dormant pruning method or other factors such as canopy density and shading that result from that pruning system. Results of bud fruitfulness quantifications showed that dormant basal buds were fruitful in both cane and spur pruned vines. The first two years of the study had higher bud fruitfulness (3.1 inflorescences per compound bud in January 2017 and 2018) compared to 2.3 inflorescences per compound bud in January 2019. On average, the primary buds had two inflorescence primordia and secondary buds had one or fewer inflorescences per node. The buds at basal nodes 1 to 5 were compared between cane and spur-pruned vines, and there were no differences in the fruitfulness of nodes 1, 2, and 4 along the cane or spur. However, spur pruned vines had lower fruitfulness than cane at node 5 in one year and smaller inflorescence primordia at node 3 in another year. When comparing average fruitfulness data from all buds along canes and spurs, we found that spur pruned vines had fewer inflorescence primordia per node (2.1) and/or smaller inflorescence primordia in only the third season of the study, compared to cane pruned vines (2.5 inflorescences per node). We quantified the number of inflorescences that grew at each node in spring and found no differences in 2018 and only minor differences in 2017 (2.2 and 2.8 inflorescences per node for spur and cane, respectively). However, once shoots were thinned to one shoot per node, spur pruned vines had fewer flowers per inflorescence and fewer berries per cluster post fruit set than cane pruned vines. By harvest, spur pruned vines had 30-40 g smaller clusters due to fewer berries per cluster than cane pruned vines (Table 1). There were no differences by pruning method for berry weight (1.1 g) or cluster compactness in either year. Although cluster size was smaller in spur pruned vines, final yield did not differ since there were several more shoots and clusters on spur pruned vines (Table 1). The vineyard was not cluster thinned but was shoot thinned by the commercial vineyard crew in spring to one shoot per node and all other adventitious shoots removed on the head or cordon (except for renewal spur positions). Spur pruned vines had slightly higher shoot densities than cane pruned vines due to growth of adventitious shoots along the cordon, but the commercial crews thinned those out to maintain a target canopy density. According to the vineyard manager, spur pruning required more time than cane pruning to shoot thin early in the season.

Table 1. Pinot noir vine growth, yield, and vine balance metrics in a pruning trial conducted in Dayton, OR over two growing seasons

Year	Dormant pruning method	Shoot density (#/ft)	Clusters/ vine at harvest	Harvest yield (lb/ft)	Harvest cluster weight (g)	Dormant pruning weight (lb/ft)	Crop load (yield/pruning weight)
2017	cane	1.9 b	12 b	1.2	150 a	0.52 b	2.2
	spur	2.5 a	16 a	1.2	121 b	0.63 a	1.9
	p	0.0141	0.0379	ns	0.0019	0.0005	ns
2018	cane	2.2 b	15 b	2.2	229 a	0.40 b	5.4 a
	spur	3.0 a	19 a	2.2	187 b	0.53 a	4.2 b
	p	0.0142	0.0111	ns	0.0021	0.0105	0.0028

Cane pruned vines were pruned to one, 10-12 bud cane. Spur pruned vines were cordon-trained with 5-6 spurs and two buds/spur. Means are presented in each column with p-values determined from analysis of variance. A different letter following means indicates a difference in means based on Tukey's Honestly Significant Difference Test ($p<0.05$). ns indicates no significance based on statistical analysis (no difference in the means).

Vine growth and fruit ripeness. There were no differences in phenological advancement (bud break, bloom, and véraison) of cane and spur pruned vines during the two growing seasons. Cane pruned vines had longer shoots than spur pruned vines before bloom, but both grew full canopies that needed hedging by fruit set, and there were no differences in vine leaf area at veraison. Dormant pruning weights were higher in spur pruned vines both years (Table 1), and this was likely due to the few more shoots per vine. There were no differences in crop load (yield/pruning weight) in one year, but the crop load was higher in cane pruned vines by the second year of the study. However, there was no difference in harvest fruit maturity in either year, and vines looked equally balanced in the field (Figure 1). Fruit from both pruning treatments were harvested on the same day, just one or two days before commercial harvest each year. Harvest maturity measures were 24.0°Brix, pH=3.3, and TA=8.0 g/L in 2017 and 21.6°Brix, pH=3.1, and TA=6.7 g/L in 2018.

Figure 1. Cane pruned Pinot noir (left) and cordon-trained, spur pruned Pinot noir (right) just before harvest in 2018 in a commercial vineyard trial conducted near Dayton, OR.

Considerations and conclusions. This study confirms that cane and spur pruned Pinot noir can maintain similar yields in the Willamette Valley. However, spur pruned vines have smaller clusters. The biggest difference between the two pruning methods was apparent with early season shoot growth, since spur pruned vines had more adventitious shoot growth along the cordon, whereas cane pruned vines only had this growth at the head of the vine. This may require more labor hours to shoot thin spur pruned vines in spring. However, there were no other growth differences between the two pruning methods

the remainder of the season. With good canopy management practices, optimum shoot density should be a target for both spur and cane pruned vines.

We encourage growers to give spur pruning a try on some acreage to learn the pruning practice and outcomes firsthand. It is likely that the region's lack of confidence in spur pruning stems from being unfamiliar with the practice since most vineyards are exclusively cane pruned (Skinkis and Gregory 2017). This means that most pruning crews are also unfamiliar with this practice and may be somewhat resistant to change. As more growers try spur pruning and learn proper techniques for developing cordons and maintaining spur pruning, there will likely be more examples of success over time. In addition, spur pruning is worth trying since it is a low risk way to increase vineyard mechanization and improve production efficiency, even for smaller vineyards in the state.

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